Faculty of Engineering & Technology

Syllabus

For

Bachelor of Technology (B. Tech.)

in

Computer Science& Engineering

(AI & ML)

(Program Code: ET0141AIML)

(2023-24)

***Approved by the Academic Council vide resolution no ……**

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1. INTRODUCTION

The quality of technical education should be improved in such a manner that engineering graduates are able to compete globally in terms of their knowledge and skills and serve for the society and nation. And for this purpose Learning Outcome-based Curriculum Framework (LOCF) is developed.

Incorporation of Learning Outcome-based Curriculum Framework (LOCF) in the Graduate program like B. Tech. makes it student-centric, interactive and outcome-oriented to achieve well-defined aims, objectives and goals. The learning outcomes are attained by students through development of skills acquired during the program of study by providing them practical exposure. Program learning outcomes will include subject-specific skills and generic skills, including transferable global skills and competencies. It would also focus on knowledge and skills that prepare students for further study, employment and society development. LOCF help ensure comparability of learning levels and academic standards across colleges/universities.

At present, the goal of technical education may be achieved using the following measures:

i. Curriculum reform based on learning outcome-based curriculum framework (LOCF).

ii. Improving learning environment and academic resources.

iii. Elevating the quality of teaching and research.

iv. Involving students in discussions, problem-solving and out of box thinking about various ideas and their applicability, which may lead to empowerment and enhancement of the social welfare.

v. Motivating the learners to understand various concepts of their educational program keeping in view the regional context.

vi. Enabling learners to create research atmosphere in their colleges/ institutes/ universities.

vii. Teach courses based on Choice Based Credit System (CBCS).

2. LEARNING OUTCOME-BASED APPROACH TO CURRICULUM PLANNING

The Bachelor of Technology (B. Tech.) degree is awarded to the students on the basis of knowledge, understanding, skills, values and academic achievements. Hence, the learning outcomes of this program are aimed at facilitating the learners to acquire these attributes, keeping in view of their preferences and aspirations for knowledge.

The course for B. Tech. is designed according to outcome-based approach in the light of graduate attributes, description of qualifications, courses and program learning outcomes. It may lead to all round development and delivery of complete curriculum planning. Hence, it provides specific guidelines to the learners to acquire sufficient knowledge during this program.

The program has been planned in such manner that there is scope of flexibility and innovation in

i. Modifications of prescribed syllabi.

ii. Teaching-learning methodology.

iii. Assessment technique of students and knowledge levels.

iv. Learning outcomes of courses.

v. Addition of new elective courses subject to availability of experts in colleges/institutes/universities across the country.

2.1. Nature and Extent of Undergraduate Program

As a part of effort to enhance employability of engineering graduates the outcome-based curriculum is very essential in present day perspective. Therefore, higher education degrees must formulate Graduate Attributes (GAs), qualification descriptors, learning outcomes and course learning outcomes which will help in curriculum planning and development in the form of design and delivery of courses. The overall formulation of the degree program must equip learner to have competencies to provide deliverables to the industry.

2.2. Aims of undergraduate program (B. Tech.)

The overall aims of B. Tech. program are to:

ii. Create deep interest in Practical learning.

iii. Develop broad and balanced knowledge and understanding of definitions, concepts and principles.

iv. Familiarize the students with suitable tools related to designing, modeling etc.

v. Enhance the ability of learners to apply the knowledge and skills acquired by them during the program to solve specific problems of their courses.

vi. Provide learners sufficient knowledge and skills enabling them to undertake higher studies in technical field.

vii. Encourage the students to develop a range of generic skills helpful in employment, internships and social activities.

2.3. Motive behind curriculum planning and development

The committee considered and discussed the following factors for LOCF for the graduates:

1) Framing of syllabi
2) Learners attributes
3) Qualification descriptors
4) Program learning outcomes
5) Course learning outcomes
6) Necessity of having elective courses
7) Academic standards

3. PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

The program educational objectives are set in line with Institutional and Departmental mission statements. The program educational objectives of Bachelor of Technology are to produce engineers who later take the responsibility of engineering professionals and researchers with following qualities:

- **PEO1.** Apply basic knowledge of mathematics, principles of physics and chemistry, and interdisciplinary engineering for the design and development.
- **PEO2.** Demonstrate the application of exploration practices and engineering principles through development of innovative tools that are beneficial in production.

- **PEO3.** Exhibit skills of design and construct machineries based on requirement and need of Technology operations.
- **PEO4.** Exhibit strong, independent learning, analytical and problem-solving skills with special emphasis on design, communication, and ability to work in teams.
- **PEO5.** To have successful career as engineering professional or a researcher through lifelong learning in the field of Bachelor of Technology.

4. GRADUATION ATTRIBUTES (GAs)

The graduate attributes in B. Tech. are the summation of the expected course learning outcomes mentioned in the end of each course. Some of them are stated below.

GA1: Discipline-specific Knowledge: Capability of demonstrating comprehensive knowledgeof B. Tech. program and understanding of core branch so that it forms a foundation for a graduate program of study.

GA2: Critical Thinking & Analytical Reasoning: Ability to employ critical thinking in understanding the concepts relevant to the various branches of engineering. Ability to analyzethe results and apply them in various problemsappearing in different streams.

GA3: Problem Solving: Capability to solve problems by using research-based knowledge and research methods including innovative thinking, design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

GA4: Research-related skills: To develop a sense of inquiry and capability for asking relevant and intelligent questions, problem identification, synthesizing and articulating; ability to recognize and establish cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.

GA5: Usage of Modern Tools (Information/digital literacy): To create, select, and apply appropriate techniques, resources, and modern science and IT tools including prediction and modeling to complex science activities with an understanding of the limitations.

GA6: Social Responsibilities: Ability to work with contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

GA7: Self-directed learning with environment: Ability to work independently and doing-depth study of variousproblems and requirements of society with natural available resources which leads to sustainable development.

GA8. Moral and ethical awareness/reasoning: Ability to identify unethical behavior such as falsification or misrepresentation of data and adopting objective, unbiased and truthful actions in all aspects of their program.

GA9. Leadership Readiness/Qualities: Capability for mapping out the tasks in a team or an organization, self-motivating and inspiring team members to engage with the team objectives/vision; and using management skills to follow the mapped path to the destination in a smooth and efficient way.

GA10: Communication skills:

a. Ability to communicate various concepts of technical education effectively using practical approach and their geometrical visualizations.

b. Ability to use courses as a precise language of communication in other branchesof human knowledge.

c. Ability to resolve unsolved problems and requirements of industries and societies.

d. Ability to show the importance of their technical knowledge as precursor to various scientific developments since the beginning of the civilization.

GA11: Project Management and Finance: Ability to 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

GA12: Lifelong learning: Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning.

5. QUALIFICATION DESCRIPTORS (QDs)

The qualification descriptor suggests the generic outcomes and attributes to be obtained while obtaining the degree of B. Tech. The qualification descriptors indicate the academic standards on the basis of following factors:

1. Level of knowledge
2. Understanding
3. Skills
4. Competencies and attitudes
5. Values.

These parameters are expected to be attained and demonstrated by the learners after becoming graduates in this program. The learning experiences and assessment procedures should be so designed that every graduate may achieve the program learning outcomes with equal opportunity irrespective of the class, gender, community and regions. Each graduate in engineering should be able to:

I. Demonstrate fundamental systematic knowledge and its applications. It should also enhance the subject specific knowledge and help in creating jobs in various sectors.

II. Demonstrate educational skills in areas of their program.

III. Apply knowledge, understanding and skills to identify the difficult/unsolved problems in courses of their program and to collect the required information in possible range of sources and try to analyze and evaluate these problems using appropriate methodologies.

IV. Apply one's disciplinary knowledge and skills in newer domains and uncharted areas.

V. Identify challenging problems and obtain well-defined solutions.

VI. Exhibit subject-specific transferable knowledge relevant to job trends and employment opportunities.

6. PROGRAM LEARNING OUTCOMES (POs)

Students graduating with the B. Tech. degree should be able to acquire with following PLOs

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Lifelong 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.

Mapping of Graduate Attributes (GAs) and Program Learning Outcomes (PLOs):

PLO/GA	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
PLO1	■											
PLO2		■										
PLO3			■									
PLO4				■								
PLO5					■							
PLO6						■						
PLO7							■					
PLO8								■				
PLO9									■			
PLO10										■		
PLO11											■	
PLO12												■

7. PROGRAM SPECIFIC OUTCOMES (PSO's):

PSO1: Professionally empowering the student as technical manpower in industry or an entrepreneur for production analytics and innovation.

PSO2: Able to excel in various technological challenges and contribute for self-reliant society.

8. TYPES OF COURSES

1. Courses in a program may be of four kinds: Core, Elective, Ability Enhancement and Skill Enhancement.

a) Core Course: -

There may be a Core Course in every semester. This is the course which is to be compulsorily studied by a student as a requirement to complete the program in a said discipline of study.

b) Elective Course: -

Elective course is a course which can be chosen from a pool of papers. It may be

1) Supportive to the discipline of study
2) Providing an expanded scope
3) Enabling an exposure to some other discipline/domain
4) Nurturing student's proficiency/skill.

An Elective Course may be 'Discipline Centric/Specific' & Generic Elective

Discipline Centric/Specific Elective (DSE): Elective courses offered under themain discipline/subject of study are referred to as Discipline Centric/Specific.

Generic/Open Elective (GE): An elective course chosen from an unrelateddiscipline/subject is called Generic/Open Elective. These electives will be focusing on those courses which add generic proficiency of students.

c) Ability Enhancement Compulsory Courses (AECC): -

AECC courses are based upon the content that leads to knowledge enhancement, for example: English Communication, Environment Science/ Studies, etc.

d) Skill Enhancement Courses (SEC): -

SEC Courses provide value based and/or skill-based knowledge and may content both Theory and Lab/Training/Field Work. The main purpose of these courses is to provide students life- skills in hands- on mode so as to increase their employability.

2. List of Course

a)Core Course: -

- Engineering Mathematics-I
- EngineeringPhysics
- EngineeringMathematics-II
- EngineeringChemistry
- EngineeringPhysics Lab
- EngineeringChemistryLab
- DiscreteMathematics Structure
- Foundation of AI & ML
- Python Programming
- Data Structures and Algorithms
- Object Oriented Programming
- Software Engineering
- Data Structures and Algorithms Lab
- Object Oriented Programming Lab
- Software Engineering Lab
- Python Lab
- Industrial Training/ Seminar
- Data Science with R Programming
- DatabaseManagement System
- Theoryof Computation
- DataCommunication andComputerNetworks
- Internet and web Technology Lab
- DatabaseManagement SystemLab
- NetworkProgrammingLab
- LinuxShellProgramming Lab
- RLab
- Java Programming
- Deep Learning
- OperatingSystem
- Computer Graphics & Multimedia
- AnalysisofAlgorithms
- ComputerGraphics& MultimediaLab
- Deep Learning Lab

- AnalysisofAlgorithms Lab
- Java Lab
- Industrial Training
- Business Process Management
- Data Privacy & Security
- InformationSecuritySystem
- Advance Computer Organization
- Natural Language Processing (NLP)
- Business Process Management Lab
- Natural Language Processing Lab
- Cyber Security Lab
- Seminar
- Business Intelligence and Data Visualization
- Social Network Analysis
- Internet of Things Lab
- Big Data Analytics Lab
- Data Visualization Lab
- Industrial Training
- Project-I
- Project-II

b) Elective Course: -

- Compiler Design
- Software Project Management
- Bioinformatics
- Distributed System
- Cloud Computing
- Ecommerce & ERP
- Big Data Analytics
- Internet of Things
- Data Forensics
- Internet of Things Lab
- Big Data Analytics Lab

c) Humanities, Social Science And Management Course (HSMC): -

- Communication Skills (Jeevan Kaushal-I)
- Universal HumanValues
- Environment Studies
- HumanValues Activities
- Fundamentals of Indian Knowledge Systems
- Leadership & Management Skills
- Professional Skills
- Critical Thinking

Computation of Workload:

Lecture (L) : 1 Credit = 1 Theory period of one hour duration

Tutorial (T) : 1 Credit = 1 Tutorial period of one hour duration

Practical (P) : 1 Credit = 1 Practical period of two hour duration

d) Course code and definition

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
C	Credits
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses

9. PROGRAM STRUCTURE B. Tech. CS (Data Science)

Semester - I

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC101	Engineering Mathematics-I	BSC	30	70	100	3	1	-	4
BTBSC102A/ BTBSC102B	Engineering Physics/ Engineering Chemistry	BSC	30	70	100	3	1	-	4
BTHSMC103	Communication Skills	HSMC	30	70	100	2	-	-	2
BTESC104	Programming for Problem Solving	ESC	30	70	100	3	-	-	3
BTESC 105A/ BTESC 105B	Basic Civil Engineering/ Basic Electrical Engineering	ESC	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTBSC106A/ BTBSC106B	Engineering Physics Lab/ Engineering Chemistry Lab	LC	60	40	100	-	-	1	1
BTHSMC107	Language Lab	LC	60	40	100	-	-	1	1
BTESC108	Computer Programming Lab	LC	60	40	100	-	-	1	1
BTESC 109A / BTESC 109B	Basic Civil Engineering Lab/ Basic Electrical Engineering Lab	LC	60	40	100	-	-	1	1
BTESC110	Computer Aided Engineering Graphics	LC	60	40	100	-	-	1	1
BTHSMC111	Social Outreach, Discipline &Extra Curricular Activities	HSMC	100	-	100	-	-	-	1
	Total		**550**	**550**	**1100**	**14**	**2**	**5**	**22**

Semester - II

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC 201	Engineering Mathematics-II	BSC	30	70	100	3	1	-	4
BTBSC202A/ BTBSC202B	Engineering Chemistry / Engineering Physics	BSC	30	70	100	3	1	-	4
BTHSMC203	Universal Human Values	HSMC	30	70	100	2	-	-	2
BTESC204	Basic Mechanical Engineering	ESC	30	70	100	2	-	-	2
BTESC205A/ BTESC205B	Basic Electrical Engineering/ Basic Civil Engineering	ESC	30	70	100	3	-	-	3
BTVAC206	Environment Studies	VAC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTBSC 207A/ BTBSC 207B	Engineering Chemistry Lab/ Engineering Physics Lab	LC	60	40	100	-	-	1	1
BTESC208	Manufacturing Practices Workshop	LC	60	40	100	-	-	1	1
BTESC209A/ BTESC209B	Basic Electrical Engineering Lab/ Basic Civil Engineering	LC	60	40	100	-	-	1	1
BTESC210	Computer Aided Machine Drawing	LC	60	40	100	-	-	1	1
BTHSMC 211	Social Outreach, Discipline & Extra Curricular Activities	HSMC	100	-	100	-	-	-	1
	Total		**520**	**580**	**1100**	**16**	**2**	**4**	**22**

Semester–III

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSBSC301	**Discrete Mathematics Structure**	**BSC**	30	70	100	3	-	-	3
BTCSPCC302	Object Oriented Programming	PCC	30	70	100	3	-	-	3
BTCSPCCAIML303	**Python Programming**	PCC	30	70	100	3	-	-	3
BTCSPCC304	Data Structures and Algorithms	PCC	30	70	100	3	-	-	3
BTCSPCC305	Internet & Web Technology	PCC	30	70	100	3	-	-	3
BTCSPCC306	Software Engineering	PCC	30	70	100	3	-	-	3
BTCSHSMC307	Fundamentals of Indian Knowledge System	HSMC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCSPCC 308	Data Structures and Algorithms Lab	LC	60	40	100	-	-	1	1
BTCSPCC 309	Object Oriented Programming Lab	LC	60	40	100	-	-	1	1
BTCSPCC 310	Software Engineering Lab	LC	60	40	100	-	-	1	1
BTCSPCCAIML 311	**Python Lab**	LC	60	40	100	-	-	1	1
BTCSPCCAIML312	Internet & Web Technology Lab	LC	60	40	100	-	-	1	1
BTCSPROJ313	Industrial Training / Seminar	PROJ	60	40	100	-	-	1	1
BTCSHSMC314	Social Outreach, Discipline & Extra Curricular Activities	HSMC	100	-	100	-	-	-	1
	TOTAL		**670**	**730**	**1400**	**20**	**0**	**6**	**27**

Semester-IV

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCCAIML401	**Artificial Intelligence**	PCC	30	70	100	3	1	-	4
BTCSHSMC 402	Critical Thinking	HSMC	30	70	100	2	-	-	2
BTCSPCCAIML403	Machine Learning-I	PCC	30	70	100	2	-	-	2
BTCSPCC404	Database Management System	PCC	30	70	100	3	0	0	3
BTCSPCC405	Theory of Computation	PCC	30	70	100	3	1	0	4
BTCSPCC406	Data Communication and Computer Networks	PCC	30	70	100	3	0	0	3
BTCSVAC407	Web Development	VAC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCSPCC408	Web Development Lab	LC	60	40	100	0	0	1	1
BTCSPCC409	Database Management System Lab	LC	60	40	100	0	0	1	1
BTCSPCC410	Network Programming Lab	LC	60	40	100	0	0	1	1
BTCSPCC411	Linux Shell Programming Lab	LC	60	40	100	0	0	1	1
BTCSPCCAIML412	**Machine Learning Lab**	LC	60	40	100	-	-	1	1
BTCSHSMC 413	Social Outreach, Discipline & Extra Curricular Activities	HSMC	100	-	100	-	-		1
	TOTAL		**610**	**690**	**1300**	**19**	**2**	**5**	**27**

Semester –V

Code	Subject/ Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCC 501	Java Programming	PCC	30	70	100	3	-	-	3
BTCSPCCAIML 502	**Deep Learning**	PCC	30	70	100	3	-	-	3
BTCSPCC 503	Operating System	PCC	30	70	100	3	-	-	3
BTCSPCC 504	Computer Graphics & Multimedia	PCC	30	70	100	3	-	-	3
BTCSPCC 505	Analysis of Algorithms	PCC	30	70	100	3	-	-	3
	Elective								
BTCSPEC 506A	Human Computer Interaction	PEC	30	70	100	3	-	-	3
BTCSPEC 506B	Software Project Management	PEC	30	70	100	3	-	-	3
BTCSPEC 506C	Bioinformatics	PEC	30	70	100	3	-	-	3
BTCSHSMC507	Professional Skills	HSMC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCSPCC 508	Computer Graphics & Multimedia Lab	LC	60	40	100	-	-	1	1
BTCSPCCAIML 509	**Deep Learning Lab**	LC	60	40	100	-	-	1	1
BTCSPCC 510	Analysis of Algorithms Lab	LC	60	40	100	-	-	1	1
BTCSPCC 511	Java Lab	LC	60	40	100	-	-	1	1
BTCSPROJ 512	Industrial Training	PROJ	60	40	100	-	-	1	1
BTCSHSMC 513	Social Outreach, Discipline & Extra Curricular Activities	HSMC	100	-	100				1
	TOTAL		**610**	**690**	**1300**	**20**	**-**	**5**	**26**

Semester–VI

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCCAIML**601**	**Artificial Neural Network**	PCC	30	70	100	3	0	0	3
BTCSPCCALML**602**	**Machine Learning –II**	PCC	30	70	100	3	0	0	3
BTCSPCC 603	Information Security System	PCC	30	70	100	3	0	0	3
BTCSPCC 604	Computer Architecture and Organization	PCC	30	70	100	3	0	0	3
BTCSPCCAIML 605	**Natural Language Processing (NLP)**	PCC	30	70	100	3	0	0	3
	Elective Subject								
BTCSPEC 606A	Distributed System	PEC	30	70	100	3	0	0	3
BTCSPEC 606B	Cloud Computing	PEC	30	70	100	3	0	0	3
BTCSPEC 606C	Ecommerce & ERP	PEC	30	70	100	3	0	0	3
BTCSVAC607	Introduction to Cloud Computing with Amazon Web Services	VAC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCSPCCALML**608**	**Machine Learning- II Lab**	LC	60	40	100	0	0	1	1
BTCSPCCAIML 609	**Natural Language Processing Lab**	LC	**60**	**40**	**100**	**0**	**0**	**1**	**1**
BTCSPCC 610	Cyber Security Lab	LC	60	40	100	0	0	1	1
BTCSPROJ 611	Project-I	LC	60	40	100	0	0	1	1
BTCSHSMC 612	Social Outreach, Discipline & Extra Curricular Activities	HSMC	100		100				1
	TOTAL		**550**	**650**	**1200**	**20**	**0**	**4**	**25**

B.Tech. (Data Science)

Semester–VII

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCCAIML 701	Robotics and Control	PCC	30	70	100	3	1	-	4
BTCSPCCAIML702	**Design of Artificial Intelligence Product**	PCC	30	70	100	3	-	-	3
	Elective Subject								
BTCSPEC703A	Big Data Analytics	PEC	30	70	100	3		-	3
BTCSPEC703B	Internet of Things	PEC	30	70	100	3		-	3
BTCSOE704A	Supply Chain Management	OEC	30	70	100	3		0	3
BTCSOE704B	Operation Research	OEC	30	70	100	3		0	3
BTCSOE704C	Micro and Smart System Technology	OEC	30	70	100	3		0	3
BTCSHSMC705	Research and Publication Ethics	HSMC	30	70	100	3	-	-	3
BTCSHSMC706	Leadership & Management Skills	HSMC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCSPCC707A/ BTCSPCC707B	Big Data Analytics Lab / Internet of Things Lab	LC	60	40	100	0	0	1	1
BTCSPCC708	Robotics Lab	LC	60	40	100	0	0	1	1
BTCSPCC709	Industrial Training	PROJ	60	40	100	0	0	1	1
BTCSPROJ710	Project-II	PROJ	60	40	100	0	0	3	3
BTCSHSMC711	Social Outreach, Discipline &Extra Curricular Activities	HSMC	100	-	100	-	-	-	1
	TOTAL		**520**	**580**	**1100**	**17**	**1**	**6**	**25**

Semester–VIII

PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPROJ801	Project-III	PROJ	360	240	600	-	-	-	12
BTCSHSMC802	Social Outreach, Discipline & Extra Curricular Activities	HSMC	100	-	100	-	-	-	1
	TOTAL		**460**	**240**	**700**	**0**	**0**	**0**	**13**

Note:

- A student is required to obtain min. 40% marks in individual paper to pass.
- The total credit of B.Tech. (AI & ML) Program is 187. However, the minimum credit required for award of degree shall be 181.
- The credit relaxation will be applicable only on the elective course from different semester (i.e., the student can opt out only elective subject).
- Out of the total credits, 20% of the credits may be earned by the student through MOOCs (SWAYAM, NPTEL, Coursera etc.). However, the choice of online courses to be approved in advance by Dean/ HOD and Coordinator SWAYAM keeping in view the latest guidelines of the UGC/ respective regulatory body guidelines.

10. COURSE-WISE LEARNING OBJECTIVES, STRUCTURES AND OUTCOMES (CLOSOs)

Semester - I

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC101	Engineering Mathematics-I	BSC	30	70	100	3	1	-	4
BTBSC102A/ BTBSC102B	Engineering Physics/ Engineering Chemistry	BSC	30	70	100	3	1	-	4
BTHSMC103	Communication Skills	HSMC	30	70	100	2	-	-	2
BTESC104	Programming for Problem Solving	ESC	30	70	100	3	-	-	3
BTESC 105A/ BTESC 105B	Basic Civil Engineering/ Basic Electrical Engineering	ESC	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTBSC106A/ BTBSC106B	Engineering Physics Lab/ Engineering Chemistry Lab	LC	60	40	100	-	-	1	1
BTHSMC107	Language Lab	LC	60	40	100	-	-	1	1
BTESC108	Computer Programming Lab	LC	60	40	100	-	-	1	1
BTESC 109A / BTESC 109B	Basic Civil Engineering Lab/ Basic Electrical Engineering Lab	LC	60	40	100	-	-	1	1
BTESC110	Computer Aided Engineering Graphics	LC	60	40	100	-	-	1	1
BTHSMC111	Social Outreach, Discipline &Extra Curricular Activities	HSMC	100	-	100	-	-	-	1
	Total		**550**	**550**	**1100**	**14**	**2**	**5**	**22**

BTBSC101: Engineering Mathematics-I

Course Objectives:

- To achieve conceptual understanding and to retain the best traditions of traditional calculus.
- To provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.
- To familiarize the prospective engineers with techniques in calculus, multivariate analysis and differential equations.
- To equip the students with standard concepts and tools at an intermediate to advanced level

Course Content:

Unit I: **Single-variable Calculus (Differentiation):** (6 hours)
Rolle's Theorem, Mean value theorems and applications; Extreme values of functions; Linear approximation; Indeterminate forms and L' Hospital's rule. Curvature, evolutes and involutes

.

Unit II: **Multivariable Calculus (Differentiation):** (8 hours)
Limit, continuity and partial derivatives, directional derivatives, gradient, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers.

Unit III: **Sequences and series:** (10 hours)
Limits of sequence of numbers, Calculation of limits, Infinite series; Tests for convergence; Power series, Taylor and Maclaurin series; Taylor theorem, convergence of Taylor series, error estimates.

Unit IV: **Basic Calculus:** (6 hours)
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 V: **Multivariable Calculus (Integration):** (10 hours)
Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Triple integrals (Cartesian), Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Gradient, curl and divergence, Theorems of Green, Gauss and Stokes.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson,Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edit ion, John Wiley & Sons,2006. F201
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications,

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Know the applications of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.

CO2: Apply the Concepts of the differential calculus

CO3: Understand and apply the concept of sequence and series.

CO4: Understand and apply the concept of Beta and Gamma functions.

CO5: Understand the calculation and Applications of Multivariable integrals.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping between Objectives and Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L3	H	M	H	M	L	M	-	-	M	-	M	H	H	M
CO2	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO3	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO4	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO5	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	-
CD4	Project Discussions	-
CD5	Self- learning advice using internets	CO1,CO4,CO5

BTBSC102A: Engineering Physics

Course Objective:

- To understand the concepts of interference, Diffraction and Polarization.
- To know about wave particle duality.
- To know applications of Optical fibre.
- To know applications of Lasers in Science, engineering and medicine.
- To know classification of Solid.

Course Content:

Unit I: Wave Optics

Newton's Rings, Michelson's Interferometer, Fraunhofer Diffraction from a Single Slit. Diffraction grating: Construction, theory and spectrum, Resolving power and Rayleigh criterion for limit of resolution, Resolving power of diffraction grating, X-Ray diffraction and Bragg's Law.

Unit II: Quantum Mechanics

Introduction to quantum Mechanics, Wave-particle duality, Matter waves, Wave function and basic postulates, Time dependent and time independent Schrodinger's Wave Equation, Physical interpretation of wave function and its properties, Applications of the Schrodinger's Equation: Particle in one dimensional and three dimensional boxes.

Unit III: Coherence and Optical Fibers

Spatial and temporal coherence: Coherence length; Coherence time and 'Q' factor for light, Visibility as a measure of Coherence and spectral purity, Optical fiber as optical wave guide, Numerical aperture; Maximum angle of acceptance and applications of optical fiber.

Unit IV: Laser

Einstein's Theory of laser action; Einstein's coefficients; Properties of Laser beam, Amplification of light by population inversion, Components of laser, Construction and working of He-Ne and semiconductor lasers, Applications of Lasers in Science, engineering and medicine.

Unit V: Material Science & Semiconductor Physics

Bonding in solids: covalent and metallic bonding, Energy bands in solids: Classification of solids as Insulators, Semiconductors and Conductors, Intrinsic and extrinsic semiconductors, Fermi dirac distribution function and Fermi energy, Conductivity in semiconductors, Hall Effect: Theory, Hall Coefficient and applications.

References:

1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
4. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
5. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
6. Online course: “Semiconductor Optoelectronics” by M R Shenoy on NPTEL
7. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Guptaon NPTEL

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Enhance the basic skills required to understand, develop, and design various engineering applications involving Wave Optics.

CO2: Understand Quantum Mechanics and apply them to diverse engineering problems.

CO3: Analyze the nature of light propagation in guided medium for engineering applications and study in Coherence and Optical Fibers.

CO4: Describe different Laser problems.

CO5: Describe Material Science & Semiconductor Physics.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	H	-	H	-	M	-	-	-	-	L	H	M
CO2	L3	H	H	H	H	-	M	-	-	-	-	-	-	M	M
CO3	L4	M	L	M	-	L	-	L	-	-	-	-	-	H	H
CO4	L2	H	M	H	H	M	-	M	L	-	L	-	L	H	M
CO5	L2	H	M	H	H	M	-	M	L	-	L	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3
CD3	Seminars	CO1, CO2, CO4, CO5
CD4	Self- learning advice using internets	CO1, CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTBSC102B: Engineering Chemistry

Course Objective:

- To acquire the knowledge about impurities in water, their determination and purification.
- To learn about different types of fuel and lubricant and their applications.
- To gain the basic knowledge, applications and control methods of corrosion.
- To get the knowledge of preparation and significance of explosives, cement, refractories and glass.
- To get the knowledge of organic reaction mechanism and their uses with different types of drugs

Course Contents:

Unit I: Water

Common impurities, hardness, determination of hardness by complexometric (EDTA method), Degree of hardness, Units of hardness Municipal water supply: Requisite of drinking water, Purification of water; sedimentation, filtration, disinfection, breakpoint chlorination. Boiler troubles: Scale and Sludge formation, Internal treatment methods, Priming and Foaming, Boiler corrosion and Caustic embrittlement Water softening; Lime-Soda process, Zeolite (Permutit) process, Demineralization process. Numerical problems based on Hardness, EDTA, Lime-Soda and Zeolite process.

Unit II: Organic Fuels

Solid fuels: Coal, Classification of Coal, Proximate and Ultimate analyses of coal and its significance, Gross and Net Calorific value, Determination of Calorific value of coal by Bomb Calorimeter. Metallurgical coke, Carbonization processes; Otto-Hoffmann byproduct oven method. Liquid fuels : Advantages of liquid fuels, Mining, Refining and Composition of petroleum, Cracking, Synthetic petrol, Reforming, Knocking, Octane number, Anti-knocking agents, Cetane number Gaseous fuels; Advantages, manufacturing, composition and Calorific value of coal gas and oil gas, Determination of calorific value of gaseous fuels by Junker's calorimeter Numerical problems based on determination of calorific value (bomb calorimeter/Junkers calorimeter/Dulongs formula, proximate analysis & ultimate and combustion of fuel.

Unit III: Corrosion and its control

Definition and significance of corrosion, Mechanism of chemical (dry) and electrochemical (wet) corrosion, galvanic corrosion, concentration corrosion and pitting corrosion. Protection from corrosion; protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design.

Unit IV: Engineering Materials

Portland Cement; Definition, Manufacturing by Rotary kiln. Chemistry of setting and hardening of cement. Role of Gypsum. Glass: Definition, Manufacturing by tank furnace, significance of annealing, Types and properties of soft glass, hard glass, borosilicate glass, glass wool, safety glass Lubricants: Classification, Mechanism,

Properties; Viscosity and viscosity index, flash and fire point, cloud and pour point. Emulsification and steam emulsion number.

Unit V: Organic reaction mechanism and introduction of drugs

Organic reaction mechanism: Substitution; SN1, SN2, Elecrophilic aromatic substitution in benzene, free radical halogenations of alkanes, Elimination; elimination in alkyl halides, dehydration of alcohols, Addition: electrophilic and free radical addition in alkenes, nucleophilic addition in aldehyde and ketones, Rearrangement; Carbocation and free radical rearrangements Drugs : Introduction, Synthesis, properties and uses of Aspirin, Paracetamol

Suggested Text / Reference Books

1. Morrison R.T & Boyn R. N ; Organic Chemistry; Prentice Hall of India 1999
2. Lee J. D. ; Inorganic Chemistry ;Blackwell Science
3. Gopalan R., Venkappayya D., Nagarajan S. “Engineering Chemistry” Vikas Publishing House Pvt Ltd 2000.
4. Jain & Jain “ Engineering Chemistry” Dhanpat Rai publishing company
5. Dara S. S. , “ A Text Book of Engineering Chemistry” S. Chand and Company Ltd, 2008
6. Keeler J and Wolhess P, Why Chemical Reaction Happen Oxford Press.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Gain knowledge about impurities in water, their determination and purification.

CO2: Understand organic fuels and various emerging new areas of organic chemistry.

CO3: Learn about Corrosion and its control.

CO4: Get knowledge about the chemistry of some Engineering Materials like Portland Cement.

CO5: Understand and study Organic reaction mechanisms.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2	H	-	M	-	-	-	-	-	-	M	-	H	M	M
CO2	L2	M	-	-	-	L	-	-	-	-	L	-	M	M	M
CO3	L1	M	-	-	-	-	-	-	-	-	L	-	M	M	L
CO4	L2	M	-	-	-	-	-	-	-	-	L	-	M	H	M
CO5	L2	M	-	-	-	-	-	-	-	-	-	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO1, CO2, CO3
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO1, CO5

BTHSMC103: Communication Skills

Course Objectives:

- To identify common communication problems that may be holding learners back
- To perceive what the non-verbal messages are communicating to others
- To understand the role of communication in the teaching-learning process
- To learn to communicate through the digital media
- To understand the importance of empathetic listening
- To explore communication beyond language.

Course Content:

Unit I: Listening & Speaking

Listening: Techniques of Effective Listening, Listening and Comprehension, Probing Questions, Barriers to Listening

Speaking: Pronunciation, Enunciation, Vocabulary, Fluency, Common Errors

Unit II: Reading, Writing and Different Modes of Writing

Reading: Techniques of Effective Reading, Gathering Ideas and Information from a Given Text, Evaluating these Ideas and Information, Interpreting the Text

Writing and Different Modes of Writing: The Writing Process, Effective Writing Strategies, Different Modes of Writing

Unit III: Digital Literacy and Social Media

Basic Computer Skills: Introduction to Microsoft (MS) Office Suite, Open Educational Resources

Basic Virtual Platforms

Trending Technologies: Machine Learning, Artificial Intelligence (AI), Internet of Things (IoT)

Social Media: Introduction to Social Media Websites, Advantages of Social Media, Ethics and Etiquettes of Social Media, How to Use Google Search Better, Effective Ways of Using Social Media

Digital Marketing: Introduction to Digital Marketing, Traditional Marketing versus Digital Marketing, Digital Marketing Tools, Social Media for Digital Marketing,

Digital Marketing Analytics

Unit IV: Digital Ethics and Cyber Security

Digital Ethics: Digital Literacy Skills, Digital Etiquette, Digital Life Skills

Cyber Security: Understanding and introducing the environment of security, Types of attacks and attackers, The art of protecting secrets

Unit V: Non-Verbal Communication

Meaning of nonverbal communication, Advantages of using nonverbal communication, Introduction to modes of nonverbal communication: Open and Closed body language, Eye contact and Facial expression, Hand gestures. Do's and Don'ts in NVC, Learning from experts, Activities-based learning

Reference Books:

1. Ahmed, R. (2015. June 18). Five essential listening skills for English learners. British Council. https://www.britishcouncil.org/voices-magazine/five-essential-listening-skills-englishlearners

2. Skills You Need. (n.d.). Barriers to Effective Listening. Skills You Need. https://www. skillsyouneed.com/ips/ineffective-listening.html

3. Weiler, A. (2017. October 7). How to Improve English Pronunciation. Strategies in language learning. https://www.strategiesinlanguagelearning.com/how-to-improve-englishpronunciation/
4. Kirkham, L. (2022. February 16). How to Enunciate. Wiki how. https://www.wikihow.com/Enunciate
5. Literary Devices. (n.d.). Context. Literary Devices. https://literarydevices.net/context/
6. Bailey, Stephen. 2010. Academic Writing: A Handbook for International Learners. Routledge
7. Sherman. (2021, February 2). What is Digital Marketing? Here's Everything You Need to Know. Lyfe Marketing. https://www.lyfemarketing.com/blog/what-is-digital-marketing/
8. Loewus, L. (2016. November 8). What is Digital Literacy? Education Week. https://www. edweek.org/teaching-learning/what-is-digital-literacy/2016/11
9. Nordquist, R. (2020, June 29). What is Nonverbal Communication? ThoughtCo. https:// www.thoughtco.com/what-is-nonverbal-communication-1691351

Course Outcomes:

CO1 Utilize active listening in communication and use appropriate language to communicate their thoughts and ideas clearly

CO2 Utilize the reading skill to gain additional knowledge and confidence to improve speaking and writing abilities with use effective strategies for writing in different modes of writing.

CO3 Use digital literacy in their professional life for communication. Apply basic functionalities of trending technologies like machine learning, artificial intelligence, and IoT. Demonstrate the effectiveness of digital marketing for business and using the tools to reach a global audience.

CO4 Use ethical digital behaviours. Use practices that incorporate transparency, responsibility, and accountability. Assess the current security landscape, including the nature of the threat and the general status of common vulnerabilities. Identify core networking and infrastructure components, and the roles they serve in preparing a secured system.

CO5 Realize the importance of nonverbal communication. Use nonverbal communication effectively in communication as an aid.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Levels	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L3	-	**L**	-	-	-	-	-	-	-	**H**	-	**H**	-	-
CO2	L3	-	-	-	-	-	-	-	-	-	**H**	-	**M**	-	-
CO3	L3	-	**L**	-	-	**M**	-	-	-	-	**H**	-	**M**	-	-
CO4	L2	-	-	-	-	**L**	-	-	**L**	**L**	**H**	-	**M**	-	-
CO5	L3	-	**L**	-	-	**L**	-	-	-	-	**M**	-	**M**	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1,CO2,CO3, CO4,CO5
CD3	Seminars	CO2,CO3, CO4,CO5
CD4	Self- learning advice using internets	CO1, CO2,CO3, CO4
CD5	Industrial visit	CO5

BTESC104: Programming for Problem Solving

Course Objective:

- To learn the fundamentals of computers.
- To understand the various steps in program development.
- To learn the syntax and semantics of C programming language.
- To learn the usage of structured programming approach in solving problems.

Course Contents:

Unit I: Fundamentals of Computer:
Stored program architecture of computers, Storage device- Primary memory, and Secondary storage, Random, Direct, Sequential access methods.

Unit II: Concepts of High-level, Assembly and Low-level languages, Representing algorithms through flowchart and pseudo code.

Unit III: Number system:
Data representations, Concepts of radix and representation ofnumbers in radix r with special cases of r=2, 8, 10 and 16 withconversion from radix r1 to r2, r's and (r-1)'s complement, Binaryaddition, Binary subtraction, Representation of alphabets.

Unit IV: C Programming:
Problem specification, flow chart, data types, assignment statements,input output statements, developing simple C programs, Ifstatement, for loops, while loops, do-while loops, switch statement,break statement, continue statement.

Unit V: Development of C programs using
Arrays, functions, parameter passing,recursion, Programming in C using these statements, Structures,files, pointers and multi file handling.

Text / Reference Books

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Know and understand the conventions of Fundamentals of Computer.

CO2: Represent algorithms through flowchart and pseudo code.

CO3: Learn Number system and apply these skills in developing new products.

CO4: Understand and learn C Programming.

CO5: Comprehend the Development of C programs using- Arrays, functions.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	H	M	-	M	L	-	-	-	-	-	L	H	M
CO2	L2	H	H	M	L	M	L	-	-	-	L	-	L	M	M
CO3	L3	H	L	M	L	M	L	-	-	-	L	-	L	H	H
CO4	L2	M	H	L	M	H	-	-	-	-	M	-	M	H	M
CO5	L2	M	H	H	M	H	-	-	-	-	M	-	M	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTESC105A: Basic Civil Engineering

Course Objective:

- To inculcate the essentials of Civil Engineering field to the students of all branches of Engineering.
- To provide students the significance of the Civil Engineering Profession in satisfying societal needs.

Course Contents:

Unit I: Introduction to objective, scope and outcome the subject

Basic Knowledge of Concrete , Mortar , R.C.C , P.C.C , Grade of Concrete ,Masonry , Map Scale , Indian Standard Codes etc

Unit II: Scope and Specialization

Scope and Specialization of Civil Engineering, Role of civil Engineer in Society, Impact of infrastructural development on economy of country.

Unit III: **Surveying** Object, Principles & Types of Surveying; Site Plans, Plans& Maps; Scales & Unit of different Measurements. Linear Measurements: Instruments used. Linear Measurement by Tape, Ranging out Survey Lines and overcoming Obstructions; Measurements on sloping ground; Tape corrections, conventional symbols. Angular Measurements: Instruments used; Introduction to Compass Surveying,Bearings and Longitude & Latitude of a Line, Introduction to total station. Levelling: Instrument used, Object of leveling, Methods of leveling in brief, and Contour maps.

Unit IV: Buildings

Selection of site for Buildings, Layout of Building Plan, Types of buildings, Plinth area, carpet area, floor space index, Introduction to building byelaws, concept of sun light and ventilation. Components of Buildings & their functions, Basic concept of R.C.C., Introduction to types of foundation.

Unit V: Transportation

Introduction to Transportation Engineering; Traffic and Road Safety: Types and Characteristics of Various Modes of Transportation; Various Road Traffic Signs, Causes of Accidents and Road Safety Measures.

Text Books:

1. Gopi, S., Basic Civil Engineering, Pearson Publishers
2. Kandya, A. A., Elements of Civil Engineering, Charotar Publishing house
3. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
4. Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house

References Books:

1. Chudley, R., Construction Technology, Vol. I to IV, Longman Group, England
2. Chudley, R. and Greeno, R., Building Construction Handbook, Addison Wesley, Longman Group, England
3. McKay, W. B. and McKay, J. K., Building Construction Volumes 1 to 4, Pearson India Education Services
4. Minu, S., Basic Civil Engineering, Karunya Publications

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Illustrate the fundamental aspects of Civil Engineering.
CO2: Understand the scope of civil engineering.
CO3: Explain the concepts of surveying for making horizontal and vertical measurements.
CO4: Describe plan and set out of a building, also illustrate the uses of various building materials and explains the method of construction of different components of a building.
CO5: Understand the modes of Traffic and Road Safety and Road Safety Measures

Course Delivery methods:

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	-	-	-	-	M	L	-	-	-	-	M	M	M
CO2	L2	H	M	M	L	-	M	L	-	-	L	-	L	M	M
CO3	L2	M	H	M	L	H	-	H	-	-	L	-	L	L	L
CO4	L2	M	H	M	L	H	-	H	-	-	L	-	L	M	M
CO5	L2	M	M	L	H	M	L	-	H	-	H	-	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO5
CD5	Industrial visit	CO3, CO4, CO5

BTESC105B: Basic Electrical Engineering

Course Objective:

- To Understand the basic concept of Electrical engineering instruments for engineering applications.
- To Understand the basic electrical engineering parameters and their importance.
- To Understand the concept of various laws and principles associated with electrical systems.
- To Develop the knowledge to apply concepts in the field of electrical engineering, projects and research.

Course Contents:

Unit I: DC Circuits:

Electrical circuit elements (R, L and C), voltage and current sources,Kirchhoff current and voltage laws, Series-Parallel circuits, Nodevoltage method, Mesh current method, Superposition, Thevenin's,Norton's and Maximum power transfer theorems.

Unit II: AC Circuits:

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

Unit III: Transformers:

Ideal and practical transformer, EMF equation, equivalent circuit,losses in transformers, regulation and efficiency.

Unit IV: Electrical Machines:

Generation of rotating magnetic fields, Construction and working ofa three-phase induction motor, Significance of torque-slipcharacteristic. Starting and speed control of induction motor, singlephaseinduction motor. Construction, working, torque-speedcharacteristic and speed control of separately excited DC motor.Construction and working of synchronous generators.

Unit V: Power Converters:

Semiconductor PN junction diode and transistor (BJT).Characteristics of SCR, power transistor and IGBT. Basic circuits ofsingle phase rectifier with R load, Single phase Inverter, DC-DCconverter.

Suggested Text / Reference Books

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, " Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Apply basic skills for designing various instruments for engineering applications.

CO2: Determine error in laboratory measurements and techniques used to minimize such error.

CO3: Gain knowledge regarding the various laws and principles associated with electrical systems.

CO4: Understand electrical machines and apply them for practical problems.

CO5: Understand the concepts in the field of electrical engineering, projects and research.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	M	M	-	-	-	-	-	M	-	L	M	M
CO2	L5	L	M	H	M	L	-	-	-	-	M	-	M	M	M
CO3	L1	M	H	H	H	-	-	-	-	-	H	-	M	M	M
CO4	L2	H	L	M	L	-	-	-	-	-	L	-	L	H	M
CO5	L2	M	H	H	H	-	-	-	-	-	H	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO3, CO4, CO5
CD5	Industrial visit	CO5

BTBSC106A: Engineering Physics Lab

Course Objective:

- To understand the concepts of interference.
- To know about wavelength of light.
- To know about depletion layer and band gap of semiconductor.
- To know dispersion of light through prism.
- To understand the concept of magnetic field.

LIST OF EXPERIMENTS :

1. To determine the wave length of sodium light by Newton's Ring.
2. To determine the wave length of monochromatic light with the help of Fresnel's Biprism.
3. To determine the wave length of prominent lines of mercury by plane diffraction grating with the help of spectrometer.
4. Determination of band gap using a P-N junction diode.
5. To determine the height of given object with the help of sextant.
6. To determine the dispersive power of material of a prism with the help of spectrometer.
7. To study the charge and discharge of a condenser and hence determine the time constant for which both current and voltage graphs are to be plotted.
8. To determine the coherence length and coherence time of laser using He – Ne laser.
9. To measure the numerical aperture of an optical fibre.
10. To study the variation of magnetic field at the center of coil using tangent galvanometer.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the usage of common Ammeter, Voltmeter and Multimeter.

CO2: Deep learning of optical phenomenon such as Interference, diffraction and dispersion of light.

CO3: Understand the usage of common electrical measuring instruments.

CO4: Gain knowledge about the concept of optical fiber and Laser.

CO5: Understand the usage of optical instruments.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	-	H	-	M	-	-	H	-	L	H	L
CO2	L4	H	H	-	H	-	M	-	-	-	-	-	-	M	M
CO3	L2	M	L	-	-	L	-	L	-	-	L	-	-	M	L
CO4	L2	H	M	-	H	M	-	M	L	-	M	-	L	M	M
CO5	L2	H	M	-	H	M	-	M	L	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	CO1,CO2, CO3, CO4,CO5
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	----------

BTBSC106B: Engineering Chemistry Lab

Course Objective:

- To understand the method for the determination of hardness in water and purification process.
- To understand about different types of volumetric analysis.
- To learn about properties of lubricant oil.
- To Synthesize a small drug molecule and analyse a salt sample

List of Experiments:

1. Determination the hardness of water by EDTA method
2. Determination of residual chlorine in water
3. Determination of dissolved oxygen in water
4. Determination of the strength of Ferrous Ammonium sulphate solution with the help of K2Cr2O7 solution by using diphenyl amine indicator
5. Determination of the strength of CuSO4 solution iodometrically by using hypo solution
6. Determination of the strength of NaOH and Na2CO3 in a given alkali mixture
7. Proximate analysis of Coal
8. Determination of the flash & fire point and cloud & pour point of lubricating oil
9. Determination of the kinematic viscosity of lubricating oil by Redwood viscometer no. 1 at different temperature
10. Synthesis of Aspirin/ Paracetamol

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the method for the determination of hardness in water and purification process.

CO2: Understand about different types of volumetric analysis.

CO3: Learn about properties of lubricant oil.

CO4: Synthesize a small drug molecule and analyse a salt sample

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2	H	M	-	M	-	-	L	-	-	M	-	-	M	L
CO2	L1	L	H	M	H	-	-	L	-	-	H	-	-	M	M
CO3	L1	M	L	H	L	L	-	M	-	-	L	-	L	M	M
CO4	L3	L	L	H	L	L	-	L	-	-	L	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO1,CO2,CO5
CD5	Industrial visit	CO1,CO2, CO3, CO4

BTHSMC107: Language Lab

Course Objective:

- To understand concepts of basic English language fundamentals.
- To understand the communication skills.
- To develop Dialogue Writing and Listening comprehension.

Syllabus

1. Phonetic Symbols and Transcriptions.
2. Extempore.
3. Group Discussion.
4. Dialogue Writing.
5. Listening comprehension.

Course Outcomes:

At the end of the course, the student will be able to:
CO1: understand the Phonetic Symbols and Transcriptions.
CO2: Understand the skills required in Extempore.
CO3: improve their communication skills for Group Discussion.
CO4: improve their technical communication skills.
CO5: Understand Dialogue Writing and Listening skills.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	-	-	-	H	M	-	-	-	H	-	M	H	M
CO2	L2	M	-	-	-	-	M	-	-	H	H	-	L	M	L
CO3	L6	M	-	-	-	-	M	-	-	H	H	-	M	M	L
CO4	L6	M	-	-	-	M	M	-	-	-	H	-	M	M	M
CO5	L2	M	-	-	-	M	M	-	-	M	H	-	H	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	CO4,CO5
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	-

BTESC 108: Computer Programming Lab

Course Objective(s):

- To understand the various steps in program development.
- To learn the syntax and semantics of C programming language.
- To learn the usage of structured programming approach in solving problems.

LIST OF EXPERIMENTS :

1. To learn about the C Library, Preprocessor directive, Input-output statement.
2. Programs to learn data type, variables, If-else statement
3. Programs to understand nested if-else statement and switch statement
4. Programs to learn iterative statements like while and do-while loops
5. Programs to understand for loops for iterative statements
6. Programs to learn about array and string operations
7. Programs to understand sorting and searching using array
8. Programs to learn functions and recursive functions
9. Programs to understand Structure and Union operation
10. Programs to learn Pointer operations
11. Programs to understand File handling operations
12. Programs to input data through Command line argument

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Learn about the C Library, Preprocessor directive, Input-output statement.

CO2: Learn data type, variables, and conditional statement.

CO3: Learn about array and string operations.

CO4: Understand File handling operations.

CO5: learn programs related to C Programming and apply them to solve real world problems.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	H	-	-	M	L	-	-	-	L	-	L	M	L
CO2	L2	H	H	M	L	M	L	-	-	-	L	-	L	M	M
CO3	L2	H	L	M	L	M	L	-	-	-	L	-	L	H	M
CO4	L2	M	H	L	M	H	L	L	-	-	L	-	M	H	M
CO5	L3	M	H	H	M	H	M	L	-	-	M	-	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	----------

BTESC 109A: Basic Civil Engineering Lab

Course Objective(s):

- To Introduce The Various Activities Regarding Measurement And Leveling
- To Water Supply Procedure And Various Discharge And Pressure Measuring Apparatuses

LIST OF EXPERIMENTS:

1. Linear Measurement by Tape:
   a) Ranging and Fixing of Survey Station along straight line and across obstacles.
   b) Laying perpendicular offset along the survey line
2. Compass Survey: Measurement of bearing of line susing Surveyor's and Prismatic compass
3. Leveling: Using Tilting/ Dumpy/ Automatic Level
   a) To determine the reduced levels in closed circuit.
   b) To carry out profile leveling and plot longitudinal and cross sections for road by Height of Instrument and Rise & Fall Method.
4. To study and take measurements using various electronic surveying instruments like EDM, Total Station etc.
5. To determine pH, hardness and turbidity of the given sample of water.
6. To study various water supply Fittings.
7. To determine the pH and total solids of the given sample of sewage.
8. To study various Sanitary Fittings.

Course Outcomes:
At the end of the course, the student will be able to:
CO1: Conduct survey and collect field data.
CO2: Review field notes from survey data.
CO3: Interpret survey data and compute areas and volumes.
CO4: Describe Total station and measurement
CO5: Describe various water fittings and find out the various fluids properties

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	H	L	L	L	H	M	L	-	L	L	-	M	H	M
CO2	L2	H	M	M	M	-	M	L	-	L	M	-	L	M	L
CO3	L4	M	H	M	H	H	M	H	-	L	H	-	L	L	H
CO4	L2	M	H	M	H	H	M	H	-	L	H	-	L	-	M
CO5	L2	M	M	L	H	M	M	-	-	L	H	-	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	----------

BTESC 109B: Basic Electrical Engineering Lab

Course Objectives:

- To understand training on different trades like Fitting, Carpentry and Casting
- To learn various joints are made using wood and other metal pieces.
- To develop machining skills in students.

List of Experiments

1. Basic safety precautions. Introduction and use of measuring instruments –voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Transformers: Observation of the no-load current waveform on an oscilloscope. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
3. Three - phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).Phase-shifts between the primary and secondary side.
4. Demonstration of cut-out sections of machines: dc machine (commutate or brush arrangement), induction machine (squirrel cage rotor), synchronous (field winging - slip ring arrangement) and single-phase induction
5. Torque Speed Characteristic of separately excited dc motor.
6. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Adapt knowledge regarding the various laws and principles associated with electrical systems.

CO2: Adapt knowledge regarding electrical machines and apply them for practical problems.

CO3: Understand various types' Electrical Equipments.

CO4: Understanding digital measuring equipments.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom 's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	M	M	M	-	-	-	-	M	-	L	H	M
CO2	L3	L	M	H	M	M	-	-	-	-	M	-	M	M	M
CO3	L2	M	H	H	H	M	-	-	-	-	H	-	M	H	H
CO4	L2	H	L	M	L	M	-	-	-	-	L	-	L	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	

BTESC110: Computer Aided Engineering Graphics

Course Objectives:

- To Increase ability to communicate with people
- To Learn to sketch and take object dimensions.
- To Learn to take data and transform it into graphic drawings.

Course Contents:

Introduction: Principles of drawing, lines, type of lines, usage of Drawing instruments, lettering, Conic sections including parabola, hyperbola, Rectangular Hyperbola (General method only); Scales-Plain, Diagonal and Vernier Scales.

Projections of Point & Lines: Position of Point, Notation System, Systematic Approach for projections of points, front view & Top view of point, Position of straight lines, line parallel to Both the RPs, Line perpendicular to either of the RPs, Line inclined to one RP and parallel to the other, Line inclined to Both the RPs, Traces of a line (One drawing sheet, one assignment in sketch book).

Projection of Planes: Positions of planes, Terms used in projections of planes, plane parallel to RP, plane inclined to one RP and perpendicular to the other RP, plane perpendicular to Both the RPs, plane Inclined to Both the RPs, True shape of the plane, Distance of a point from plane, Angle between two planes.

Projections of Regular Solids: frustum and truncated solids, those inclined toboth the Planes-Auxiliary Views.

Section of Solids: Theory of sectioning, section of prisms and cubes, section ofpyramids and Tetrahedron section of Cylinders, section of cones, section ofspheres (One drawing sheet, one assignment in sketch book)

Overview of Computer Graphics : Covering theory of CAD software [such as: Themenu System, Toolbars (standard, Object Properties, Draw, Modify andDimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialogboxes and windows, Shortcut menus (Button Bars), Command Line (whereapplicable), The Status Bar, Different methods of zoom as used in CAD, Select anderase objects.: Isometric Views of lines, Planes, Simple and compound Solids.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Know and understand the conventions and the method of engineering drawing.

CO2: Interpret engineering drawings using fundamentals of different views to construct basic and intermediate geometry.

CO3: Know the Theory of sectioning and Section of Solids.

CO4: Comprehend the theory of projection.

CO5: Improve their drawing skill in the form of Computer Graphics.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	L	M	L	L	-	-	L	M	-	L	L	M
CO2	L4	H	M	L	M	L	L	-	-	-	M	-	L	L	M
CO3	L1	H	M	L	M	L	L	-	-	L	M	-	L	L	L
CO4	L2	H	H	M	H	L	L	-	-	L	H	-	M	M	M
CO5	L2	H	M	M	M	L	L	-	-	L	M	-	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	CO2
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	CO5

BTHSMC111: Social Outreach, Discipline & Extra Curricular Activities

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

B.Tech. (Data Science)

Semester - II

Semester - II

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC 201	Engineering Mathematics-II	BSC	30	70	100	3	1	-	4
BTBSC202A/ BTBSC202B	Engineering Chemistry / Engineering Physics	BSC	30	70	100	3	1	-	4
BTHSMC203	Universal Human Values	HSMC	30	70	100	2	-	-	2
BTESC204	Basic Mechanical Engineering	ESC	30	70	100	2	-	-	2
BTESC205A/ BTESC205B	Basic Electrical Engineering/ Basic Civil Engineering	ESC	30	70	100	3	-	-	3
BTVAC206	Environment Studies	VAC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTBSC 207A/ BTBSC 207B	Engineering Chemistry Lab/ Engineering Physics Lab	LC	60	40	100	-	-	1	1
BTESC208	Manufacturing Practices Workshop	LC	60	40	100	-	-	1	1
BTESC209A/ BTESC209B	Basic Electrical Engineering Lab/ Basic Civil Engineering	LC	60	40	100	-	-	1	1
BTESC210	Computer Aided Machine Drawing	LC	60	40	100	-	-	1	1
BTHSMC 211	Social Outreach, Discipline & Extra Curricular Activities	HSMC	100	-	100	-	-	-	1
	Total		**520**	**580**	**1100**	**16**	**2**	**4**	**22**

BTBSC 201: Engineering Mathematics-II

Course Objective:

- To provide detailed of matrices which is applied for solving system of linear equations and useful in various fields of technology.
- To understand and make use of the concepts of differential equations.
- To examine and analyze the complex function.
- To understand the numerical methods to find roots of the equations.

Course Content:

Unit-I: Matrices (10 hours)

Linear Systems of Equations; Linear Independence; Rank of a Matrix; Determinant, Inverse of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Orthogonal transformation; Diagonalization of matrices; Cayley-Hamilton Theorem, and quadratic to canonical forms.

Unit-II: Ordinary differential equations: (10 hours)

Exact, linear and Bernoulli's equations. Second order linear differential equations with Constant and variable coefficients. Power series solutions.

Unit-III: Partial differential equations: (8 hours)

Linear Partial differential equations of First order, Lagrange's Form, Non Linear Partial Differential equations of first order, Charpit's method, Standard forms. Separation of variables method to solve the simple problems in Cartesian coordinates.

Unit-IV: Complex Variable – Differentiation: (10 hours):

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, Conformal mappings, Mobius transformations. Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (withoutproof), Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof).

Unit-V: Numerical Methods: (6 hours):

Roots of algebraic and transcendental equations using numerical methods as Bisection method, Regula-Falsi method, Newton-Raphson Method, Secant method.

Textbooks/References:

1. G.B.Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9thEdit ion, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.
8. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
9. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the matrices and method for solving system of linear equations.

CO2: Solve the ODE differential.

CO3: Find the solutions of PDE.

CO4: Examine and analyze the complex functions and complex integrations and contour integrals.

CO5: Determine the roots of equations by numerical methods.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping between Objectives and Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	L3	H	M	H	M	L	M	-	-	M	-	M	H	H	M
CO2	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO3	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO4	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO5	L2	H	M	M	M	L	M	-	-	M	-	M	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	-
CD4	Project Discussions	-
CD5	Self- learning advice using internets	CO1,CO2,CO4,CO5

BTBSC202A: Engineering Chemistry

Course Objective:

- To acquire the knowledge about impurities in water, their determination and purification.
- To learn about different types of fuel and lubricant and their applications.
- To gain the basic knowledge, applications and control methods of corrosion.
- To get the knowledge of preparation and significance of explosives, cement, refractories and glass.
- To get the knowledge of organic reaction mechanism and their uses with different types of drugs

Course Contents:

Unit I: Water

Common impurities, hardness, determination of hardness by complexometric (EDTA method), Degree of hardness, Units of hardness Municipal water supply: Requisite of drinking water, Purification of water; sedimentation, filtration, disinfection, breakpoint chlorination. Boiler troubles: Scale and Sludge formation, Internal treatment methods, Priming and Foaming, Boiler corrosion and Caustic embrittlement Water softening; Lime-Soda process, Zeolite (Permutit) process, Demineralization process. Numerical problems based on Hardness, EDTA, Lime-Soda and Zeolite process.

Unit II: Organic Fuels

Solid fuels: Coal, Classification of Coal, Proximate and Ultimate analyses of coal and its significance, Gross and Net Calorific value, Determination of Calorific value of coal by Bomb Calorimeter. Metallurgical coke, Carbonization processes; Otto-Hoffmann byproduct oven method. Liquid fuels : Advantages of liquid fuels, Mining, Refining and Composition of petroleum, Cracking, Synthetic petrol, Reforming, Knocking, Octane number, Anti-knocking agents, Cetane number Gaseous fuels; Advantages, manufacturing, composition and Calorific value of coal gas and oil gas, Determination of calorific value of gaseous fuels by Junker's calorimeter Numerical problems based on determination of calorific value (bomb calorimeter/Junkers calorimeter/Dulongs formula, proximate analysis & ultimate and combustion of fuel.

Unit III: Corrosion and its control

Definition and significance of corrosion, Mechanism of chemical (dry) and electrochemical (wet) corrosion, galvanic corrosion, concentration corrosion and pitting corrosion. Protection from corrosion; protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design.

Unit IV: Engineering Materials

Portland Cement; Definition, Manufacturing by Rotary kiln. Chemistry of setting and hardening of cement. Role of Gypsum. Glass: Definition, Manufacturing by tank furnace, significance of annealing, Types and properties of soft glass, hard glass, borosilicate glass, glass wool, safety glass Lubricants: Classification, Mechanism, Properties; Viscosity and viscosity index, flash and fire point, cloud and pour point. Emulsification and steam emulsion number.

Unit V: Organic reaction mechanism and introduction of drugs

Organic reaction mechanism: Substitution; SN1, SN2, Elecrophilic aromatic substitution in benzene, free radical halogenations of alkanes, Elimination; elimination in alkyl halides, dehydration of alcohols, Addition: electrophilic and free radical addition in alkenes, nucleophilic addition in aldehyde and ketones, Rearrangement; Carbocation and free radical rearrangements Drugs : Introduction, Synthesis, properties and uses of Aspirin, Paracetamol

Suggested Text / Reference Books

1. Morrison R.T & Boyn R. N ; Organic Chemistry; Prentice Hall of India 1999
2. Lee J. D. ; Inorganic Chemistry ;Blackwell Science
3. Gopalan R., Venkappayya D., Nagarajan S. “Engineering Chemistry” Vikas Publishing House Pvt Ltd 2000.
4. Jain & Jain “ Engineering Chemistry” Dhanpat Rai publishing company
5. Dara S. S. , “ A Text Book of Engineering Chemistry” S. Chand and Company Ltd, 2008
6. Keeler J and Wolhess P, Why Chemical Reaction Happen Oxford Press.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Gain knowledge about impurities in water, their determination and purification.

CO2: Understand organic fuels and various emerging new areas of organic chemistry.

CO3: Learn about Corrosion and its control.

CO4: Get knowledge about the chemistry of some Engineering Materials like Portland Cement.

CO5: understand and study Organic reaction mechanisms.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2	H	-	M	-	-	-	-	-	-	M	-	H	M	M
CO2	L2	M	-	-	-	L	-	-	-	-	L	-	M	M	M
CO3	L1	M	-	-	-	-	-	-	-	-	L	-	M	M	L
CO4	L2	M	-	-	-	-	-	-	-	-	L	-	M	H	M
CO5	L2	M	-	-	-	-	-	-	-	-	-	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO1, CO2, CO3
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO1, CO5

BTBSC202B: Engineering Physics

Course Objective:

- To understand the concepts of interference, Diffraction and Polarization.
- To know about wave particle duality.
- To know applications of Optical fibre.
- To know applications of Lasers in Science, engineering and medicine.
- To know classification of Solid.

Course Contents:

Unit I: Wave Optics

Newton's Rings, Michelson's Interferometer, Fraunhofer Diffraction from a Single Slit. Diffraction grating: Construction, theory and spectrum, Resolving power and Rayleigh criterion for limit of resolution, Resolving power of diffraction grating, X-Ray diffraction and Bragg's Law.

Unit II: Quantum Mechanics

Introduction to quantum Mechanics, Wave-particle duality, Matter waves, Wave function and basic postulates, Time dependent and time independent Schrodinger's Wave Equation, Physical interpretation of wave function and its properties, Applications of the Schrodinger's Equation: Particle in one dimensional and three dimensional boxes.

Unit III: Coherence and Optical Fibers

Spatial and temporal coherence: Coherence length; Coherence time and 'Q' factor for light, Visibility as a measure of Coherence and spectral purity, Optical fiber as optical wave guide, Numerical aperture; Maximum angle of acceptance and applications of optical fiber.

Unit IV: Laser

Einstein's Theory of laser action; Einstein's coefficients; Properties of Laser beam, Amplification of light by population inversion, Components of laser, Construction and working of He-Ne and semiconductor lasers, Applications of Lasers in Science, engineering and medicine.

Unit V: Material Science & Semiconductor Physics

Bonding in solids: covalent and metallic bonding, Energy bands in solids: Classification of solids as Insulators, Semiconductors and Conductors, Intrinsic and extrinsic semiconductors, Fermi dirac distribution function and Fermi energy, Conductivity in semiconductors, Hall Effect: Theory, Hall Coefficient and applications.

References:

1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
4. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
5. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
6. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL
7. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Guptaon NPTEL

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Enhance the basic skills required to understand, develop, and design various engineering applications involving Wave Optics.

CO2: Understand Quantum Mechanics and apply them to diverse engineering problems.

CO3: Analyze the nature of light propagation in guided medium for engineering applications and study in Coherence and Optical Fibers.

CO4: Describe different Laser problems.

CO5: Describe Material Science & Semiconductor Physics.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	H	-	H	-	M	-	-	-	-	L	H	M
CO2	L3	H	H	H	H	-	M	-	-	-	-	-	-	M	M
CO3	L4	M	L	M	-	L	-	L	-	-	-	-	-	H	H
CO4	L2	H	M	H	H	M	-	M	L	-	L	-	L	H	M
CO5	L2	H	M	H	H	M	-	M	L	-	L	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3
CD3	Seminars	CO1, CO2, CO4, CO5
CD4	Self- learning advice using internets	CO1, CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTHSMC203: Universal Human Values

Objectives:

- To describe the meaning, purpose, and relevance of universal human values.
- To understand the importance of values in individual, social, career, and national life.
- To learn from the lives of great and successful people who followed and practised human values and achieved self-actualization.

Course Content:

Unit I: **Love and Compassion (Prem and Karuna):** What is love and its forms: love for self, parents, family, friend, spouse, community, nation, humanity and other beings—living and non-living. Love and compassion and inter-relatedness. Love, compassion, empathy, sympathy and non-violence, Individuals who are remembered in history for practicing compassion and love (such as the Buddha, and Jesus Christ). Narratives and anecdotes from history, literature, including local folklore. Practicinglove and compassion: What will learners learn gain if they practice love and compassion? What will learners lose if they don't practice love and compassion?, Sharing learner's individual and/or group experience(s). Simulated situations, Case studies.

Truth (Satya): What is truth? Universal truth, truth as value, truth as fact (veracity, sincerity, honesty among others), Individuals who are remembered in history for practicing this value Narratives and anecdotes from history, literature including local folklore, Practicing Truth: What will learners learn/gain if they practice truth? What will learners lose if they don't practice it?, Learners' individual and/or group experience(s) Simulated situations, Case studies.

Unit II: **Non-Violence (Ahimsa): Introduction:** What is non-violence? Its need. Love, compassion, empathy sympathy for others as pre-requisites for non-violence, Ahimsa as non-violence and nonkilling, Individuals and organisations that are known for their commitment to nonviolence. Narratives and anecdotes about non-violence from history, and literature including local folklore, Practicing non-violence What will learners learn/gain if they practice nonviolence? What will learners lose if they don't practice it? , Sharing learner's individual and/or group experience(s) about non-violence.

Righteousness (Dharma): Introduction, What is righteousness. Righteousness and dharma, righteousness and propriety. Individuals who are remembered in history for practising righteousness. Narratives and anecdotes from history and literature, including local folklore. What will learners learn/gain if they practice righteousness? What will learners lose if they don't practice it? Sharing learners' individual and/or group experience(s). Simulated situations. Case studies.

Unit III: **Peace (Shanti):** Introduction, What is peace and its need? Peace, harmony and balance. Individuals and organizations that are known for their commitment to peace (Mahatma Gandhi, United Nations). Narratives and anecdotes about peace from history and literature including local folklore. What will learners learn/gain if they practice peace? What will learners lose if they don't practice it? Sharing the learner's individual and/or group experience(s) about peace. Simulated situations, Case studies.

Service (Seva): Introduction, What is service? Forms of service: for self, parents, spouse, family, friends, community, persons in distress, nation, humanity and other living and non-living things. Individuals who are remembered in history for practising this value. Narratives and anecdotes dealing with instances of service from history

and literature including local folklore. What will learners learn or gain if they practice service? What will learners lose if they don't practice it? Sharing learner's individual and/or group experience(s) regarding service. Simulated situations, Case studies.

Unit IV: **Renunciation Sacrifice (Tyaga):** Introduction, What is renunciation? Renunciation and sacrifice. Greed is the main obstruction in the path of renunciation. Self-restraint and other ways of overcoming greed. Renunciation with action as true renunciation. Individuals who are remembered in history for practising this value like: Sri Rama, Bhishma, Gautama Buddha, Mahavira, Jesus Christ, Guru Govind Singh, Bhagat Singh, and Mahatma Gandhi. Narratives and anecdotes from history and literature, including local folklore about individuals who are remembered for their sacrifice and renunciation. What will learners learn/gain if they practice renunciation and sacrifice? What will learners lose if they don't practise it? Sharing learner's individual and/or group experience(s) Simulated situations, Case studies.

Unit V: **Constitutional Values, Justice, and Human Rights:**

Fundamental Values: Justice, Liberty, Equality, Fraternity, Human Dignity Fundamental Rights: Right to Life, Right to Freedom of Speech and Expression, Right to Education, Right to Health and Housing, Right to Work and Decent Living, Right against Exploitation

Fundamental Duties: Fundamental Duties of Indian Citizens (Article 51 A of the Constitution)

Patriotism, Pride and Gratitude for the Nation:

Reference Books:

1. Basham, A. L. (1954). The Wonder That Was India. London: Picador Press.
2. Basu, D. D. (2015). Workbook on the Constitution of India, Paperback Edition. Nagpur: Lexisnexis.
3. Ghosh, A. (1998). The Foundations of Indian Culture. Pondicherry: Sri Aurobindo Ashram.
4. Joshi, K. (1997). Education for Character Development. Delhi: Dharam Hinduja Centre of Indic Studies.
5. Milton, R. (1973). The Nature of Human Values. New York: The Free Press.
6. Preamble to The Constitution of India together with Articles 15, 16, 19-22, 23, 24, 26, 39, 51A.

Course Outcomes:

The learners shall be able to:

CO1 Become conscious practitioners of values.
CO2 Realize their potential as human beings and conduct themselves properly in the ways of the world.
CO3 Develop integral life skills with values
CO4 Inculcate and practice them consciously to be good human beings.
CO5 Realize their potential as human beings.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	-	-	-	-	-	L	-	H	L	-	-	H	-	-
CO2	L2	-	-	-	-	-	L	-	M	M	-	-	H	-	-
CO3	L3	-	-	-	-	-	M	-	H	L	-	-	H	-	-
CO4	L2	-	-	-	-	-	M	-	H	L	-		H	-	-
CO5	L3	-	-	-	-	-	M	-	H	L	-	-	H	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO5
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	

BTESC 204: Basic Mechanical Engineering

Course Objectives:

- To Increase ability to understand machine working
- To Learn to understand fundamentals of mechanical systems
- To Learn to make different mechanical aspects of engineering

Course Contents:

Unit I: Fundamentals:
Introduction to mechanical engineering, concepts of thermal engineering, mechanical machine design, industrial engineering and manufacturing technology. Steam Boilers classification and types of steam boilers and steam turbines. Introduction and Classification of power plants.

Unit II: Pumps and IC Engines:
Applications and working of Reciprocating and Centrifugal pumps.Introduction, Classification of IC Engines, Main Components of ICEngines, Working of IC Engines and its components.

Unit III: Refrigeration and Air Conditioning:
Introduction, classification and types of refrigeration systems andair-conditioning. Applications of refrigeration and Air-conditioning.

Unit IV: Transmission of Power:
Introduction and types of Belt and Rope Drives, Gears.

Unit V: Primary Manufacturing Processes:Metal Casting Process: Introduction to Casting Process, Patterns,Molding, Furnaces. Metal Forming Processes: Introduction toForging, Rolling, Extrusion, Drawing. Metal Joining Processes:Introduction to various types of Welding, Gas Cutting, Brazing, andSoldering.

Text Books:

- Agarwal C M, Agarwal Basant “Basic Mechanical Engineering” 2019

Reference Books

- Shanmugam G, Ravindran S “Basic Mechanical Engineering” TMH Publication , 2019
- Bansal R K “Basic Mechanical Engineering” Laxmi Publication 2019

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Know and understand the Fundamentals of thermal engineering, mechanical machine design, industrial engineering and manufacturing technology.

CO2: Understand the Refrigeration and Air Conditioning.

CO3: Understand the Applications and working of Reciprocating and Centrifugal pumps.

CO4: Know the Transmission of Power through Belt and Rope Drives, Gears.

CO5: Understand of Primary Manufacturing Processes.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	L	M	L	-	-	-	-	M	-	L	M	M
CO2	L2	H	M	L	M	L	-	L	-	-	M	-	L	M	M
CO3	L2	H	L	L	L	M	-	-	-	-	L	-	L	M	M
CO4	L2	H	L	L	L	L	-	L	-	-	L	-	L	M	M
CO5	L2	M	L	L	L	-	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3,
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTESC205A: Basic Electrical Engineering

Course Objective:

- To Understand the basic concept of Electrical engineering instruments for engineering applications.
- To Understand the basic electrical engineering parameters and their importance.
- To Understand the concept of various laws and principles associated with electrical systems.
- To Develop the knowledge to apply concepts in the field of electrical engineering, projects and research.

Course Contents:

Unit I: DC Circuits:

Electrical circuit elements (R, L and C), voltage and current sources,Kirchhoff current and voltage laws, Series-Parallel circuits, Nodevoltage method, Mesh current method, Superposition, Thevenin's,Norton's and Maximum power transfer theorems.

Unit II: AC Circuits:

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

Unit III: Transformers:

Ideal and practical transformer, EMF equation, equivalent circuit,losses in transformers, regulation and efficiency.

Unit IV: Electrical Machines:

Generation of rotating magnetic fields, Construction and working ofa three-phase induction motor, Significance of torque-slipcharacteristic. Starting and speed control of induction motor, singlephaseinduction motor. Construction, working, torque-speedcharacteristic and speed control of separately excited DC motor.Construction and working of synchronous generators.

Unit V: Power Converters:

Semiconductor PN junction diode and transistor (BJT).Characteristics of SCR, power transistor and IGBT. Basic circuits ofsingle phase rectifier with R load, Single phase Inverter, DC-DCconverter.

Suggested Text / Reference Books

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, " Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Apply basic skills for designing various instruments for engineering applications.

CO2: Determine error in laboratory measurements and techniques used to minimize such error.

CO3: Gain knowledge regarding the various laws and principles associated with electrical systems.

CO4: Understand electrical machines and apply them for practical problems.

CO5: Understand the concepts in the field of electrical engineering, projects and research.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	M	M	-	-	-	-	-	M	-	L	M	M
CO2	L5	L	M	H	M	L	-	-	-	-	M	-	M	M	M
CO3	L1	M	H	H	H	-	-	-	-	-	H	-	M	M	M
CO4	L2	H	L	M	L	-	-	-	-	-	L	-	L	H	M
CO5	L2	M	H	H	H	-	-	-	-	-	H	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO3, CO4, CO5
CD5	Industrial visit	CO5

BTESC205B: Basic Civil Engineering

Course Objective:

- To inculcate the essentials of Civil Engineering field to the students of all branches of Engineering.
- To provide students the significance of the Civil Engineering Profession in satisfying societal needs.

Course Contents:

Unit I: Introduction to objective, scope and outcome the subject

Unit II: Introduction

Scope and Specialization of Civil Engineering, Role of civil Engineer in Society, Impact of infrastructural development on economy of country.

Unit III: Surveying Object, Principles & Types of Surveying; Site Plans, Plans& Maps; Scales & Unit of different Measurements. Linear Measurements: Instruments used. Linear Measurement by Tape, Ranging out Survey Lines and overcoming Obstructions; Measurements on sloping ground; Tape corrections, conventional symbols. Angular Measurements: Instruments used; Introduction to Compass Surveying,Bearings and Longitude & Latitude of a Line, Introduction to total station. Levelling: Instrument used, Object of leveling, Methods of leveling in brief, and Contour maps.

Unit IV: Buildings

Selection of site for Buildings, Layout of Building Plan, Types of buildings, Plinth area, carpet area, floor space index, Introduction to building byelaws, concept of sun light and ventilation. Components of Buildings & their functions, Basic concept of R.C.C., Introduction to types of foundation.

Unit V: Transportation

Introduction to Transportation Engineering; Traffic and Road Safety: Types and Characteristics of Various Modes of Transportation; Various Road Traffic Signs, Causes of Accidents and Road Safety Measures.

TEXTBOOKS:

1. Gopi, S., Basic Civil Engineering, Pearson Publishers
2. Kandya, A. A., Elements of Civil Engineering, Charotar Publishing house
3. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
4. Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house

References Books:

1. Chudley, R., Construction Technology, Vol. I to IV, Longman Group, England
2. Chudley, R. and Greeno, R., Building Construction Handbook, Addison Wesley, Longman Group, England
3. McKay, W. B. and McKay, J. K., Building Construction Volumes 1 to 4, Pearson India Education Services
4. Minu, S., Basic Civil Engineering, Karunya Publications

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Illustrate the fundamental aspects of Civil Engineering.
CO2: Understand the scope of civil engineering.
CO3: Explain the concepts of surveying for making horizontal and vertical measurements.
CO4: Describe plan and set out of a building, also illustrate the uses of various building materials and explains the method of construction of different components of a building.
CO5: Understand the modes of Traffic and Road Safety and Road Safety Measures

Course Delivery methods:

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	-	-	-	-	M	L	-	-	-	-	M	M	M
CO2	L2	H	M	M	L	-	M	L	-	-	L	-	L	M	M
CO3	L2	M	H	M	L	H	-	H	-	-	L	-	L	L	L
CO4	L2	M	H	M	L	H	-	H	-	-	L	-	L	M	M
CO5	L2	M	M	L	H	M	L	-	H	-	H	-	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO5
CD5	Industrial visit	CO3, CO4, CO5

BTVAC206: Environmental Studies

Course Objectives:

- To provide student with an understanding of the natural, human and social dimensions of local and wider environments.\
- To provide students with opportunities to engage in active learning
- To encourage students to use a wide range of skills, and acquire open, critical and responsible attitudes.

Course Contents:

Unit I Ecosystems and Biodiversity

Ecosystem – Introduction- Abiotic and Biotic components. Structure and functions of Ecosystem, Food Chain, Food web, Ecological pyramids, Energy flow and biogeochemical cycle, Biodiversity – Values, Type and levels of Biodiversity. Causes of depletion. Conservation of biodiversity.

Unit II Natural Resources and Environment

Forest resources: types and Values, Water resources: Types of water resources- fresh water and marine resources; Availability and use of water resources, Soil and mineral resources: Important minerals; Mineral exploitation; Environmental problems due to extraction of minerals and use; Soil as a resource and its degradation, Non-Conventional energy sources, Introduction, renewable sources of energy, Potential of renewable energy resources in India, solar energy, wind energy, Energy from ocean, energy from biomass, geothermal energy and nuclear energy.

Unit III Environmental Pollutions

Water Pollution – Sources of water, water quality standards, type of pollutants – its sources and effects, Air Pollution – composition of atmosphere, Air quality standards, Sources and adverse effects of air pollution, Greenhouse effect, global warming, acid rain, ozone depletion, Noise Pollution – Introduction, Level of noise, Sources and adverse effects of noise, Control of noise pollution.

Unit IV Environmental Management and Sustainable Development

Solid Waste Management, Municipal waste – Introduction, classification of solid waste, composition and characteristics of solid waste, Collection conveyance and disposal of solid waste, recovery of resources. Sanitary land filling, Vermi-composting, incineration, Biomedical waste – Generation, collection and disposal. Water Conservation, Rain Water Harvesting.

Unit V Social Issues and Environmental Legislation

Social Issues and Environmental Impact Assessment (EIA), Sustainable development, Public awareness and environmental education, Environmental Legislations in India – Environmental Protection act-1986, Air (Prevention and control of Pollution) act, water (Prevention and control of Pollution) act, wildlife protection act, Forest conservation act.

Suggested Readings

1. Bamanayha B.R., Verma, L.N. and Verma A (2005). Fundamentals of Environmental Sciences, Yash Publishing House, Bikaner.
2. Dhaliwal G.S., Sangha G.S. and Ralhan P.K. (2000) Fundamentals of Environmental Sciences,Kalyani Publishers, New Delhi.
3. Odum E.P. and Barrett G.W.(2007) Fundamentals of Ecology, Akash Press, New Delhi.
4. Agrawal, K.C.(1999) Environmental Biology, Agro Botanica, Bikaner.
5. Ranjeeta Soni, Environmental Studies and Disaster management" New India Publication Agency (NIPA), New Delhi.
6. Shikha Agarwal,Suresh Sahu,,Environmental Engineering, Dhanpat Rai Publication.
7. M N RaoHVN Rao ,Air Pollution,Tata Mcgraw Hill Education Private Limited.

Course Outcomes:

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

CO1: Understand the interdisciplinary branches of environment and their scopes. Ecosystem Links between environmental components and their role and types of ecosystems. Types of biodiversity, their values, depletion and various conservation methods.

CO2: Concepts and classification of natural resources. They will able to understand about biotic resources, soil and mineral resources, Concept of non Conventional energy resources, types and various applications of renewable resources and current potentials of energy resources.

CO3: Understand about various types of pollutions and their classification, types of pollutants and their sources. Various quality standards for pollutions, adverse health effects including air, water, soil, noise thermal and radioactive pollutions.

CO4: Basic knowledge about management system, cost benefit analysis,EIA and EA solid and hazardous waste management ,concept of 3Rs and Sustainable development Goals and strategies.

CO5: Basic knowledge about various constitutional acts, laws, agreements and about organizations on international level for environmental initiatives.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments,Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1,L2	M	-	-	-	-	--	H	-	-	-	-	H	-	-
CO2	L2,L4	M	-	-	-	-	-	H	-	-	-	-	H	-	-
CO3	L1,L4	M	-	-	-	-	L	H	-	-	-	-	H	-	-
CO4	L1,L2	M	-	-	-	-	-	H	-	-	-	-	H	-	-
CO5	L1,L2	M	-	-	-	-	L	H	-	-	-	-	H	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO1,CO2,CO5
CD5	Industrial visit	CO1,CO2, CO3, CO4

BTBSC207A: Engineering Chemistry Lab

Course Objective:

- To understand the method for the determination of hardness in water and purification process.
- To understand about different types of volumetric analysis.
- To learn about properties of lubricant oil.
- To Synthesize a small drug molecule and analyse a salt sample

List of Experiments:

1. Determination the hardness of water by EDTA method
2. Determination of residual chlorine in water
3. Determination of dissolved oxygen in water
4. Determination of the strength of Ferrous Ammonium sulphate solution with the help of K2Cr2O7 solution by using diphenyl amine indicator
5. Determination of the strength of CuSO4 solution iodometrically by using hypo solution
6. Determination of the strength of NaOH and Na2CO3 in a given alkali mixture
7. Proximate analysis of Coal
8. Determination of the flash & fire point and cloud & pour point of lubricating oil
9. Determination of the kinematic viscosity of lubricating oil by Redwood viscometer no. 1 at different temperature
10. Synthesis of Aspirin/ Paracetamol

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the method for the determination of hardness in water and purification process.

CO2: understand about different types of volumetric analysis.

CO3: learn about properties of lubricant oil.

CO4: Synthesize a small drug molecule and analyse a salt sample

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2	H	M	-	M	-	-	L	-	-	M	-	-	M	L
CO2	L1	L	H	M	H	-	-	L	-	-	H	-	-	M	M
CO3	L1	M	L	H	L	L	-	M	-	-	L	-	L	M	M
CO4	L3	L	L	H	L	L	-	L	-	-	L	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO1, CO2, CO3, CO4, CO5
CD4	Self- learning advice using internets	CO1,CO2,CO5
CD5	Industrial visit	CO1,CO2, CO3, CO4

BTBSC 207B: Engineering Physics Lab

Course Objective:

- To understand the concepts of interference.
- To know about wavelength of light.
- To know about depletion layer and band gap of semiconductor.
- To know dispersion of light through prism.
- To understand the concept of magnetic field.

LIST OF EXPERIMENTS :

1. To determine the wave length of sodium light by Newton's Ring.
2. To determine the wave length of monochromatic light with the help of Fresnel's Biprism.
3. To determine the wave length of prominent lines of mercury by plane diffraction grating with the help of spectrometer.
4. Determination of band gap using a P-N junction diode.
5. To determine the height of given object with the help of sextant.
6. To determine the dispersive power of material of a prism with the help of spectrometer.
7. To study the charge and discharge of a condenser and hence determine the time constant for which both current and voltage graphs are to be plotted.
8. To determine the coherence length and coherence time of laser using He – Ne laser.
9. To measure the numerical aperture of an optical fibre.
10. To study the variation of magnetic field at the center of coil using tangent galvanometer.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the usage of common Ammeter, Voltmeter and Multimeter.

CO2: Deep learning of optical phenomenon such as Interference, diffraction and dispersion of light.

CO3: Understand the usage of common electrical measuring instruments.

CO4: Gain knowledge about the concept of optical fiber and Laser.

CO5: Understand the usage of optical instruments.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	-	H	-	M	-	-	H	-	L	H	L
CO2	L4	H	H	-	H	-	M	-	-	-	-	-	-	M	M
CO3	L2	M	L	-	-	L	-	L	-	-	L	-	-	M	L
CO4	L2	H	M	-	H	M	-	M	L	-	M	-	L	M	M
CO5	L2	H	M	-	H	M	-	M	L	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	CO1,CO2, CO3, CO4,CO5
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	----------

BTESC208: Manufacturing Practices Workshop

Course Objectives:

- To discuss the modules include training on different trades like Fitting, Carpentry and Casting
- To learn various joints are made using wood andother metal pieces.
- To develop machining skills in students.

Carpentry Shop

1. T – Lap joint
2. Bridle joint

Foundry Shop

3. Mould of any pattern
4. Casting of any simple pattern

Welding Shop

5. Lap joint by gas welding
6. Butt joint by arc welding
7. Lap joint by arc welding
8. Demonstration of brazing, soldering & gas cutting

Machine Shop Practice

9. Job on lathe with one step turning and chamfering operations

Fitting and Sheet Metal Shop

10. Finishing of two sides of a square piece by filing
11. Making mechanical joint and soldering of joint on sheet metal
12. To cut a square notch using hacksaw and to drill a hole and tapping

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Describe cast different parts through Carpentry.

CO2: Define control manufacturing via computers.

CO3: Understanding use power tools and fitting tools.

CO4: Knowledge of various welding operations

CO5: Understanding different metallic and non-metallic objects.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	L	L	L	L	-	-	-	L	L	-	L	H	M
CO2	L2	H	M	L	M	M	-	-	-	-	M	-	L	M	L
CO3	L2	H	M	L	M	M	-	-	-	-	M	-	L	H	M
CO4	L2	H	M	L	M	M	-	L	-	L	M	-	L	H	M
CO5	L2	H	M	L	M	M	-	L	-	L	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	

BTESC209A: Basic Electrical Engineering Lab

Course Objectives:

- To understand training on different trades like Fitting, Carpentry and Casting
- To learn various joints are made using wood and other metal pieces.
- To develop machining skills in students.

List of Experiments

1. Basic safety precautions. Introduction and use of measuring instruments –voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Transformers: Observation of the no-load current waveform on an oscilloscope. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
3. Three - phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).Phase-shifts between the primary and secondary side.
4. Demonstration of cut-out sections of machines: dc machine (commutate or brush arrangement), induction machine (squirrel cage rotor), synchronous (field winging - slip ring arrangement) and single-phase induction
5. Torque Speed Characteristic of separately excited dc motor.
6. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Adapt knowledge regarding the various laws and principles associated with electrical systems.

CO2: Adapt knowledge regarding electrical machines and apply them for practical problems.

CO3: Understand various types' Electrical Equipments.

CO4: Understanding digital measuring equipments.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom 's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	M	M	M	-	-	-	-	M	-	L	H	M
CO2	L3	L	M	H	M	M	-	-	-	-	M	-	M	M	M
CO3	L2	M	H	H	H	M	-	-	-	-	H	-	M	H	H
CO4	L2	H	L	M	L	M	-	-	-	-	L	-	L	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	

BTESC209B: Basic Civil Engineering Lab

Course Objective(s):

- To Introduce The Various Activities Regarding Measurement And Leveling
- To Water Supply Procedure And Various Discharge And Pressure Measuring Apparatuses

LIST OF EXPERIMENTS:

1. Linear Measurement by Tape:
   a) Ranging and Fixing of Survey Station along straight line and across obstacles.
   b) Laying perpendicular offset along the survey line
2. Compass Survey: Measurement of bearing of linesusing Surveyor's and Prismatic compass
3. Levelling: Using Tilting/ Dumpy/ Automatic Level
   a) To determine the reduced levels in closed circuit.
   b) To carry out profile levelling and plot longitudinal and cross sections for road by Height of Instrument and Rise & Fall Method.
4. To study and take measurements using various electronic surveying instruments like EDM, Total Station etc.
5. To determine pH, hardness and turbidity of the given sample of water.
6. To study various water supply Fittings.
7. To determine the pH and total solids of the given sample of sewage.
8. To study various Sanitary Fittings.

Course Outcomes:
At the end of the course, the student will be able to:
CO1: Conduct survey and collect field data.
CO2: Review field notes from survey data.
CO3: Interpret survey data and compute areas and volumes.
CO4: Describe Total station and measurement
CO5: Describe various water fittings and find out the various fluids properties

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	H	L	L	L	H	M	L	-	L	L	-	M	H	M
CO2	L2	H	M	M	M	-	M	L	-	L	M	-	L	M	L
CO3	L4	M	H	M	H	H	M	H	-	L	H	-	L	L	H
CO4	L2	M	H	M	H	H	M	H	-	L	H	-	L	-	M
CO5	L2	M	M	L	H	M	M	-	-	L	H	-	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	----------

BTESC210: Computer Aided Machine Drawing

Course Objective:

- To design, develop and analyze simple linear and non linear computer based drawing.
- To identify and apply the suitable knowledge of computers to understand the shape and size of Drawing Objects.

Course Contents:

Introduction: Principles of drawing, conventional representation of machine components and materials, lines, types of lines, dimensioning types, rules of dimensioning.

Conversion of pictorial views into orthographic views: (1 drawing sheet) Introduction to orthographic projection, concept of first angle and third angle projection, drawing of simple machine elements in first angle projection, missing view problems covering Principles of Orthographic Projections.

Sectional views of mechanical components: (1 drawing sheet) Introduction, cutting plane line, type of sectional views-full section, half section, partial or broken section, revolved section, removed section, offset section, sectioning conventions-spokes, web rib, shaft, pipes, different types of holes, conventions of section lines for different metals and materials.

Fasteners and other mechanical components: (Free hand sketch) Temporary and permanent fasteners, thread nomenclature and forms, thread series, designation, representation of threads, bolted joints, locking arrangement of nuts, screws, washers, foundation bolts etc., keys, types of keys, cotter and knuckle joints. Riveted joints, rivets and riveting, type of rivets, types of riveted joints etc. Bearing: Ball, roller, needle, foot step bearing. Coupling: Protected type, flange, and pin type flexible coupling. Other components: Welded joints, belts and pulleys, pipes and pipe joints, valves etc.

Overview of Computer Graphics: (2 drawing sheets) Covering theory of CAD software such as: The menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Command Line (Where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.: Isometric Views of Lines, Planes, Simple and compound Solids.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the conventions and the method of engineering drawing.

CO2: Interpret engineering drawings using fundamentals of different views to construct basic and intermediate geometry.

CO3: Adapt theory of sectioning and Section of Solids.

CO4: Classify the theory of projection.

CO5: Understand drawing skill in the form of Computer Graphics.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	L	L	L	L	-	-	-	L	L	-	L	L	M
CO2	L4	H	L	H	L	L	-	-	-	-	L	-	L	L	L
CO3	L3	H	H	H	H	L	-	-	-	-	H	-	L	L	M
CO4	L4	H	M	H	M	L	-	-	-	L	M	-	L	M	L
CO5	L2	H	M	H	M	L	-	-	-	L	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	----------
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	-----

BTHSMC211: Social Outreach, Discipline & Extra Curricular Activities

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

B.Tech. (Data Science)

Semester–III

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSBSC301	**Discrete Mathematics Structure**	**BSC**	30	70	100	3	-	-	3
BTCSPCC302	Object Oriented Programming	PCC	30	70	100	3	-	-	3
BTCSPCCAIML303	**Python Programming**	PCC	30	70	100	3	-	-	3
BTCSPCC304	Data Structures and Algorithms	PCC	30	70	100	3	-	-	3
BTCSPCC305	Internet & Web Technology	PCC	30	70	100	3	-	-	3
BTCSPCC306	Software Engineering	PCC	30	70	100	3	-	-	3
BTCSHSMC307	Fundamentals of Indian Knowledge System	HSMC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCSPCC 308	Data Structures and Algorithms Lab	LC	60	40	100	-	-	1	1
BTCSPCC 309	Object Oriented Programming Lab	LC	60	40	100	-	-	1	1
BTCSPCC 310	Software Engineering Lab	LC	60	40	100	-	-	1	1
BTCSPCCAIML 311	**Python Lab**	LC	60	40	100	-	-	1	1
BTCSPCCAIML312	Internet & Web Technology Lab	LC	60	40	100	-	-	1	1
BTCSPROJ313	Industrial Training / Seminar	PROJ	60	40	100	-	-	1	1
BTCSHSMC314	Social Outreach, Discipline & Extra Curricular Activities	HSMC	100	-	100	-	-	-	1
	TOTAL		**670**	**730**	**1400**	**20**	**0**	**6**	**27**

BTCSBSC301: Discrete Mathematical Structures

Course Objective:

- To develop logical thinking and its application to computer science, especially to emphasize the importance of proving statements correctly
- To develop the concept of number theory.
- To enhances one's ability to reason and ability to present a coherent and mathematically accurate argument.
- To build theoretical concepts behind various higher level concepts such as graphs.
- To learn the concept of group theory and its various applications.

Course Contents:

Unit I: **Notion of proof**: Propositional and predicate logic, proof by counterexample, the contrapositive, proof by contradiction, inductive proofs. Propositional and predicate logic

Unit II: **Number Theory**- Divisibility, Euclidean algorithm, prime numbers, Fundamental Theorem of Arithmetic, greatest common divisors, Fermat's little theorem, Congruence's, solution of congruence's, Chinese remainder theorem, Euler's phi function, Quadratic residues and reciprocity, Jacobi Symbol, binary quadratic forms, equivalence and reduction of binary forms, sums of two squares, greatest integer function, arithmetic functions,

Unit III: **Combinatorial number theory:** Basic counting techniques, pigeon-hole principle, recurrence relations, generating functions, Polya's counting theorem. Introduction to probabilistic method in combinatorics, Inclusion-exclusion principle, Techniques of numerical calculation, Public key Cryptography.

Unit IV: **Graph Theory**- Introduction and basic terminology of graphs, Planer graphs, Multigraphs and weighted graphs, Isomorphic graphs, Paths, Cycles and connectivity, Shortest path in weighted graph, Introduction to Eulerian paths and circuits, Hamiltonian paths and circuits, Graph coloring, chromatic number, Isomorphism and Homomorphism of graphs, matching, vertex/edge covering.

Unit V: **Algebraic Structures:** Definition, Properties, types: Semi Groups, Monoid, Groups, Abelian group, properties of groups, Subgroup, cyclic groups, Cosets, Permutation groups, Normal subgroup, Homomorphism and isomorphism of Groups,

Text Books:

1. C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 2000.
2. R. C. Penner, Discrete Mathematics: Proof Techniques and Mathematical Structures, World Scientific, 1999.
3. S.B. Singh, Discrete Structures, Khanna Book Publishing Company, 2019.

References:

1. Chartrand, Lesniak, and Zhang. *Graphs and Digraphs*, Fifth Edition. CRC Press. 2010.
2. D. Jungnickel. Graphs, *Networks and Algorithms*, Fourth Edition. Springer. 2013.
3. Douglas B. West. *Introduction to Graph Theory*, Second Edition. Prentice Hall. 2001.
4. I. Niven, H.S. Zuckerman, H. L. Montgomery, *An Introduction to theory of numbers (fifth edition*), John Wiley & Sons, Inc.
5. Neal Koblitz, *A course in Number theory and Cryptography (second edition)*, Springer-Verlag.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Construct simple mathematical proofs and to verify them • Have substantial experience to comprehend formal logical arguments. skillful in expressing mathematical properties formally via the formal language of propositional logic and predicate logic

CO2: Understand and implement the number theory

CO3: Apply the knowledge of combinatorics and its applications such as pigeon hole principles, recurrence relations, generator functions, counting principles etc.

CO4: Understand the graph theory and its application.

CO5: Understand the concept of group theory.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars / Presentations
CD4	Project Discussions
CD5	Self- learning advice using internets

Mapping between Objectives and Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	L3	H	M	H	M	L	M	-	-	M	-	M	H	H	M
CO2	L4	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO3	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO4	L2	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO5	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3,CO4,CO5
CD2	Tutorials/Assignments	CO1,CO2,CO3,CO4,CO5
CD3	Seminars / Presentations	-
CD4	Project Discussions	-
CD5	Self- learning advice using internets	CO1,CO2,CO4,CO5

BTCSPCC 302: Object Oriented Programming

Course Objective:

- To perform object oriented programming to develop solutions to problems demonstrating usage of control structures, modularity, I/O. and other standard language constructs.
- To demonstrate adeptness of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance.
- To demonstrate ability to implement one or more patterns involving realization of an abstract interface and utilization of polymorphism in the solution of problems which can take advantage of dynamic dispatching.
- To learn syntax, features of, and how to utilize the Standard Template Library. Learn other features of the C++ language including templates, exceptions, forms of casting, conversions, covering all features of the language.

Course Contents:

Unit I Introduction to different programming paradigm, characteristics ofOOP, Class, Object, data member, member function, structures in C++, different access specifies, defining member function inside and outside class, array of objects.

Unit II Concept of reference, dynamic memory allocation using new and delete operators, inline functions, function overloading, function with default arguments, constructors and destructors, friend function and classes, using this pointer.

Unit III Inheritance, types of inheritance, multiple inheritance, virtual base class, function overriding, abstract class and pure virtual function

Unit IV Constant data member and member function, static data member and member function, polymorphism, operator overloading, dynamic binding and virtual function

Unit V Exception handling, Template, Stream class, File handling.

Textbooks/References:

- E. Balagurusamy, Object Oriented programming, Tata McGraw Hill.
- K R Venugopal, Rajkumar, T Ravishankar, Mastering C++, Tata McGraw Hill.
- C. Thomas Wu, An Introduction to OOP with Java, McGraw Hill.
- Timothy Wood, An Introduction to Object Oriented Programming, Addison Wesley.
- John R. Hubbard, Programming with C++, McGraw Hill International.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Underline the features of C++ supporting object oriented programming.

CO2: Describe the relative merits of C++ as an object oriented programming language.

CO3: Use how to produce object-oriented software using C++.

CO4: Describe how to apply the major object-oriented concepts to implement object oriented programs in C++, encapsulation, inheritance and polymorphism.

CO5: Understand advanced features of C++ specifically stream I/O, templates and operator overloading.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	M	H	M	H	-	-	-	L	M	L	L	L	L
CO2	L2	H	M	M	M	M	-	-	-	L	M	-	M	M	L
CO3	L3	H	M	L	M	M	-	-	-	L	M	L	L	M	L
CO4	L1	M	M	M	M	M	L	-	-	L	M	-	M	L	M
CO5	L2	H	M	H	H	L	L	-	-	L	M	-	L	M	L

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO5
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO5
CD5	Industrial visit	CO4, CO5

BTCSPCCAIML303: Python Programming

Course Objective:

The course is designed to provide Basic knowledge of Python. Python programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn the Python programming language.

Course Contents:

Unit I: Python Interpreter, The Interpreter and Its Environment, Control Flow Tools if Statements, for Statements, The range() Function, break and continue Statements, and else Clauses on Loops, pass Statements, Defining Functions, More on Defining Functions .

Unit II: **Data Structures :** More on Lists , The del statement , Tuples and Sequences, Sets, Dictionaries Looping Techniques, More on Conditions, Comparing Sequences and Other Types .

Unit III: Functions, Modules, Standard Modules, The dir() Function, Packages, Files, Tuple Packing and Unpacking

Unit IV: **Input and Output:** Fancier Output Formatting , Reading and Writing Files, Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User-defined Exceptions , Defining Clean-up Actions, Predefined Clean-up Actions

Unit V: **Classes :** A Word About Names and Objects, Python Scopes and Namespaces, Inheritance, Private Variables, Odds and Ends, Iterators, Generators, Generator Expressions, Standard Library : Operating system Interface, command line Argument, String Pattern matching, Internet access

References:

1. Starting Out with Python (2009) Pearson , Tonny Gaddis
2. Beginning Pyhton Wrox Publication Peter Norton, Alex Samuel
3. Python Algorithms Apress, Magnus Liet Hetland,
4. Python Object Oriented Programming PACKT Press, Dusty Phillips
5. Python for Unix and Linux System Administration O'Relly, Noad Gift

Course Outcomes:

CO1: Define and learn basics of Python

CO2: develop console application in python

CO3: Implement Data structures using puthon.

CO4: Develop database application in python

CO5: Use various data analysis libraries available in Python

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L2	H	-	M	-	M	L	H	M	-	M	-	M	M	M
CO2	L2	H	-	L	-	H	H	M	-	-	L	-	L	H	M
CO3	L3	M	-	M	-	H	M	H	L	L	L	L	L	H	H
CO4	L6	M	-	M	-	H	M	H	L	L	L	L	L	H	H
CO5	L2	M	-	M	-	H	M	H	L	L	L	L	L	H	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3,CO4,CO5
CD2	Tutorials/Assignments	CO2, CO3 ,CO4,CO5
CD3	Seminars	CO3
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	CO3

BTCSPCC 304: Data Structures and Algorithms

Course Objectives:

- 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 understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures.

Course Contents:

Unit I **Stacks:** Basic Stack Operations, Representation of a Stack using Static Array and Dynamic Array, Multiple stack implementation using single array, Stack Applications: Reversing list, Factorial Calculation, Infix to postfix Transformation, Evaluating Arithmetic Expressions and Towers of Hanoi.

Unit II **Queues**: Basic Queue Operations, Representation of a Queue using array, Implementation of Queue Operations using Stack, Applications of Queues- Round Robin Algorithm. Circular Queues, DeQueue Priority Queues.

Linked Lists: Introduction, single linked list, representation of a linked list in memory, Different Operations on a Single linked list, Reversing single linked list, Advantages and disadvantages of single linked list, circular linked list, double linked list and Header linked list.

Unit-3 **Searching Techniques:** Sequential and binary search. Sorting Techniques: Basic concepts, Sorting by: bubble sort, Insertion sort, selection sort, quick sort, heap sort; merge sort, radix sort and counting sorting algorithms.

Unit-4 **Trees:** Definition of tree, Properties of tree, Binary Tree, Representation of Binary trees using arrays and linked lists, Operations on a Binary Tree, Binary Tree Traversals (recursive), Binary search tree, B-tree , B+tree, AVL tree, Threaded binary tree.

Unit-5 **Graphs**: Basic concepts, Different representations of Graphs, Graph Traversals (BFS & DFS), Minimum Spanning Tree(Prims &Kruskal), Dijkstra's shortest path algorithms. Hashing: Hash function, Address calculation techniques, Common hashing functions, Collision resolution: Linear and Quadratic probing, Double hashing.

Textbooks/References:

- Schaum Series, "Introduction to Data Structures", TMH.
- R.B. Patel, "Expert Data Structures with C", Second Edition, Khanna Book publishing Co (P) Ltd.
- Tenenbaum, "Data Structure using C++", PHI.
- Chattopadhyay S., Dastidar d G.andChattopadhyayMatangini., "Data Structure through C language", BPB publications.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Discuss the algorithms to determine the time and Computation complexity and justify the correctness.

CO2: Implement given Search problem (Linear Search and Binary Search).

CO3: Implement Stack and Queue and analyze the same to determine the time and computation complexity.

CO4: Apply 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.

CO5: Implement Graph search and traversal algorithms and determine the time and computation complexity.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	H	H	H	-	L	-	-	L	M	-	L	M	M
CO2	L3	H	H	M	H	M	-	-	-	L	M	-	M	H	L
CO3	L3	H	M	L	M	M	-	-	-	L	M	M	L	M	M
CO4	L3	M	H	M	H	M	L	-	-	L	M	M	M	H	M
CO5	L4	H	M	H	M	L	L	-	-	L	M	M	L	H	L

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO5
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO5
CD5	Industrial visit	CO4, CO5

BTCSPCC 305: Internet & Web Technology

Course Objectives:

- To design and develop a dynamic website
- To provide some basic knowledge of web services which are useful for the same

Course Contents:

Unit–I **Introduction to Web**: what is www, Protocols and programs, application and development tools like Dream Weaver , Gif Animator , the web browser, What is server, Search Engines choices, setting up web servers, Logging users, dynamic IP Web Design: Web site design principles, planning the site and navigation,

Unit–II **Introduction to HTML:** What HTML is-and What It isn't, History of HTML, Structuring HTML page, The HTML><HEAD><TITLE><BODY>tags, Paragraphs, Font tags, Creating different types of Links, Introduction to lists, Different types of lists. , Table pats, Sizing tables, borders, cells, Table and cell color and alignment, Aligning your table content, spanning multiple rows and columns, grouping and aligning rows and columns.

Unit–III **Scripting:** What is the scripting, server side and client side scripting, Javascript : Client side scripting, What is Javascript, How to develop Javascript, simple Javascript, variables, functions, conditions, loops and repetition

Unit–IV **DHTML:** What is DHTML, The concept of style sheets, Approaches to style sheets, commonly used style sheet properties and values, Controlling page layout CSS properties, Backgrounds, colors and images, setting border appearance Inline style sheets

Unit–V **Web Forms:** Understanding forms and functions, Essential elements of forms, Displaying control labels, Grouping control with field set and legend, What are frames , Working with linked windows, Working with frames, Changing frame borders

Text Books:

1. K. K. Sharma, "Web Technology", A.B. Publication Delhi, First Edition, 2008.
2. Jonathan Gennick with Tom Luers, 'Teach yourself HTML', 2nd Edition ,SAMS
3. Ethan Cerami, "Web Services", O'Reilly Media, 2002.
4. Achyut S Godbole and AtulKahate, "Web Technologies", Tata McGraw Hill.

References:

1. Raj Kamal , "Internet and Web Technologies", TMH.
2. Deitel, "Internet & World Wide Web , How to Program", PHI.
3. HTML: A Beginner's GuidebyWendy Willard (Author)
4. Rick Dranell, "HTML4 unleashed", Techmedia Publication, 2000.
5. T. M. Ramachandran , "Internet & Web development", Dhruv.
6. Ivan Bay Ross, "HTML, DHTML, Java script, Perl CGI", BPB.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the basics of internet and Working with HTML and scripting.

CO2: Create web pages using HTML

CO3: Build dynamic web pages using JavaScript

CO4: Work with DHTML

CO5: Work with Forms.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2
CO1	L2	H	-	M	-	M	-	M	-	-	H	L	L
CO2	L3	M	-	L	-	M	-	H	-	-	H	L	L
CO3	L2	L	-	L	-	M	-	H	-	-	M	M	M
CO4	L1	M	-	M	-	H	-	M	-	-	M	L	L
CO5	L2	M	-	M	-	M	L	L	L	-	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	CO4, ,CO5
CD4	Self- learning advice using internets	CO1, CO2,CO3, CO4,CO5
CD5	Industrial visit	CO3, CO4,CO5

BTCSPCC 306: Software Engineering

Course Objectives:

- To help students to develop skills that will enable them to construct software of high quality – software that is reliable, and that is reasonably easy to understand, modify and maintain.
- To foster an understanding of why these skills are important.

Course Contents:

Unit I Introduction, software life-cycle models, software requirements specification, formal requirements specification, verification and validation.

Unit II **Software Project Management:** Objectives, Resources and their estimation, LOC and FP estimation, effort estimation, COCOMO estimation model, risk analysis, software project scheduling.

Unit-III **Requirement Analysis:** Requirement analysis tasks, Analysis principles. Software prototyping and specification data dictionary, Finite State Machine (FSM) models. Structured Analysis: Data and control flow diagrams, control and process specification behavioral modeling

Unit-IV **Software Design:** Design fundamentals, Effective modular design: Data architectural and procedural design, design documentation.

Unit-V **Object Oriented Analysis:** Object oriented Analysis Modeling, Data modeling. Object Oriented Design: OOD concepts, Class and object relationships, object modularization, Introduction to Unified Modeling Language.

Text/ Reference Books:

- R. S. Pressman, "Software Engineering – A practitioner's approach", McGraw Hill Int. Ed.
- I. Sommerville, "Software Engineering", Addison Wesley, 2004
- Rajib Mall, "Fundamental of Software Engineering", 3rd Edition, PHI Learning Private Limited
- K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers
- K. K. Aggarwal & Yogesh Singh, "Software Engineering", 2nd Ed., New Age International, 2005.
- James Peter, W. Pedrycz, "Software Engineering: An Engineering Approach", John Wiley & Sons.
- Pankaj Jalote, "An Integrated Approach to Software Engineering", Narosa, 3rd Ed., 2005.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand large scale software development from a broader perspective, and function in multidisciplinary teams.

CO2: Apply knowledge gained in the course to practical software development situations.

CO3: Describe software systems to meet desired needs with realistic constraints.

CO4: Describe software development activities.

CO5: Discuss contemporary issues in Software development and engage in life-long learning, understand professional and ethical responsibility

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	H	M	-	-	-	-	L	L	L	M	H	M
CO2	L3	H	L	M	L	M	-	-	-	M	L	L	M	M	H
CO3	L1	H	M	L	M	M	-	-	-	H	M	-	M	M	M
CO4	L1	M	L	M	L	M	-	-	-	M	L	L	M	H	M
CO5	L2	H	H	H	H	L	-	-	-	M	L	L	L	M	H

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO5
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO5
CD5	Industrial visit	CO4, CO5

BTCSHSMC307: Fundamentals of Indian Knowledge System

Course Objective:

- Creating awareness amongst the youths about the true history and rich culture of the country;
- Understanding the scientific value of the traditional knowledge of Bharata;
- Promoting the youths to do research in the various fields of Bharatiya knowledge system;
- Converting the Bharatiya wisdom into the applied aspect of the modern scientific paradigm.
- Approaches for conservation and Management of rich Indian culture.

Course Contents:

Unit-I: Introduction of Indian Knowledge System (IKS)

Definition and scope of IKS, Importance of ancient knowledge, General structure of the Vedic Literature, Gurukul System of Vedic times, Main Schools of Philosophy, the Takṣaśilā University, the Nālandā University, General Introduction of Upaniṣadic Literature, Philosophical Ideas and Ethics in Upaniṣads, Ṛta, Ṛna, Puruṣārtha, Varṇa Dharma, Brahman and Ātman, Mokṣa.

Unit-II: Indian Literature and Scholars

Philosophy and Literature (Maharishi Vyas, Manu, Kanad, Pingala, Parasar, Banabhatta, Nagarjuna and Panini) Mathematics and Astronomy (Aryabhatta, Mahaviracharya, Bodhayan, Bhashkaracharya, Varahamihira and Brahmgupta) Medicine and Yoga (Charak, Susruta, Maharishi Patanjali and Dhanwantri)

Unit III: Scientific aspects of Indian Knowledge System

History and Culture of Astronomy, Sun, Earth, Moon, and Eclipses, Earth is Spherical and Rotation of Earth, Concepts of Zero and Pi, Number System, Pythagoras Theorem, and Vedic Mathematics, Origin and development of Patanjali Yoga, Ayurveda and its Relevance, Integrated Approach to Holistic Health Care

Unit IV: Ancient Technology and Architecture

Pre-Harappan and Sindhu Valley Civilization, Engineering Science and Technology in the Vedic Age and Post-Vedic Records, Iron Pillar of Delhi, Rakhigarhi, Mehrgarh, Sindhu Valley Civilization, Marine Technology, and Bet–Dwarka.

Unit-V: Protection, preservation and management of Indian Knowledge System

Documentation and Preservation of IKS, Approaches for conservation and Management of nature and bio-resources, Approaches and strategies to protection and conservation of IKS

Text books:

1. Text book on IKS: The Knowledge system of Bhārata by Prof. Bhag Chand Chauhan, Publisher: Garuda Prakashan
2. Text book on “Introduction to Indian Knowledge system: Concepts & Applications” by Mahadevan B et al. Publisher: PHI Learning
3. History of Science in India Volume-1, Part-I, Part-II, Volume VIII, by Sibaji Raha, et al. National Academy of Sciences, India and The Ramkrishan Mission Institute of Culture, Kolkata (2014).

Reference Books:

1. Pride of India- A Glimpse of India’s Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati (2006).
2. Vedic Physics by Keshav Dev Verma, Motilal Banarsidass Publishers (2012).
3. India’s Glorious Scientific Tradition by Suresh Soni, Ocean Books Pvt. Ltd. (2010).
4. Kapoor, Kapil, Avadesh Kr. Singh (eds.) Indian Knowledge Systems (Two Vols), IIAS, Shimla, (2005)

Course Outcomes: Get awareness of Indian

	The learners shall be able to:	Bloom Level
CO1	Get awareness of Indian knowledge systems, ancient wisdom, Vedic literature, philosophical schools, historical educational institutions, and key philosophical concepts, enabling them to appreciate the rich heritage of Indian thought and its relevance in today's world.	L2
CO2	Understand the contributions of prominent Indian scholars and their works in the different fields.	L2
CO3	Explore the scientific aspects of Indian knowledge systems.	L3
CO4	Understand the Ancient Technology and Architecture	L2
CO5	Analyze the Protection, preservation and management of Indian Knowledge System	L4

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	**Bloom Level**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**P011**	**PO12**	**PSO1**	**PSO2**
CO1	L2	-	-	-	-	-		-	M	-	-	-	M	-	-
CO2	L2	-	-	-	-	-	L	-	-	-	-	-	M	-	-
CO3	L3	M	-	-	-	-	L	-	-	-	-	-	M	-	-
CO4	L2	L	-	L	-	-	L	-	-	-	-	-	M	-	-
CO5	L4	-	-	L	-	L		L	-	-	-	-	M	-	-

BTCSPCC 308: Data Structures and Algorithms Lab

Course Objectives:

- 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.

List of Experiments:

S.No.	***List of Exercises***
1	Write a program to insert an element at desire position in the array.
2	Write a program to delete an element at desire position from the array.
3	Write a program to replace an element at desire position in the array.
4	Write a program to search (linear search) an element in the array.
5	Write a program to search (binary search) an element in the array.
6	Write a program to addition and multiply of two matrices.
7	Write a program to implementation of stack using array.
8	Write a program to implementation of queue using array.
9	Write a program to implementation link list.
10	Write a program that sorts the array through Bubble sort.
11	Write a program that sorts the array through Quick sort.
12	Write a program that sorts the array through Merge sort.
13	Write a program that sorts the array through Insertion sort.
14	Write a program to BST (binary search tree) addition, deletion and searching.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Select appropriate data structures as applied to specified problem definition.

CO2: Implement operations like searching, insertion, and deletion, traversing mechanism etc. on various data structures.

CO3: Implement Linear and Non-Linear data structures.

CO4: Implement appropriate sorting/searching technique for given problem.

CO5: Determine and analyze the complexity of given Algorithms.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1	H	M	H	M	M	-	-	-	L	M	L	L	M	L
CO2	L3	M	M	H	M	L	-	-	-	-	M	L	M	M	L
CO3	L3	M	M	H	M	L	-	-	-	L	M	-	L	H	M
CO4	L3	H	L	H	L	L	-	-	-	-	L	-	M	M	M
CO5	L4	H	M	H	M	M	-	-	-	M	M	L	L	M	L

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO5
CD3	Seminars	-
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO5

BTCSPCC 309: Object Oriented Programming Lab

Course Objective:

- To Perform object oriented programming for develop solutions to problems, demonstrating usage of control structures, modularity, I/O and other standard language constructs.
- To Demonstrate adeptness of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance.

List of Experiments:

1 Understand the basics of C++ library, variables, and data input-output.

2 C++ program using with the concept of structures.

3 Implement class and object concepts and function overloading.

4 Write programs to understand dynamic memory allocation and array of objects.

5 Program to understand different types of constructors and destructor.

6. Implement friend function to access private data of a class and usage of thisPointer.

7. Write programs to understand the usage of constant data member and member function, static data member and member function in a class.

8. Implement different types of inheritance, function overriding and virtual function

9. Implement Operator overloading concepts.

10. Write programs to understand function template and class template.

11. Write programs to understand exception handling techniques.

12. Write programs to understand file handling techniques.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Apply OOPs features to program design and implementation.

CO2: Create Classes according to the problem and implement programs in C++

CO3: Implement Object Oriented Programs using templates and exceptional handling concepts.

CO4: Perform console operations, applications and file handling.

CO5: Implement applications using C++.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	H	M	M	-	-	-	L	L	-	L	M	M
CO2	L6	M	M	H	M	L	-	-	-	M	L	-	L	M	M
CO3	L3	M	M	H	M	L	-	-	-	L	M	-	L	H	L
CO4	L3	H	H	H	H	-	-	-	-	M	M	-	L	M	M
CO5	L3	H	M	H	M	M	-	-	-	M	L	-	L	M	M

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO5
CD3	Seminars	CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO5

BTCSPCC 310: Software Engineering Lab

Course Objective:

- To help students to develop skills that will enable them to construct software of high quality software that is reliable and reasonably also easy to understand, modify and maintain.
- To foster an understanding of why these skills are important.

Tool Required: Rational Rose Enterprise Edition

List of Experiments:

1. Development of requirements specification, function oriented design using/SD, object-oriented design using UML, test case design, and implementation using Java and testing. Use of appropriate CASE tools and other tools such as configuration management tools, program analysis tools in the software lifecycle.
2. Develop Software Requirements Specification (SRS) for a given problem in IEEE template.
3. Develop DFD model (level-0, level-1 DFD and Data dictionary) of the project.
4. Develop structured design for the DFD model developed.
5. Developed all Structure UML diagram of the given project.
6. Develop Behavior UML diagram of the given project.

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Preparing of software requirements specification for a given problem in IEEE template. using UML.

CO2. Use of appropriate CASE tools.

CO3. Implement models for software applications.

CO4. Create DFD's for software applications.

CO5. Use the different UML notations for designing software.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	H	M	H	M	M	L	-	-	-	M	L	L	H	M
CO2	L3	M	M	H	M	M	L	-	-	-	M	L	M	H	M
CO3	L3	M	M	H	M	L	L	-	-	-	M	L	L	M	M
CO4	L6	H	H	H	H	-	-	-	-	M	M	-	L	M	M
CO5	L3	H	M	H	M	M	-	-	-	M	L	-	L	M	M

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3,CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3,CO4
CD3	Seminars	-
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	-

BTCSPCCAIML 311: Python Lab

Course Objective:

- To describe the need for Object-oriented programming concepts in Python.
- To infer the supported data structures like lists, dictionaries and tuples in Python.
- To illustrate the application of matrices and regular expressions in building the Python programs.
- To discover the use of external modules in creating excel files and navigating the file systems.

List of Experiments

1. Write a program to demonstrate basic data type in python.
2. Write a program to compute distance between two points taking input from the user
3. Write a program add.py that takes 2 numbers as command line arguments and prints its sum.
4. Write a Program for checking whether the given number is an even number or not.
5. Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . . . , 1/10
6. Write a Program to demonstrate list and tuple in python.
7. Write a program using for loop that loops over a sequence.
8. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.
9. Find the sum of all the primes below two million.
10. By considering the terms in the Fibonacci sequence whose values do not exceed four million, WAP to find the sum of the even-valued terms.
11. Write a program to count the numbers of characters in the string and store them in a dictionary data structure.
12. Write a program to use split and join methods in the string and trace a birthday of a person with a dictionary data structure
13. Write a program to count frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file?
14. Write a program to print each line of a file in reverse order.
15. Write a program to compute the number of characters, words and lines in a file.
16. Write a function nearly equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on.
17. Write function to compute gcd, lcm of two numbers. Each function shouldn’t exceed one line.
18. Write a program to implement Merge sort.
19. Write a program to implement Selection sort, Insertion sort.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Create, Test and Debug Python Programs

CO2: Implement Conditionals and Loops for Python Programs

CO3: Use functions and represent Compound data using Lists, Tuples and Dictionaries

CO4: Read and write data from & to files in Python and develop Application using Python.

CO5: Illustrate sort methods in Python Programs.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L6	H	M	M	M	M	-	-	-	L	M	L	L	M	M
CO2	L3	M	M	M	M	L	-	-	-	M	M	L	M	H	M
CO3	L2	H	L	H	L	M	-	-	-	L	L	L	M	H	H
CO4	L6	H	M	H	M	M	-	-	-	M	M	M	L	H	H
CO5	L3	M	M	M	M	L	-	-	-	M	M	L	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,CO5
CD2	Tutorials/Assignments	CO2, CO3
CD3	Seminars	-
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit	-

BTCSPCCAIML 312: Internet & Web Technology Lab

Course Objective:

- To design web development Software and to understand web technologies.
- To make student able for designing and developing the web applications.

LIST OF EXPERIMENTS

1. Write a program to display different style of heading text?
2. Develop and demonstrate a HTML document that illustrates the use external style sheet, ordered list, table, borders, padding, color, and the tag
3. Write an html code for creates the ordered list.
4. Web page creation with all types of cascading style sheets.
5. Create a html registration form and to validate the form using JavaScript code.
6. Create a web page that displays college information using various style sheets.
7. To write a JavaScript program to define a user defined function for sorting the values in an array.
8. Create a web page with field username, password, date of birth, email, and gender contact no.
9. Create a webpage to demonstrate the validation.

BTCSPROJ 313: Industrial Training / Seminar

Course Objectives:

- To Awareness of how to use values in improving your own professionalism.
- To Learning about personal and communication styles for team building.
- To identify, formulate and present model problems.
- To Learning management of values

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Personalize and create a communication style for individual & team building.

CO2: Use values in improving one's own professionalism

CO3: Develop the higher cognitive abilities that are analysis, synthesis and evaluation.

CO4: Ability to identify, formulate and present model problems.

CO5 : Describe latest technologies in own profession.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PSO1	PSO2
CO1	L2	M	H	L	H	L	-	-	-	-	L	-	L	M	M
CO2	L3	M	L	H	H	L	-	-	-	-	L	-	M	H	M
CO3	L6	M	H	M	M	L	-	-	-	-	L	-	M	M	M
CO4	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	H
CO5	L1	M	H	L	H	L	-	-	-	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTCSHSMC 314: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Semester-IV

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCCAIML401	**Artificial Intelligence**	PCC	30	70	100	3	1	-	4
BTCSHSMC 402	Critical Thinking	HSMC	30	70	100	2	-	-	2
BTCSPCCAIML403	Machine Learning-I	PCC	30	70	100	2	-	-	2
BTCSPCC404	Database Management System	PCC	30	70	100	3	0	0	3
BTCSPCC405	Theory of Computation	PCC	30	70	100	3	1	0	4
BTCSPCC406	Data Communication and Computer Networks	PCC	30	70	100	3	0	0	3
BTCSVAC407	Web Development	VAC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCSPCC408	Web Development Lab	LC	60	40	100	0	0	1	1
BTCSPCC409	Database Management System Lab	LC	60	40	100	0	0	1	1
BTCSPCC410	Network Programming Lab	LC	60	40	100	0	0	1	1
BTCSPCC411	Linux Shell Programming Lab	LC	60	40	100	0	0	1	1
BTCSPCCAIML412	**Machine Learning Lab**	LC	60	40	100	-	-	1	1
BTCSHSMC 413	Social Outreach, Discipline & Extra Curricular Activities	HSMC	100	-	100	-	-		1
	TOTAL		**610**	**690**	**1300**	**19**	**2**	**5**	**27**

BTCSPCCAIML401: Artificial Intelligence

Course Objective:

- To introduce the basic principles, techniques, and applications of **Artificial Intelligence**.
- To become familiar with basic principles of **AI** toward problem solving, inference, perception, knowledge representation, and **learning**.

Course Contents:

Unit I: **Introduction to AI and Intelligent agent:** Different Approach of AI, Problem Solving : Solving Problems by Searching, Uninformed search, BFS, DFS, Iterative deepening, Bi directional search, Hill climbing, Informed search techniques: heuristic, Greedy search, A* search, AO* search, constraint satisfaction problems.

Unit II: **Game Playing:** Minimax, alpha-beta pruning, jug problem, chess problem, tiles problem

Unit III: **Knowledge and Reasoning:** Building a Knowledge Base: Propositional logic, first order logic, situation calculus. Theorem Proving in First Order Logic.Planning, partial order planning. Uncertain Knowledge and Reasoning, Probabilities, Bayesian Networks

Unit IV: **Learning: Overview of different forms of learning, Supervised base learning**: Learning Decision Trees, SVM, Unsupervised based learning, Market Basket Analysis, Neural Networks.

Unit V: **Introduction to Natural Language Processing:** Different issue involved in NLP, Expert System, Robotics.

Reference/Text Books:

- E.Rich,K Knight-Artificial Intelligence,Tata McGraw Hills.
- S.Russell,P.Norving-Artificial Intelligence-A Modern Approach, Pearson Education,Asia.
- Thomas Dean-Artificial Intelligence-Theory & Practice, Pearson Education, Asia.
- Alison Caursey - The Essence of Artificial Intelligence, Pearson Education, Asia.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.

CO2: Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.

CO3: Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.

CO4: Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

CO5: Understand Natural Language Processing in AI.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L3	H	L	H	L	-	M	-	-	L	L	-	M	M	M
CO2	L3	H	L	M	L	-	-	-	-	L	L	-	L	M	M
CO3	L3	M	H	M	H	-	L	-	-	L	H	-	M	H	M
CO4	L3	M	M	H	M	-	L	-	-	L	M	-	L	H	M
CO5	L2	H	M	L	M	L	-	-	-	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	CO4

BTCSHSMC 402: Critical Thinking

Course Objective:

This course provides practical skills with some theoretical background in the reasoning processes by which we reach conclusions in everyday life, as well as in academic disciplines. It prepares the student for critical thinking and develops his/her critical awareness, needed when faced with texts, case studies, articles, arguments, speeches, and information from the media.

Course Contents:

Unit I: Fundamentals of Critical Thinking: the difference between literal meaning and implication, the principles of definition, how to identify when a disagreement is merely verbal, the distinction between necessary and sufficient conditions, and problems with the imprecision of ordinary language.

Unit II: What is an Argument (Examples drawn from everyday life, philosophical, moral and legal contexts.), Rhetoric: Persuasion vs. logical support, Recognizing Arguments. Deductive Arguments: General Introduction, Validity, Soundness. Valid Argument Forms, Reductio Ad Absurdum., Fallacies related to deductive arguments. Inductive Arguments: General Introduction, Strength, Cogency,Inductive Generalizations(Enumerative Induction)

Unit III: **Argument Reconstruction: Argument Assessment:** Extraneous material; Defusing the rhetoric; logical streamlining; implicit and explicit; connecting premises; relevance; ambiguity and vagueness. Practical Reasoning: Casual generalizations. Rationally persuasive arguments; some strategies for logical assessment; refutation by counter example.

Unit IV: Fallacies Identification of major logical fallacies (false authority, circular reasoning etc.), The difference between facts and inferences, The difference between the denotative and connotative meanings of words, The differences between conscious, unconscious, warranted and unwarranted assumptions.

Unit V: Moral, Legal and Aesthetic Reasoning Principles of Moral Reasoning; Major perspectives in Moral Reasoning. Legal Reasoning. Justifying Laws, Four Perspectives. Aesthetic Reasoning. Eight aesthetic principles; Using Aesthetic Principles to Judge Aesthetic Value; Evaluating Aesthetic Criticism: Relevance and Truth; Why Reason Aesthetically.

Reference Books:

1. Bowell, T. and Kemp, G. “Critical Thinking: A Concise Guide.” Oxon: Routledge, 3rd edition, 2009.
2. Gardner, Peter S. “New Directions: Reading Writing and Critical Thinking.” Cambridge Academic Writing Collection, 2005.
3. Mayfield, Marlys. “Thinking for Yourself: Developing Critical Thinking Skills through Reading and Writing.” Eighth Edition. Boston: Wadsworth. Cengage Learning, 2010.
4. Audi, R. “Practical Reasoning and Ethical Decision.” London: Routledge, 2006.

Course Outcomes:

	The learners shall be able to:	Bloom Level
CO1	To enable students / learners to understand the logical connections between ideas.	L2
CO2	To help them to identify, construct and evaluate arguments	L3
CO3	To equip them to detect inconsistencies and common mistakes in reasoning	L3
CO4	To enable them to write analytically for academic purpose	L2
CO5	To distinguish between inferences of different types in various forms of communication.	L2

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L2	-	M	M	M	-	-	-	-	-	-	-	-	-	-
CO2	L3	-	M	M	M	-	-	-	-	-	M	-	-	-	-
CO3	L3	-	M	M	M	-	-	-	-	-	M	-	-	-	-
CO4	L2	-	M	M	H	-	-	-	-	-		-	-	-	-
CO5	L2	-	M	M	M	-	-	-	-	-	M	-	-	-	-

BTCSPCCAIML403: Machine Learning-I

Course Objectives:

- To introduce students to the basic concepts and techniques of **Machine Learning**.
- To develop skills of using recent **machine learning** software for solving practical problems.
- To gain experience of doing independent study and research.

Course Contents:

Unit I: **Supervised learning algorithm:** Introduction, types of learning, application, Supervised learning: Linear Regression Model, Naïve Bayes classifier Decision Tree, K nearest neighbor, Logistic Regression, Support Vector Machine, Random forest algorithm

Unit II: **Unsupervised learning algorithm:** Grouping unlabelled items using k-means clustering, Hierarchical Clustering, Probabilistic clustering, Association rule mining, Apriori Algorithm, f-p growth algorithm, Gaussian mixture model.

Unit III: Introduction to Statistical Learning Theory, Feature extraction-Principal component analysis, Singular value decomposition. Feature selection–feature ranking and subset selection, filter, wrapper and embedded methods, Evaluating Machine Learning algorithms and Model Selection.

Unit IV: **Semi supervised learning, Reinforcement learning:** Markov decision process (MDP), Bellman equations, policy evaluation using Monte Carlo, Policy iteration and Value iteration, Q-Learning, State-Action-Reward-State-Action (SARSA), Model-based Reinforcement Learning.

Unit V: Recommended system, Collaborative filtering, Content-based filtering Artificial neural network, Perceptron, Multilayer network, Back propagation, Introduction to Deep learning.

Reference/Text Books:

- Tom M Mitchell, Machine Learning, McGraw Hill Education
- Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.
- Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: Wiley-Interscience, 2000. ISBN: 9780471056690.
- Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995. ISBN: 9780198538646.
- Introduction to MachineLearning - EthemAlpaydin, MIT Press, Prentice hall of India.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Describe intelligent agents for search and games

CO2: Convert AI problems through programming with Python

CO3: Learning optimization and inference algorithms for model learning

CO4: Make programs for an agent to learn and act in a structured environment.

CO5: Learn recommended system in ML.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1	H	M	M	M	M	M	-	-	-	M	-	M	M	M
CO2	L2	M	M	H	M	L	-	-	-	-	M	-	L	M	M
CO3	L1	M	H	M	H	-	-	-	-	-	H	-	L	H	M
CO4	L3	H	M	H	M	M	-	M	-	-	M	-	L	H	M
CO5	L1	M	H	M	H	-	-	-	-	-	H	-	L	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3
CD3	Seminars	CO3
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	CO4

BTCSPCC 404: Database Management System

Course objectives:

- 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 Warehousing.
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Course Contents:

Unit I: **Introduction:** Objective, scope and outcome of the course.

Unit II: **Introduction to database systems**: Overview and History of DBMS. File System v/s DBMS. Advantage of DBMS Describing and Storing Data in a DBMS.Queries in DBMS.Structure of a DBMS.

Entity Relationship model: Overview of Data Design Entities, Attributes and Entity Sets, Relationship and Relationship Sets. Features of the ER Model- Key Constraints, Participation Constraints, Weak Entities, Class Hierarchies, Aggregation, Conceptual Data Base, and Design with ER Model- Entity v/s Attribute Entity vs Relationship Binary vs Ternary Relationship and Aggregation v/s ternary Relationship Conceptual Design for a Large Enterprise.

Unit III: **Relationship Algebra and Calculus:** Relationship Algebra Selection and Projection, Set Operations, Renaming, Joints, Division, Relation Calculus, Expressive Power of Algebra and Calculus.

SQL queries programming and Triggers: The Forms of a Basic SQL Query, Union, and Intersection and Except, Nested Queries, Correlated Nested Queries, Set-Comparison Operations, Aggregate Operators, Null Values and Embedded SQL, Dynamic SQL, ODBC and JDBC, Triggers and Active Databases.

Unit IV: **Schema refinement and Normal forms:** Introductions to Schema Refinement, Functional Dependencies, Boyce - Codd Normal Forms, Third Normal Form, Normalization-Decomposition into BCNF Decomposition into 3-NF.

Unit V: **Transaction Processing:** Introduction-Transaction State, Transaction properties, Concurrent Executions. Need of Serializability, Conflict vs. View Serializability, Testing for Serializability, Recoverable Schedules, Cascadeless Schedules. **Concurrency Control:** Implementation of Concurrency: Lock-based protocols, Timestamp-based protocols, Validation-based protocols, Deadlock handling,

Database Failure and Recovery: Database Failures, Recovery Schemes: Shadow Paging and Log-based Recovery, Recovery with Concurrent transactions.

References:

1 Date C J, “An Introduction to Database System”, Addision Wesley.
2 Korth, Silbertz, Sudarshan, “Database Concepts”, McGraw Hill
3 Elmasri, Navathe, “Fundamentals of Database Systems”, Addision Wesley
4 Leon & Leon, “Database Management System”, Vikas Publishing House.
5 Bipin C. Desai, “An introduction to Database Systems”, Galgotia Publication
6 Ramakrishnan, Gehrke, “Database Management System”, McGraw Hill
7 Kroenke, “Database Processing: Fundamentals, Design and Implementation”, Pearson.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Describe given query write relational algebra expressions for that query and optimize the developed expressions

CO2: Understand given specification of the requirement design the databases using E-R method and normalization.

CO3: Understand given specification construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2.

CO4: Demonstrate given query optimize its execution using Query optimization algorithms

CO5: Discuss a given transaction-processing system; determine the transaction atomicity, consistency, isolation, and durability.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	**Bloom Level**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1	H	L	M	L	H	-	-	-	L	L	L	M	M	M
CO2	L2	H	M	M	M	M	-	-	-	-	M	L	L	M	M
CO3	L2	H	L	M	L	H	-	-	-	-	L	L	M	M	M
CO4	L3	H	H	H	H	M	-	-	-	L	H	L	L	H	M
CO5	L2	H	H	M	H	M	-	-	-	L	H	M	L	H	M

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO2, CO5

BTCSPCC 405: Theory of Computation

Course Objectives:

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

Course Contents:

Unit I: **Introduction:** Objective, scope and outcome of the course.

Unit II: **Finite Automata & Regular Expression**: Basic machine, Finite state machine, Transition graph, Transition matrix, Deterministic and nondeterministic finite automation, Equivalence of DFA and NDFA, Decision properties, minimization of finite automata, Mealy & Moore machines.

Alphabet, words, Operations, Regular sets, relationship and conversion between Finite automata and regular expression and vice versa, designing regular expressions, closure properties of regular sets, Pumping lemma and regular sets, Myhill- Nerode theorem , Application of pumping lemma, Power of the languages.

Unit III: Context Free Grammars (CFG), Derivations and Languages, Relationship between derivation and derivation trees, leftmost and rightmost derivation, sentential forms, parsing and ambiguity, simplification of CFG, normal forms, Greibach and Chomsky Normal form , Problems related to CNF and GNF including membership problem.

Unit IV: Nondeterministic PDA, Definitions, PDA and CFL, CFG for PDA, Deterministic PDA, and Deterministic PDA and Deterministic CFL , The pumping lemma for CFL's, Closure Properties and Decision properties for CFL, Deciding properties of CFL.

Unit V: Turing Machines: Introduction, Definition of Turing Machine, TM as language Acceptors and Transducers, Computable Languages and functions, Universal TM & Other modification, multiple tracks Turing Machine.

Hierarchy of Formal languages: Recursive & recursively enumerable languages, Properties of RL and REL, Introduction of Context sensitive grammars and languages, The Chomsky Hierarchy.

Tractable and Untractable Problems: P, NP, NP complete and NP hard problems, Un-decidability, examples of these problems like vertex cover problem, Hamiltonian path problem, traveling sales man problem.

References:

1. K.L.P. Mishra and N.Chandrasekaran, “Theory of Computer Science, PHI
2. Martin J. C., “Introduction to Languages and Theory of Computations”, TMH
3. Hopcroft, Ullman, “Introduction to Automata Theory, Language and Computation”, Nerosa Publishing House, 3rd Edition.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Calculate formal notation for strings, languages and machines.

CO2: Apply finite automata to accept a set of strings of a language.

CO3: Understand language determine whether the given language is regular or not.

CO4: Describe context free grammars to generate strings of context free language.

CO5: Practice equivalence of languages accepted by Push Down Automata and languages generated by context free grammars

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2, L3	H	L	M	L	-	-	-	-	-	L	-	M	L	L
CO2	L3	H	M	M	M	-	-	-	-	-	L	-	L	L	L
CO3	L2	H	L	M	L	-	-	-	-	-	L	-	M	M	L
CO4	L1	H	H	H	H	-	-	-	-	-	L	-	L	L	M
CO5	L3	H	H	M	H	-	-	-	-	-	L	-	L	M	L

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO2, CO5

BTCSPCC 406: Data Communication and Computer Networks

Course objectives:

- To Understand about the evolution of data communication and networking paradigms
- To Understand the principles of data communication, channel characteristics, signaling, modulation and encoding, and multiplexing (SONET/SDH)
- To know about the various transmission media, their comparative study.
- To Understand about the channel error detection and correction, MAC protocols, Ethernet and WLAN
- To understand the operations of TCP/UDP, FTP, HTTP, SMTP, SNMP, etc.

Course Contents:

Unit I: **Introduction:** Objective, scope and outcome of the course.

Unit II: **Introductory Concepts:** Network hardware, Network software, topologies, Protocols and standards, OSI model, TCP model, TCP/IP model, Physical Layer: Digital and Analog Signals, Periodic Analog Signals, Signal Transmission, Limitations of Data Rate, Digital Data Transmission, Performance Measures, Line Coding, Digital Modulation, Media and Digital Transmission System.

Unit III: **Data Link Layer:** Error Detection and Correction, Types of Errors, Two dimensional parity check, Detection verses correction, Block Coding, Linear Block Coding, Cyclic Codes, Checksum, Standardized Polynomial Code, Error Correction Methods, Forward Error Correction, Protocols: Stop and wait, Go-back-N ARQ, Selective Repeat ARQ, Sliding window, Piggy backing, Pure ALOHA, Slotted ALOHA, CSMA/CD, CSMA/CA.

Unit IV: **Network Layer:** Design issues, Routing algorithms: IPV4, IPV6, Address mapping: ARQ, RARQ, Congestion control, Unicast, Multicast, Broadcast routing protocols, Quality of Service, Internetworking.

Unit V: **Transport Layer:** Transport service, Elements of transport protocols, User Datagram Protocol, Transmission Control Protocol, and Quality of service, Leaky Bucket and Token Bucket algorithm.

Application Layer: WWW, DNS, Multimedia, Electronic mail, FTP, HTTP, SMTP, Introduction to network security

References:

1. Computer Networking; J. F. Kurose and K.W.Ross, Pearson education
2. Data Communications and Networking; B.A. Forouzon, Tata-McGraw-Hill
3. Computer Networks; A.S. Tannenbaum
4. Communication Networks; Garcia and Widija, Tata-McGraw-Hill.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Explain the functions of the different layer of the OSI Protocol.

CO2: Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.

CO3: Calculate requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component

CO4: Calculate problem related TCP/IP protocol developed the network programming.

CO5: Discuss DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	L	M	L	-	-	-	-	-	L	-	M	L	L
CO2	L3	H	M	M	M	-	-	-	-	-	M	-	L	L	L
CO3	L2, L3	H	L	M	L	-	-	-	-	-	L	-	M	M	M
CO4	L3	H	H	H	H	-	-	-	-	-	H	-	L	L	M
CO5	L2	H	H	M	H	-	-	-	-	-	M	-	L	M	M

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO2, CO5

BTCSVAC 407: Web Development

Course objectives:

- Understand web development strategies, and protocols governing web communication.
- Master core java fundamentals, including operators, data types, variables, arrays, methods and classes.
- Explore Java Applet, string handling, event handling and basics of AWT (Abstract Window multithread programming.
- Create well-designed web pages using HTML, incorporating lists, tables, images, frames, and forms.
- Understand document type definition (DTD) and XML schemes.
- Develop proficiency in JavaScript for document manipulation, form handling and introduction to AJAX.
- Understand the architecture and lifecycle of servlets, including handling HTTP requests and session tracking.

Course Contents:

Unit I: **Introduction:** Introduction and Web Development Strategies, History of Web and Internet, Protocols Governing Web, Writing Web Projects, Connecting to Internet, Introduction to Internet services and tools, Introduction to client-server computing. Core Java: Introduction, Operator, Data type, Variable, Arrays, Methods & Classes, Inheritance, Package and Interface, Exception Handling, Multithread programming, I/O, Java Applet, String handling, Event handling, Introduction to AWT, AWT controls, Layout managers

Unit II: **Web Page Designing:** HTML: List, Table, Images, Frames, forms, CSS, Document type definition, XML: DTD, XML schemes, Object Models, presenting and using XML, Using XML Processors: DOM and SAX, Dynamic HTML

Unit III: **Scripting:** Java script: Introduction, documents, forms, statements, functions, objects; introduction to AJAX, Networking : Internet Addressing, Factory Methods, Instance Methods, TCP/IP Client Sockets, URL, URL Connection, TCP/IP Server Sockets, Datagram.

Unit IV: **Enterprise Java Bean:** Preparing a Class to be a JavaBeans, Creating a JavaBeans, JavaBeans Properties, Types of beans, Stateful Session bean, Stateless Session bean, Entity bean

Java Database Connectivity (JDBC): Merging Data from Multiple Tables: Joining, Manipulating, Databases with JDBC, Prepared Statements, Transaction Processing, Stored Procedures.

Unit V: **Servlets:** Servlet Overview and Architecture, Interface Servlet and the Servlet Life Cycle, Handling HTTP get Requests, Handling HTTP post Requests, Redirecting Requests to Other Resources, Session Tracking, Cookies, Session Tracking with Http Session

Java Server Pages (JSP): Introduction, Java Server Pages Overview, A First Java Server Page Example, Implicit Objects, Scripting, Standard Actions, Directives, Custom Tag Libraries.

Reference/Text Books:

1. Goodfellow, YoshuaBengio, Aaron Courville. Deep Learning, the MIT press, 2016
2. Bengio, Yoshua. " Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1, Now Publishers, 2009
3. Deep Learning, Rajiv Chopra, Khanna Book Publishing, Delhi 2020.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Explain web development Strategies and Protocols governing Web.

CO2: Develop Java programs for window/web-based applications.

CO3: Design web pages using HTML, XML, CSS and JavaScript.

CO4: Creation of client-server environment using socket programming

CO5: Building enterprise level applications and manipulate web databases using JDBC

CO6: Design interactive web applications using Servlets and JSP

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	L	M	L	-	-	-	-	-	L	-	M	L	L
CO2	L3	H	M	M	M	-	-	-	-	-	M	-	L	L	L
CO3	L2, L3	H	L	M	L	-	-	-	-	-	L	-	M	M	M
CO4	L3	H	H	H	H	-	-	-	-	-	H	-	L	L	M
CO5	L2	H	H	M	H	-	-	-	-	-	M	-	L	M	M

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO2, CO5

BTCSPCC 408: Web Development Lab

Course objectives:

- Equip students with hands-on experience in web development, focusing on creating responsive and interactive websites using HTML, CSS, and JavaScript.
- Introduce students to both front-end and back-end development, emphasizing the integration of databases and server-side scripting to build dynamic web applications.
- Foster an understanding of web security principles, ensuring students can develop secure web applications by addressing common vulnerabilities and implementing best practices.

List of Experiments:

This lab is based on the Web Technologies. Some examples are as follows:

1. Write HTML/Java scripts to display your CV in navigator, your Institute website, Department Website and Tutorial website for specific subject
2. Write an HTML program to design an entry form of student details and send it to store at database server like SQL, Oracle or MS Access.
3. Write programs using Java script for Web Page to display browsers information.
5. Write a Java applet to display the Application Program screen i.e. calculator and other.
6. Writing program in XML for creation of DTD, which specifies set of rules. Create a style sheet in CSS/ XSL & display the document in internet explorer.
7. Program to illustrate JDBC connectivity. Program for maintaining database by sending queries. Design and implement

   a simple servlet book query with the help of JDBC & SQL. Create MS Access Database, Create on ODBC link, Compile & execute JAVA JDVC Socket.
8. Install TOMCAT web server and APACHE. Access the above developed static web pages for books web site, using these servers by putting the web pages developed.
9. Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and pwd4 respectively.

   Write a servlet for doing the following. Create a Cookie and add these four user id's and passwords to this Cookie. 2.

   Read the user id and passwords entered in the Login form and authenticate with the values available in the cookies.
10. Install a database (Mysql or Oracle). Create a table which should contain at least the following fields: name, password, email-id, phone number Write a java program/servlet/JSP to connect to that database and extract data from the tables and display them. Insert the details of the users who register with the web site, whenever a new user clicks the submit button in the registration page.
11. Write a JSP which insert the details of the 3 or 4 users who register with the web site by using registration form.

    Authenticate the user when he submits the login form using the user name and password from the database
12. Design and implement a simple shopping cart example with session tracking API.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Develop static web pages using HTML

CO2: Develop Java programs for window/web-based applications.

CO3: Design dynamic web pages using Javascript and XML.

CO4: Design dynamic web page using server site programming Ex. ASP/JSP/PHP

CO5: Design server site applications using JDDC,ODBC and section tracking API

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	M	H	M	M	-	-	-	L	M	-	L	M	M
CO2	L3	M	M	H	M	L	-	-	-	L	M	-	M	M	M
CO3	L2	M	M	H	M	L	-	-	-	L	M	-	L	H	M
CO4	L3	H	H	H	H	L	-	-	-	L	H	-	M	H	M
CO5	L3	H	M	H	M	M	-	-	-	M	M	-	L	H	M

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO5
CD3	Seminars	-
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	-

BTCSPCC 409: Database Management System Lab

Course Objectives:

- To Understand Tables with necessary constraints ,keys and data types, Inserting data and manipulating data as per needs
- To Understand SQL Queries to retrieve required information from single/multiple tables , Creating views and manipulating them as needed
- To Implementing Operations on relations (tables) using PL/SQL
- To Writing triggers for implementing automatic operations and implementing constraints

List of Experiments:

1. Design a Database and create required tables. For e.g. Bank, College Database
2. Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.
3. Write a SQL statement for implementing ALTER, UPDATE and DELETE.
4. Write the queries to implement the joins.
5. Write the query for implementing the following functions: MAX (), MIN (), AVG () and COUNT ().
6. Write the query to implement the concept of Integrity constrains.
7. Write the query to create the views.
8. Perform the queries for triggers.
9. Perform the following operation for demonstrating the insertion , updation and deletion
10. Using the referential integrity constraints.
11. Write the query for creating the users and their role.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Describe a Database without anomalies as per requirements

CO2: Practice complex queries to retrieve required information from database

CO3: Understand SQL for generating necessary reports.

CO4: Practice procedures and functions for required database tasks.

CO5: Demonstrate assertions to implement integrity constraints on multiple tables

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	**Bloom Level**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**P011**	**PO12**	**PSO 1**	**PSO 2**
CO1	L1	H	M	H	M	M	-	-	-	L	M	-	L	M	M
CO2	L3	M	M	H	M	L	-	-	-	L	M	-	M	M	M
CO3	L2	M	M	H	M	L	-	-	-	L	M	-	L	H	M
CO4	L3	H	H	H	H	L	-	-	-	L	H	-	M	H	M
CO5	L3	H	M	H	M	M	-	-	-	M	M	-	L	H	M

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO5
CD3	Seminars	-
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	-

BTCSPCC 410: Network Programming Lab

Course Objectives:

- To introduce Network related commands and configuration files in Linux Operating System.
- To introduce tools for Network Traffic Analysis and Network Monitoring
- To practice Network Programming using Linux System Calls.
- To design and deploy Computer Networks.

List of Experiments:

1. Study of Different Type of LAN& Network Equipments.
2. Study and Verification of standard Network topologies i.e. Star, Bus, Ring etc.
3. LAN installations and Configurations.
4. Write a program to implement various types of error correcting techniques.
5. Write a program to implement various types of framing methods.
6. Write two programs in C: hello_client and hello_server
   a. The server listens for, and accepts, a single TCP connection; it reads all the data it can from that connection, and prints it to the screen; then it Closes the connection
   b. The client connects to the server, sends the string “Hello, world!”, then closes the connection
7. Write an Echo_Client and Echo_server using TCP to estimate the round trip time from client to the server. The server should be such that it can accept multiple connections at any given time.
8. Repeat Exercises 6 & 7 for UDP.
9. Repeat Exercise 7 with multiplexed I/O operations.
10. Simulate Bellman -Ford Routing algorithm in NS2

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Apply knowledge of different techniques of error detection and correction to detect and solve error bit during data transmission.

CO2: Understand and building the skills of routing mechanisms.

CO3: Explain how a collision occurs and how to solve it.

CO4: Explain familiar with network tools and network programming.

CO5: Adapt with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L3	H	M	H	M	M	_	-	-	-	M	L	L	M	M
CO2	L2	M	M	H	M	L	-	-	-	-	M	L	M	M	M
CO3	L2	M	M	H	M	L	-	-	-	-	M	L	L	H	M
CO4	L2	H	H	H	H	-	-	-	-	-	H	L	M	H	M
CO5	L3	H	M	H	M	M	-	-	-	-	M	L	L	H	M

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO5
CD3	Seminars	-
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	-

BTCSPCC 411: Linux Shell Programming Lab

Course Objectives:

- study the basic and administration concepts in Linux

List of Experiments:

1. Use of Basic Unix Shell Commands: ls, mkdir, rmdir, cd, cat, banner, touch, file, wc,sort, cut, grep, dd, dfspace, du, ulimit.
2. Commands related to inode, I/O redirection and piping, process control commands, mails.
3. Shell Programming: Shell script based on control structure -If-then-fi, if-then-else-if, nested if -else, to find:
   3.1 Greatest among three numbers.
   3.2 To find a year is leap year or not.
   3.3 To input angles of a triangle and find out whether it is valid triangle or not.
   3.4 To check whether a character is alphabet, digit or special character.
   3.5 To calculate profit or loss.
4. Shell Programming Looping-while, until, for loops
   4.1 Write a shell script to print all even and odd number from 1 to 10.
   4.2 Write a shell script to print table of a given number
   4.3 Write a shell script to calculate factorial of a given number.
   4.4 Write a shell script to print sum of all even numbers from 1 to 10.
   4.5 Write a shell script to print sum of digit of any number.
5. Shell Programming - case structure, use of break
   5.1 Write a shell script to make a basic calculator which performs addition, subtraction, Multiplication, division
   5.2 Write a shell script to print days of a week.
   5.3 Write a shell script to print starting 4 months having 31 days.
6. Shell Programming -Functions
   6.1 Write a shell script to find a number is Armstrong or not.
   6.2 Write a shell script to find a number is palindrome or not.
   6.3 Write a shell script to print Fibonacci series.
   6.4 Write a shell script to find prime number.
   6.5 Write a shell script to convert binary to decimal and decimal to binary
7. Write a shell script to print different shapes -Diamond, triangle, square, rectangle, hollow square etc.
8. Shell Programming –Arrays
   8.1 Write a C program to read and print elements of array.
   8.2 Write a C program to find sum of all array elements.
   8.3 Write a C program to find reverse of an array.
   8.4 Write a C program to search an element in an array.
   8.5 Write a C program to sort array elements in ascending or descending order.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Experiment students able to implement CPU scheduling algorithms and Bankers algorithm used for deadlock avoidance and prevention.

CO2: Implement page replacement and memory management algorithms.

CO3: Apply UNIX/LINUX operating system commands.

CO4: Understand different UNIX/LINUX shell scripts and execute various shell programs.

CO5: Implement virtualization by installing Virtual Machine software.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
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CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	H	M	H	M	M	-	-	-	M	M	-	L	M	M
CO2	L3	M	M	H	M	L	-	-	-	L	M	-	M	H	M
CO3	L3	M	M	H	M	L	-	-	-	M	M	-	L	H	M
CO4	L2	H	H	H	H	L	-	-	-	L	H	-	M	M	M
CO5	L3	H	M	H	M	M	-	-	-	M	M	-	L	H	M

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO5
CD3	Seminars	-
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	-

BTCSPCCAIML412: Machine Learning Lab

Course Objectives:

- To be able to formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To be able to apply machine learning algorithms to solve problems of moderate complexity.
- To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models

List of Experiments:

1. Write a python program to compute Central Tendency Measures: Mean, Median, Mode, Measure of Dispersion: Variance, Standard Deviation
2. Study of Python Basic Libraries such as Statistics, Math, Numpy and Scipy
3. Study of Python Libraries for ML application such as Pandas and Matplotlib
4. Write a Python program to implement Simple Linear Regression
5. Implementation of Multiple Linear Regression for House Price Prediction using sklearn
6. Implementation of Decision tree using sklearn and its parameter tuning
7. Implementation of KNN using sklearn
8. Implementation of Logistic Regression using sklearn
9. Implementation of K-Means Clustering
10. Performance analysis of Classification Algorithms on a specific dataset

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand modern notions in predictive data analysis

CO2: Select data, model selection, model complexity and identify the trends

CO3: Understand a range of machine learning algorithms along with their strengths and weaknesses

CO4: Build predictive models from data and analyze their performance

CO5: Understand performance of Classification Algorithm

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	L	M	L	L	-	-	L	M	-	L	L	M
CO2	L4	H	M	L	M	L	L	-	-	-	M	-	L	L	M
CO3	L1	H	M	L	M	L	L	-	-	L	M	-	L	L	L
CO4	L2	H	H	M	H	L	L	-	-	L	H	-	M	M	M
CO5	L2	H	M	M	M	L	L	-	-	L	M	-	M	L	L

H- High, M- Moderate, L- Low, ‘-’ for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	CO2
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	CO5

BTCSHSMC 413: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Semester –V

Code	Subject/ Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCC 501	Java Programming	PCC	30	70	100	3	-	-	3
BTCSPCCAIML 502	**Deep Learning**	PCC	30	70	100	3	-	-	3
BTCSPCC 503	Operating System	PCC	30	70	100	3	-	-	3
BTCSPCC 504	Computer Graphics & Multimedia	PCC	30	70	100	3	-	-	3
BTCSPCC 505	Analysis of Algorithms	PCC	30	70	100	3	-	-	3
	Elective								
BTCSPEC 506A	Human Computer Interaction	PEC	30	70	100	3	-	-	3
BTCSPEC 506B	Software Project Management	PEC	30	70	100	3	-	-	3
BTCSPEC 506C	Bioinformatics	PEC	30	70	100	3	-	-	3
BTCSHSMC507	Professional Skills	HSMC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCSPCC 508	Computer Graphics & Multimedia Lab	LC	60	40	100	-	-	1	1
BTCSPCCAIML 509	**Deep Learning Lab**	LC	60	40	100	-	-	1	1
BTCSPCC 510	Analysis of Algorithms Lab	LC	60	40	100	-	-	1	1
BTCSPCC 511	Java Lab	LC	60	40	100	-	-	1	1
BTCSPROJ 512	Industrial Training	PROJ	60	40	100	-	-	1	1
BTCSHSMC 513	Social Outreach, Discipline & Extra Curricular Activities	HSMC	100	-	100				1
	TOTAL		**610**	**690**	**1300**	**20**	**-**	**5**	**26**

BTCSPCC 501: Java Programming

Course Objective:

- This course introduces fundamental structured and object-orientedprogramming concepts and techniques, using Java, and is intended for allwho plan to use computer programming in their studies and careers.
- Topicscovered include variables, arithmetic operators, control structures, arrays,functions, recursion, dynamic memory allocation, files, class usage, arrays,recursion, polymorphism, exceptions, Applet Programming and classwriting. Program design and testing are also covered, in addition to moreadvanced object-oriented concepts including inheritance and exceptions astime permits.

Course Contents:

Unit I: **INTRODUCTION TO JAVA:** JAVA Evolution, Introduction to Programming Languages, The Evolution of Java, Object-Oriented Programming Concepts and Java, The Primary Characteristics of Java, The Architecture, Simple Java Program, More of Java, An Application with Two Classes Java Program structure, Java Tokens, Java Statements, Implementing a Java Program, Java Virtual Machine, Programming Style. Branching: Constants, Variables, and Using Data Types, Operators and Expressions, Type conversion and Associatively, Mathematical Functions. Decision Making and Introduction, Decision Making with if Statement, Simple if Statement, The if …… else Statement, Nesting of if-else Statements, The else if Ladder, The Switch Statement, The?: Operator. Decision Making and Looping: Introduction. The while Statement, The do Statement, the for Statement, Jumps in Loops Labeled Loops. Self- study: Java History, Differences between C++ and Java,

Unit II: **Introduction,** Defining a Class, Adding Variables, Adding Methods, Creating Objects, Accessing Class Members, Constructors, Methods Overloading, Static Members, Nesting of Methods.

Inheritance: Extending a Class Overriding Methods, Final Variables and Methods, Finalized methods, Abstract Methods and Classes, Visibility Control.

Arrays Strings and Vectors: Arrays, One – dimensional Arrays, Creating an Array, Two – dimensional Arrays, Strings, Vectors and Wrapper Classes.

Unit III: **Interfaces:** Multiple Inheritance: Introduction, Defining Interfaces, Extending Interfaces, Implementing Interfaces, Accessing Interface Variables. Packages: Putting Classes together: Introduction, Java API Packages, Using System Packages, Naming Conventions, Creating Packages, Accessing a Package, Using a Package, Adding a Class to a Package, Hiding Classes. Self-study : implementing of Interface, difference classes.

Unit IV: **Introduction,** Creating Threads, Extending the Thread Class, Stopping and Blocking a thread, Life Cycle of a thread, Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization, Implementing the 'Runnable' Interface. Self study: thread class example, synchronization strategies

Unit V: **Introduction,** Types of Errors, Exceptions, Syntax of Exception Handling Code, Multiple Catch Statements, Using Finally Statement, Throwing Our Own Exceptions, Using Exceptions for Debugging. Applet Programming: Introduction, How Applets Differ from Applications, Preparing to Write Applets, Building Applet Code, Applet Life Cycle, Creating an Executable applet, Designing a Web Page, Applet Tag, Adding Applet to HTML File, running the Applet, More about Applet Tag, Passing Parameters to Applets, Aligning the Display, More About HTML Tags, Displaying Numerical Values, Getting Input from the User.

Text Book:

1. "Introduction to Java Programming" by Daniel Liang.
2. E. Balaguruswamy, Programming with JAVA, A Primer, TMH (1999)

References:

1. Darrel Ince& Adam Freeman, Programming the Internet with Java, Addison – Wesley, (1997).
2. KenArnold& James Gosling, The Java Programming Language, Addison – Wesley, (1998)
3. Patrick Naughton& Herbert Schildt, JAVA 2: The Complete Reference, 3rd Edition, TMH, (1999). (1)

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Understand the basic concepts and principles of structured programming.

CO2: Understand the basic concepts and principles of object oriented programming.

CO3: Produce sample use-cases, pseudo-code, and an incremental coding plan for a given problem specification.

CO4: Design, write, and test a Java program to implement a solution to a given problem specification.

CO5: Understand the operation of common data structures and algorithms.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L2	H	M	M	M	-	-	-	-	M	L	-	L	L	L
CO2	L2	H	H	M	H	-	-	-	-	L	L	-	L	L	L
CO3	L1	H	H	M	H	-	-	-	-	M	L	-	L	M	M
CO4	L3	H	H	L	H	-	-	-	-	L	L	-	M	M	M
CO5	L3	M	H	H	H	-	-	-	-	L	L	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3,CO4,CO5
CD2	Tutorials/Assignments	CO2, CO3
CD3	Seminars	CO4,CO5
CD4	Self- learning advice using internets	CO3, CO4,CO5
CD5	Industrial visit	-

BTCSPCCAIML 502: Deep Learning

Course Objective:

- To introduce to students, different deep neural network architectures, training strategies/algorithms, possible challenges, tools and techniques available in designing and deploying solutions to different practical/ Engineering problems.

Course Contents:

Unit I: **Neural Networks basics –** Linear Separable Problems and Perception – Multi layer neural networks and Back Propagation, Practical aspects of Deep Learning: Train/ Dev / Test sets, Bias/variance, Vanishing/exploding gradients, Gradient checking, Hyper Parameter Tuning.

Unit II: **Convolution Neural Networks –** Basics and Evolution of Popular CNN architectures – Transfer Learning–Applications : Object Detection and Localization, Face Recognition, Neural Style Transfer

Unit III: **Recurrent Neural Networks – GRU –** LSTM – NLP – Word Embeddings – Transfer Learning – Attention Models – Applications: Sentiment Analysis, Speech Recognition, Action Recognition. Restricted Boltzmann Machine –

Unit IV: **Deep Belief Network –** Auto Encoders – Applications: Semi-Supervised classification, Noise Reduction, Non-linear Dimensionality Reduction. Goal Oriented Decision Making – Policy and Target Networks – Deep Quality Network for Reinforcement Learning. Introduction to GAN – Encoder/Decoder, Generator/Discriminator architectures.

Unit V: **Challenges in NN training –** Data Augmentation – Hyper parameter Settings – Transfer Learning– Developing and Deploying ML Models

Text Book / References

1. Ian Goodfellow, YoshuaBengio and Aeron Courville," Deep Learning", MIT Press, First Edition, 2016.
2. Adam Gibson and Josh Patterson," Deep Learning, A practitioner's approach", O'Reilly, FirstEdition, 2017.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Be able to design, train, deploy neural networks for solving different practical/engineering problems and analyze and report its efficacy

CO2: Have a good level of knowledge (Both Conceptual and Mathematical) on different neural network settings to pursue Research in this Field

CO3: Build skills in using established ML Tools/libraries and in building self-learning skills in the field

CO4: Understand Deep Network and its methodology

CO5: Develop neural Network Model

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	L	M	L	-	-	-	-	M	-	L	M	M
CO2	L2	H	M	L	M	L	-	L	-	-	M	-	L	M	M
CO3	L2	H	L	L	L	M	-	-	-	-	L	-	L	M	M
CO4	L2	H	L	L	L	L	-	L	-	-	L	-	L	M	M
CO5	L2	M	L	L	L	-	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3,
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTCSPCC 503: Operating System

Course Objective:

- To learn the mechanisms of Operating System to handle processes and threads.
- To learn the mechanisms involved in memory management in 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

Course Contents:

Unit I: **Introduction and History of Operating systems:** Structure and operations; processes and files Processor management: inter process communication, mutual exclusion, semaphores, wait and signal procedures, process scheduling and algorithms, critical sections, threads, multithreading

Unit II: Memory management: contiguous memory allocation, virtual memory, paging, page table structure, demand paging, page replacement policies, thrashing, segmentation, case study

Unit III: Deadlock: Shared resources, resource allocation and scheduling, resource graph models, deadlock detection, deadlock avoidance, deadlock prevention algorithms.

Device management: devices and their characteristics, device drivers, device handling, disk scheduling algorithms and policies

Unit IV: File management: file concept, types and structures, directory structure, cases studies, access methods and matrices, file security, user authentication

Unit V: UNIX and Linux operating systems as case studies; Time OS and case studies of Mobile OS

Text/Reference Books:

- Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
- Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
- Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
- Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
- Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
- Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Course Outcomes

At the end of the course, the student will be able to:

CO1: Understand the structure of OS and basic architectural components involved in OS design

CO2: Practice and design the applications to run in parallel either using process or thread models of different OS

CO3: Discuss the various device and resource management techniques for timesharing and distributed systems

CO4: Understand the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system

CO5: Understand the concept of time OS and Mobile OS

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	M	-	-	-	-	M	M	-	L	M	M
CO2	L3	H	H	M	H	-	-	-	-	M	M	-	M	M	M
CO3	L3	H	H	M	H	-	-	-	-	M	L	-	L	H	M
CO4	L2	H	H	L	H	-	-	-	-	L	L	-	M	H	M
CO5	L2	H	M	M	H	-	-	-	-	L	L	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3,CO4,CO5
CD2	Tutorials/Assignments	CO2, CO3,CO4
CD3	Seminars	CO3,CO4
CD4	Self- learning advice using internets	CO3, CO4
CD5	Industrial visit	-

BTCSPCC 504: Computer Graphics & Multimedia

Course Objective:

- To understand contemporary graphics principles and graphics hardware.
- To introduce comprehensive introduction to computer graphics leading to the ability to understand contemporary terminology, progress, issues, and trends.
- To go thorough introduction to computer graphics techniques, focusing on 3D modeling, image synthesis, and rendering.

Course Contents:

Unit I: **Basic of Computer Graphics:** Basic of Computer Graphics, Applications of computer graphics, Display devices, Random and Raster scan systems, Graphics input devices, Graphics software and standards

Unit II: Graphics Primitives Points, lines, circles and ellipses as primitives, scan conversion algorithms for primitives, Fill area primitives including scanline polygon filling, inside-outside test, boundary and flood-fill, character generation, line attributes, area-fill attributes, character attributers. Aliasing and introduction to Anti Aliasing (No anti aliasing algorithm).

Unit III: **Two Dimensional Graphics:** Transformations (translation, rotation, scaling), matrix representation, homogeneous coordinates, composite transformations, reflection and shearing, viewing pipeline and coordinates system, window-to-viewport transformation, clipping including point clipping, line clipping (cohen-sutherland, liang- bersky, NLN), polygon clipping

Unit IV: **Three Dimensional Graphics:** 3D display methods, polygon surfaces, tables, equations, meshes, curved lies and surfaces, quadric surfaces, spline representation, cubic spline interpolation methods, Bazier curves and surfaces, B-spline curves and surfaces.3D scaling, rotation and translation, composite transformation, viewing pipeline and coordinates, parallel and perspective transformation, view volume and general (parallel and perspective) projection transformations.

Unit V: Illumination and Colour Models: Light sources – basic illumination models – halftone patterns and dithering techniques; Properties of light – Standard primaries and chromaticity diagram; Intuitive colour concepts –RGB colour model – YIQ colour model – CMY colour model – HSV colour model – HLS colour model; Colour selection.

Text/Reference Books:

- Foley et.al, Computer Graphics Principles & Practice, Addision , 1999
- David F.Rogers, Procedural Elements for Computer Graphics, McGraw Hill Book Company
- D.Heam and P.Baker, Computer Graphics, Prentice Hall 1986
- R.Plastock and G.Kalley, Theory and Problems of Computer Graphics, Schaum's Series., McGraw Hill.
- Ralf Steinmetz &KlaraNahrstedt - Multimedia: computing, Communication & Applications, Pearson Education Asia.
- PrabhatK. Andleigh-Multimedia System Design, Prentice Hall,KiranThaukrar.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: List the basic concepts used in computer graphics.

CO2: Implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.

CO3: Describe the importance of viewing and projections.

CO4: Define the fundamentals of animation, virtual reality and its related technologies.

CO5: Implement various algorithms for Colour Models and curves

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	M	M	M	-	-	-	-	-	M	-	L	M	M
CO2	L3	H	L	M	L	L	-	-	-	-	L	-	M	M	M
CO3	L2	H	H	M	H	L	-	-	-	-	H	-	L	M	M
CO4	L1	H	M	L	M	-	-	-	-	-	M	-	M	H	M
CO5	L2	H	H	L	M	L	-	-	-	-	M	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3,CO4,CO5
CD2	Tutorials/Assignments	CO3,CO4
CD3	Seminars	CO4
CD4	Self- learning advice using internets	CO2,CO3,CO4
CD5	Industrial visit	-

BTCSPCC 505: Analysis of Algorithms

Course Objective:

- To analyze the asymptotic performance of algorithms.
- To write rigorous correctness proofs for algorithms.
- To demonstrate a familiarity with major algorithms and data structures.
- To apply important algorithmic design paradigms and methods of analysis.
- To synthesize efficient algorithms in common engineering design situations.

Course Contents:

Unit I: **Background:** Review of Algorithm, Complexity Order Notations: definitions and calculating complexity .Divide And Conquer Method: Binary Search, Merge Sort, Quick sort and Strassen's matrix multiplication algorithms.

Unit II: **Greedy Method:** Knapsack Problem, Job Sequencing, Optimal Merge Patterns and Minimal Spanning Trees. Dynamic Programming: Matrix Chain Multiplication. Longest Common Subsequence and 0/1 Knapsack Problem.

Unit III: **Branch And Bound:** Traveling Salesman Problem and Lower Bound Theory. Backtracking Algorithms and queens problem. Pattern Matching Algorithms: Naïve and Rabin Karp string matching algorithms, KMP Matcher and Boyer Moore Algorithms.

Unit IV: **Assignment Problems:** Formulation of Assignment and Quadratic Assignment Problem. Randomized Algorithms- Las Vegas algorithms, Monte Carlo algorithms, randomized algorithm for Min-Cut, randomized algorithm for 2- SAT. Problem definition of Multi-commodity flow, Flow shop scheduling and Network capacity assignment problems.

Unit V: Problem Classes Np, Np-Hard And Np-Complete: Definitions of P, NP-Hard and NP-Complete Problems. Decision Problems.Cook's Theorem.Proving NP Complete Problems - Satisfiability problem and Vertex Cover Problem. Approximation Algorithms for Vertex Cover and Set Cover Problem

Text/Reference Books:

- Design and Analysis of Algorithm; Horowitz and Sahani
- Introduction to Algorithm Design ; Corman
- Design and Analysis of Computer Algorithms ; Aho, Pearson

Course Outcomes

At the end of the course, the student will be able to:

CO1: Describe Algorithms based on asymptotic analysis and justify the correctness of algorithms.

CO2: Discuss the greedy paradigm and explain when an algorithmic design situation calls for it.

CO3: Practice the divide-and-conquer paradigm

CO4: Describe the dynamic-programming paradigm and analyze it to determine its computational complexity.

CO5: Understand the Problem Classes Np

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	M	H	M	L	-	-	-	L	M	-	L	M	L
CO2	L2	H	H	M	H	L	-	-	-	L	H	-	L	M	L
CO3	L3	L	M	H	M	L	-	-	-	L	M	-	M	M	L
CO4	L2	M	H	M	H	L	-	-	-	L	H	-	M	M	M
CO5	L2	M	M	H	H	L	-	-	-	L	H	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3,CO4,CO5
CD2	Tutorials/Assignments	CO2, CO3,CO4
CD3	Seminars	-
CD4	Self- learning advice using internets	CO3,CO4
CD5	Industrial visit	-

BTCSPEC 506A: Human Computer Interaction

Course Objective:

- To know what the user-centered design cycle and how to practice this approach to design your own website or other interactive software systems
- To critique existing website and other interactive software using guidelines from human factor theories
- To analyze one after another the main features of a GUI: the use of colors, organization and layout of content, filling the interface with useful and relevant information, and communication techniques; and to critique designs in order to provide better solutions

Course Contents:

Unit I: Historical evolution of the field, Interactive system design, Concept of usability - definition and elaboration, HCI and software Engineering, GUI design and Aesthetics, Prototyping techniques.

Model-based Design and evaluation: Basic idea, introduction to different types of models, GOMS family of models (KLM and CMNGOMS), BFitts' law and Hick-Hyman's law, Model-based design case studies,

Unit II: **Guidelines in HCI:** Shneiderman's eight, golden rules, Norman's seven principles, Norman's model of interaction, Nielsen's ten heuristics with example of its use Heuristic evaluation, Contextual inquiry, Cognitive walkthrough

Unit III: **Empirical research methods in HCI:** Introduction (motivation, issues, research question formulation techniques), Experiment design and data analysis (with explanation of one-way ANOVA)

Unit IV: **Task modeling and analysis:** Hierarchical task analysis (HTA), Engineering task models and Concur Task Tree (CTT),I introduction to formalism in dialog design, design using FSM (finite state machines) State charts and (classical) Petri Nets in dialog design

Unit V: Introduction to CA, CA types, relevance of CA in IS design Model, Human Processor (MHP), OOP- Introduction OOM- Object Oriented Modeling of User Interface Design.

Text/Reference Books:

- The essential guide to user interface design, Wilbert O Galitz, Wiley DreamaTech.
- Designing the user interface. 3rd Edition Ben Shneidermann , Pearson Education Asia.
- Human – Computer Interaction. ALAN DIX, JANET FINCAY, GRE GORYD, ABOWD, RUSSELL BEALG, PEARSON.
- Interaction Design PRECE, ROGERS, SHARPS. Wiley Dreamtech, 3. User Interface Design, SorenLauesen , Pearson Education.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Describe what interaction design is and how it relates to human computer interaction and other fields.

CO2: Describe the social mechanisms that are used by people to communicate and collaborate.

CO3: Calculate the nature of user frustration and how to reduce it.

CO4: Describe how technologies can be designed to change people's attitudes and behavior.

CO5: Understand the CA and IS design

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1,L2	H	H	L	H	L	-	-	-	-	H	-	H	L	L
CO2	L2	H	H	H	H	M	-	-	-	-	H	-	H	L	L
CO3	L3	H	M	H	M	M	-	-	-	-	M	-	L	L	M
CO4	L2	L	M	H	M	L	-	-	-	-	M	-	H	H	M
CO5	L2	L	H	M	M	L	-	-	-	-	M	-	H	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO5
CD2	Tutorials/Assignments	CO2, CO3
CD3	Seminars	CO3 ,CO4
CD4	Self- learning advice using internets	CO2,CO3
CD5	Industrial visit	-

BTCSPEC 506B: Software Project Management

Course Objective:-

- To understand the Software Project Planning and Evaluation techniques.
- To plan and manage projects at each stage of the software development life cycle (SDLC).
- To learn about the activity planning and risk management principles.
- To manage software projects and control software deliverables.
- To develop skills to manage the various phases involved in project management and people management.
- To deliver successful software projects that support organization‘s strategic goals.

Course Contents:

Unit I **Project Evaluation and Project Planning:** Importance of Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

Unit II **Project Life Cycle and Effort Estimation:** Software process and Process Models – Choice of Process models – Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II – a Parametric Productivity Model.

Unit III **Activity Planning and Risk Management:** Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

Unit IV **Project Management and Control:** Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

Unit V **Staffing in Software Projects:** Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

Text Book:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

References:

1. Robert K. Wysocki ―Effective Software Project Management – Wiley Publication, 2011.
2. Walker Royce: ―Software Project Management- Addison-Wesley, 1998.
3. Gopalaswamy Ramesh, ―Managing Global Software Projects – McGraw Hill Education (India), Fourteenth Reprint 2013.

Course Outcomes

At the end of the course, the student will be able to:

CO1: Understand Project Management principles while developing software.

CO2: Gain extensive knowledge about the basic project management concepts, framework and the process models.

CO3: Obtain adequate knowledge about software process models and software effort estimation techniques.

CO4: Estimate the risks involved in various project activities.

CO5: Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1,L2	H	H	L	H	L	-	-	-	-	H	-	H	L	L
CO2	L2	H	H	H	H	M	-	-	-	-	H	-	H	L	L
CO3	L3	H	M	H	M	M	-	-	-	-	M	-	L	L	M
CO4	L2	L	M	H	M	L	-	-	-	-	M	-	H	H	M
CO5	L2	L	H	M	M	L	-	-	-	-	M	-	H	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO5
CD2	Tutorials/Assignments	CO2, CO3
CD3	Seminars	CO3 ,CO4
CD4	Self- learning advice using internets	CO2,CO3
CD5	Industrial visit	-

BTCSPEC 506C: Bioinformatics

Course Objectives:

- To use bioinformatics in your own work.
- To Build a solid foundation and acquire the vocabulary you need to supervise or to communicate with others who use these tools.

Course Contents:

Unit I: **Introduction:** Basics of biology.

Unit II **Sequences:** Problem Statement, Edit distance and substitution matrices, HMMs and pairwise HMMs, Global and local alignments, Spliced alignment, Space-efficient sequence alignment, multiple alignment, Database searching tools, Sequence by hybridization, Profile HMMs

Unit III: **Structures:** Protein structure alignment, Protein structure prediction

Unit IV: **Phylogenetic trees:** Large parsimony and small parsimony problems, Probabilistic approaches, Grammar-based approaches

Unit V: **Miscellaneous topics:** Pathways and networks, Microarrays, Biomedical images

Text/Reference Books:

- Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications. Oxford University Press.
- Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley-Blackwell. Campbell A. M., Heyer L. J. (2006)
- Discovering Genomics, Proteomics and Bioinformatics. II Edition. Benjamin Cummings.

Course Outcomes

At the end of the course, a student will be able to:

CO1: Discribe the basic concepts of Bioinformatics and its significance in Biological data analysis.

CO2: Describe the history, scope and importance of Bioinformatics and role of internet in Bioinformatics.

CO3: Explain about the methods to characterize and manage the different types of Biological data.

CO4 : Define different types of Biological Databases.

CO5 : Discuss basics of sequence alignment and analysis.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1, L2	H	M	M	M	L	-	-	-	-	M	-	L	L	L
CO2	L2	H	L	M	L	L	-	-	-	-	L	-	M	L	L
CO3	L2	H	H	M	H	L	-	-	-	-	H	-	L	L	M
CO4	L1	H	M	-	M	L	-	-	-	-	M	-	M	M	M
CO5	L2	H	L	M	L	L	-	-	-	-	L	-	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3,CO4,CO5
CD2	Tutorials/Assignments	CO2, CO3,CO4
CD3	Seminars	CO4,CO5
CD4	Self- learning advice using internets	CO3, CO4,CO5
CD5	Industrial visit	-

BTCSHSMC 507: Professional Skills

Course Objectives:

- To acquire career skills and fully pursue to partake in a successful career path.
- To prepare a good resume.
- To prepare for interviews and group discussions.
- To understand the significance of team skills.
- To acquire team skills.
- To design, develop, and adapt to situations as an individual and as a team member.

Course Content:

Unit I: Career Skills (Resume Skills and Interview Skills)

Resume Skills: Preparation and Presentation: Introduction of Resume and Related Terms, Importance of Preparing a Good Resume, Difference between a CV, Resume, and Biodata, Essential Components of a Good Resume.

Resume Skills: Common Errors: Common Errors, Guidelines for Resume Preparation.

Interview Skills: Preparation and Presentation: Meaning of Interview, Types of Interview, STAR Approach for Facing an Interview.

Interview Procedure: Do's and Don'ts, Important Questions Generally Asked in a Job Interview.

Interview Skills: Common Errors: Common Errors, Interview Questions for Assessing Strengths and Weaknesses.

Simulation: Job Simulation Formats, Comment Critically on Simulated Interviews.

Demonstrate an Ideal Interview.

Unit II: Career Skills (Group Discussion Skills and Exploring Career Opportunities)

Meaning and Importance of Group Discussion (GD): Meaning of a Group Discussion, Importance of a Group Discussion, Types of Group Discussions.

Procedure of a Group Discussion: Methodology, Ground Rules, Stages of group formations, Evaluation of Group Discussion, Group Discussion Common Errors, Simulation

Process of Career Exploration, Knowing Yourself — Personal Characteristics, Knowledge about the World of Work, Requirements of Jobs Including Self-employment. Sources of Career Information. Preparing for a Career Based on Potentials of Learners and Availability of Opportunities

Unit III: Team Skills (Cognitive and Non-cognitive Skills and Presentation Skills)

Cognitive Skills: Meaning, types of cognitive skills, and strategies. Critical Thinking Skills. Problem-solving Skills, Ability to Learn.

Non-cognitive Skills: Meaning, Types of Non-Cognitive skills and Strategies, Empathy, Teamwork, Creativity, Collaboration, Resilience, Interpersonal Skills, Perseverance, Self Control, Social Skill, Peer Pressure, Stress and Stress Management.

Presentation: Meaning and Types: Meaning of Presentation, Types of Presentations, Presentation for Internal and External Communication, Presentation Strategies, Ways to Improve Presentation Skills over Time.

Unit IV: Team Skills (Trust and Collaboration and Listening as a Team Skill)

Explain the importance of trust in creating a collaborative team: Definition of Trust, Importance of Trust in Creating a Collaborative Team. Strategies to Build Trust with Employees. Criteria for Evaluation of Trust and Collaboration in Teams. Agree to Disagree and Disagree to Agree – Spirit of Teamwork.

Understanding Fear of Being Judged and Strategies to Overcome Fear: Understanding the Fear of Being Judged, Signs and Symptoms of Social Anxiety Disorder, Strategies to Overcome Fear or Social Anxiety. Listening as a Team Skill: Listening Skill, Advantages of Effective Listening Skills, Types of Listening. Listening as a Team Member and Team Leader: Listening as a Team Leader, Listening as a Team Member, Improving Listening Skills. Uses of Active Listening Strategies to Encourage Sharing of Ideas: The Importance of Active Listening in the Workplace, Strategies for Improving Active Listening Skills to Encourage Sharing of Ideas

Unit V: **Team Skills (Brainstorming, Social and Cultural Etiquettes, Internal Communication)**

Brainstorming as a Technique to Promote Idea Generation: Brainstorming: The Meaning and Process, Procedure for Conducting Brainstorming, Importance of Using the Brainstorming Technique, Types of Brainstorming.

Learning and Showcasing the Principles of Documentation of Team Session Outcomes

Etiquette: Meaning, Need for Effective Interpersonal Relationships

Aspects of Social and Cultural/Corporate Etiquette in Promoting Teamwork: Social Etiquette, Cultural Etiquette and its role in promoting teamwork, Corporate/Professional Etiquette

Internal Communication: Meaning and Need: Meaning, Need for Internal Communication.

Use of Various Channels of Transmitting Information to Team Members including Digital and Physical

Reference Books:

1. Lee, K. (2021, February 14). How to Write a Neat Resume. Wikihow. https://www..com/Write-a-Neat-Resume
2. Moore, E. (2019, January 23). What Is a Job Simulation & How Can You Prepare for One?.Glassdoor. https://www.glassdoor.com/blog/job-simulation-preparation/
3. Griffin, T. (2022, September 26). How to Conduct a Group Discussion. wikiHow. https://www.wikihow.com/Conduct-a-Group-Discussion
4. McKay, D. R. (2022, September 13). The Career Planning Process. The Balance. https://www.thebalancecareers.com/the-career-planning-process-524774.
5. Kapoor, I., Sharma, S., & Khosla, M. (2020). Social Anxiety Disorder Among Adolescents in Relation to Peer Pressure and Family Environment. Bioscience Biotechnology Research Communications, 13(2), 923-929.
6. Gilda Bonanno. (n.d.). Presentation skills coaching videos. home. https://www.gildabonanno. com/presentation-skill-coaching-videos.
7. Mind Tools. (n.d.). Building Trust Inside Your Team. Mind Tools https://www.mindtools.com/pages/article/building-trust-team.htm.
8. Roy, B. D. (2022, August 1). Active listening; its skills and importance in the workplace. Nurture an Engaged and Satisfied Workforce | Vantage Circle HR Blog. https://blog.vantagecircle.com/active-listening/.
9. Wikimedia Foundation. (2022, November 16). Brainstorming. Wikipedia. https://en.wikipedia.org/wiki/Brainstorming.
10. Lyon, S. (2022, September 22). How to be socially acceptable in all situations. The Spruce.https://www.thespruce.com/what-is-etiquette-and-why-is-it-important-1216650.
11. Sinclair, S. (2021, February 8). This is why internal and external communication should work in Harmony. Employee Engagement App. https://www.talkfreely.com/blog/internal-and-external-communication.

Course Outcomes:

	The learners shall be able to:
CO1	Prepare their résumé on an appropriate template without grammatical and other errors and using proper syntax. Participate in a simulated interview.
CO2	Actively participate in group discussions towards gainful employment. Perform appropriately and effectively in group discussions. Identify career opportunities in consideration of personal potential and aspirations.
CO3	Demonstrate a set of cognitive skills such as critical thinking, problem-solving and the ability to learn for smooth and efficient functioning at a workplace. Demonstrate a set of non-cognitive skills such as empathy, creativity, teamwork, and collaboration, for smooth and efficient functioning at a workplace. Use common technology messaging tools that are used in an organization for the flow of information and transition from command and control to informal communication during an online or offline team session.
CO4	Demonstrate a set of cognitive and non-cognitive skills for maintaining good interpersonal relations and smooth and efficient functioning at a workplace. Empathize with and trust colleagues for improving interpersonal relations.
CO5	Generate, share and maximize new ideas with the concept of brainstorming and the documentation of key critical ideas/thoughts articulated and action points to be implemented with timelines in a team discussion (as MOM) in identified applicable templates. Project a good personal image and social etiquette so as to have a positive impact on building of the chosen career

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Levels	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L6								**H**	**L**			**M**	**L**	**L**
CO2	L3									**M**	**M**		**M**	**L**	**L**
CO3	L3		**M**	**M**	**M**	**M**				**M**			**M**	**L**	**M**
CO4	L3						**M**		**L**	**M**	**M**		**M**	**L**	**M**
CO5	L3		**L**							**H**	**H**		**M**	**L**	**M**

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO1, CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTCSPCC 508: Computer Graphics & Multimedia Lab

Course Objective:

- To implement different computer graphics algorithms, this algorithm make them learn about the creation of primitives of graphics, storage and generation.
- To create interactive graphics applications in C++ using one or more graphics application programming interfaces.
- To write programs that demonstrates geometrical transformations.

List of Experiments:

1. Implementation of Line, Circle and ellipse attributes
2. To plot a point (pixel) on the screen
3. To draw a straight line using DDA Algorithm
4. Implementation of mid-point circle generating Algorithm
5. Implementation of ellipse generating Algorithm
6. Two Dimensional transformations - Translation, Rotation, Scaling, Reflection, Shear
7. Composite 2D Transformations
8. Cohen Sutherland 2D line clipping and Windowing
9. Sutherland – Hodgeman Polygon clipping Algorithm
10. Three dimensional transformations - Translation, Rotation, Scaling
11. Composite 3D transformations
12. Drawing three dimensional objects and Scenes
13. Generating Fractal images

Course Outcomes

At the end of the course, a student will be able to:

CO1: List the basic concepts used in computer graphics.

CO2: Implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.

CO3: Describe the importance of viewing and projections.

CO4: Define the fundamentals of animation, virtualreality and its related technologies.

CO5: Implement various algorithms to Fractal images, dimensional objects and Scenes

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L3	H	H	M	H	L	-	-	-	-	H	-	L	M	M
CO2	L3	H	L	M	L	M	-	-	-	-	L	-	M	H	M
CO3	L2	H	H	M	H	L	-	-	-	-	H	-	L	H	M
CO4	L1	H	M	H	M	H	-	-	-	-	M	-	L	H	M
CO5	L1	H	M	M	M	H	-	-	-	-	L	-	L	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3
CD3	Seminars	-
CD4	Self- learning advice using internets	CO2, CO3,CO4
CD5	Industrial visit	

BTCSPCCAIML509: Deep Learning Lab

Course Objective:

- Student will understand Deep learning Techniques and their principles. The course will cover theory as well as practice aspects of a subject through scheduled lectures and labs, course will cover details of neural networks, Convolutional neural network and its applications, Neural language processing RNN, LSTM, GRU, DBM- Image Segmentation.

List of Experiments:

1. Implement Simple Programs like vector addition in TensorFlow.
2. Implement a simple problem like regression model in Keras.
3. Implement a perceptron in TensorFlow/Keras Environment.
4. Implement a Feed-Forward Network in TensorFlow/Keras.
5. Implement an Image Classifier using CNN in TensorFlow/Keras.
6. Implement a Transfer Learning concept in Image Classification.
7. Implement an Autoencoder in TensorFlow/Keras.
8. Implement a Simple LSTM using TensorFlow/Keras.
9. Implement an Opinion Mining in Recurrent Neural network.
10. Implement an Object Detection using CNN.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the role of deep learning in machine learning applications and get familiar with the use of TensorFlow/Keras in deep learning applications (Understanding)

CO2: Compare Various deep learning Algorithms used for Classification, Segmentation and detection. (Evaluate)

CO3: Apply various concepts related with Deep Learning to solve Problems.

CO4: Analyze different deep learning models in Image related projects.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	L	M	L	L	-	-	L	M	-	L	L	M
CO2	L4	H	M	L	M	L	L	-	-	-	M	-	L	L	M
CO3	L1	H	M	L	M	L	L	-	-	L	M	-	L	L	L
CO4	L2	H	H	M	H	L	L	-	-	L	H	-	M	M	M
CO5	L2	H	M	M	M	L	L	-	-	L	M	-	M	L	L

H- High, M- Moderate, L- Low, ‘-’ for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4 ,CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4,CO5
CD3	Seminars	CO2
CD4	Self- learning advice using internets	CO1,CO2, CO3, CO4
CD5	Industrial visit	CO5

BTCSPCC 510: Analysis of Algorithms Lab

Course Objective:

- To Design and implement efficient algorithms for a specified application.
- To Strengthen the ability to identify and apply the suitable algorithm for the given real world problem.

List of Experiments:

1. Sort a given set of elements using the Quicksort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
2. Implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
3. a. Obtain the Topological ordering of vertices in a given digraph. b. Compute the transitive closure of a given directed graph using Warshall's algorithm.
4. Implement 0/1 Knapsack problem using Dynamic Programming.
5. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
6. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
7. a. Print all the nodes reachable from a given starting node in a digraph using BFS method. b. Check whether a given graph is connected or not using DFS method.
8. Find Minimum Cost Spanning Tree of a given undirected graph using Prim’s algorithm.
9. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.
10. Implement N Queen's problem using Back Tracking.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Discuss algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.

CO2: Understand the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.

CO3: Experiment 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.

CO4: Experiment the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.

CO5: Practice the Floyd's algorithm, Back Tracking and Spanning Tree

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	H	M	M	-	-	-	-	M	L	H	M	M
CO2	L2	H	M	L	H	H	-	-	-	-	H	-	M	H	M
CO3	L4	H	L	M	H	H	-	-	-	-	H	-	M	H	M
CO4	L3	H	L	H	L	M	-	-	-	-	L	L	L	H	H
CO5	L3	M	L	L	L	M	-	-	-	-	L	L	L	H	H

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO2, CO3, CO5
CD3	Seminars	-
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit	-

BTCSPCC 511: Java Lab

Course Objective:

- To Using Graphics, Animations and Multithreading for designing Simulation and Game based applications.
- To Design and develop GUI applications using Abstract Windowing Toolkit (AWT), Swing and Event Handling.
- To Design and develop Web applications
- To Designing Enterprise based applications by encapsulating an application's business logic.
- To Designing applications using pre-built frameworks.

List of Experiments:

1. Introduction To Swing, MVC Architecture, Applets, Applications and Pluggable Look and Feel, Basic swing components : Text Fields, Buttons, Toggle Buttons, Checkboxes, and Radio Buttons
2. Java database Programming, java.sql Package, JDBC driver, Network Programming With java.net Package, Client and Server Programs, Content And Protocol Handlers
3. RMI architecture, RMI registry, Writing distributed application with RMI, Naming services, Naming And Directory Services, Overview of JNDI, Object serialization and Internationalization
4. J2EE architecture, Enterprise application concepts, n-tier application concepts, J2EE platform, HTTP protocol, web application, Web containers and Application servers
5. Server side programming with Java Servlet, HTTP and Servlet, Servlet API, life cycle, configuration and context, Request and Response objects, Session handling and event handling, Introduction to filters with writing simple filter application
6. JSP architecture, JSP page life cycle, JSP elements, Expression Language, Tag Extensions, Tag Extension API, Tag handlers, JSP Fragments, Tag Files, JSTL, Core Tag library, overview of XML Tag library, SQL Tag library and Functions Tag library

Course Outcomes

At the end of the course, the student will be able to:

CO1: Show to access database through Java programs, using Java Data Base Connectivity (JDBC)

CO2: Practice to create dynamic web pages, using Servlets and JSP.

CO3: Apply to make a reusable software component, using Java Bean.

CO4: Classify the invoke the remote methods in an application using Remote Method Invocation (RMI)

CO5: Understand the multi-tier architecture of web-based enterprise applications using Enterprise JavaBeans (EJB).

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	H	H	H	-	-	-	-	-	H	-	M	M	M
CO2	L2	M	M	H	M	M	-	-	-	-	M	-	L	M	M
CO3	L3	H	M	M	M	M	-	-	-	-	M	-	H	H	M
CO4	L4	M	H	H	H	M	-	-	-	-	H	-	L	H	M
CO5	L2	H	H	H	H	-	-	-	-	-	H	-	H	H	M

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO5
CD3	Seminars	-
CD4	Self- learning advice using internets	CO2, CO3, CO5
CD5	Industrial visit	-

BTCSPROJ 512: Industrial Training / Seminar

Course Objectives:

- To acquire and apply fundamental principles of engineering.
- To update with all the latest changes in technological world.
- To identify, formulate and model problems and find engineering solution based on a systems approach.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Capability to acquire and apply fundamental principles of engineering.

CO2: Become master in one's specialized technology

CO3: Become updated with all the latest changes in technological world.

CO4: Ability to identify, formulate and model problems and find engineering solution based on a systems approach.

CO5: Ability to understand the real problems of world and use the models to solve it.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PSO1	PSO2
CO1	L2	M	H	L	H	L	-	-	-	-	L	-	L	M	M
CO2	L3	M	L	H	H	L	-	-	-	-	L	-	M	H	M
CO3	L6	M	H	M	M	L	-	-	-	-	L	-	M	M	M
CO4	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	H
CO5	L2	H	M	L	M	L	-	-	-	-	M	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

BTCSHSMC 513: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Semester–VI

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCCAIML**601**	**Artificial Neural Network**	PCC	30	70	100	3	0	0	3
BTCSPCCALML**602**	**Machine Learning –II**	PCC	30	70	100	3	0	0	3
BTCSPCC 603	Information Security System	PCC	30	70	100	3	0	0	3
BTCSPCC 604	Computer Architecture and Organization	PCC	30	70	100	3	0	0	3
BTCSPCCAIML 605	**Natural Language Processing (NLP)**	PCC	30	70	100	3	0	0	3
	Elective Subject								
BTCSPEC 606A	Distributed System	PEC	30	70	100	3	0	0	3
BTCSPEC 606B	Cloud Computing	PEC	30	70	100	3	0	0	3
BTCSPEC 606C	Ecommerce & ERP	PEC	30	70	100	3	0	0	3
BTCSVAC607	Introduction to Cloud Computing with Amazon Web Services	VAC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCSPCCALML**608**	**Machine Learning- II Lab**	LC	60	40	100	0	0	1	1
BTCSPCCAIML 609	**Natural Language Processing Lab**	LC	**60**	**40**	**100**	**0**	**0**	**1**	**1**
BTCSPCC 610	Cyber Security Lab	LC	60	40	100	0	0	1	1
BTCSPROJ 611	Project-I	LC	60	40	100	0	0	1	1
BTCSHSMC 612	Social Outreach, Discipline & Extra Curricular Activities	HSMC	100		100				1
	TOTAL		**550**	**650**	**1200**	**20**	**0**	**4**	**25**

BTCSPCCAIML601: Artificial Neural Network

Course Objectives:

- To understand the biological neural network and to model equivalent neuron models.
- To understand the architecture, learning algorithm and issues of various feed forward and feedback neural networks

Course Contents:

Unit I **Introduction:** A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks. Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process.

Unit II **Single Layer Perceptrons:** Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron – Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment. Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection.

Unit III **Back Propagation:** Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning

Unit IV **Self-Organization Maps (SOM):** Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification

Unit V **Neuro Dynamics:** Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm. Hopfield Models – Hopfield Models, Computer Experiment.

Course Outcomes:

CO1: Develop a foundational understanding of neural networks, encompassing neuron models, network architectures, and knowledge representation.

CO2: Gain proficiency in diverse learning processes, including error correction and Hebbian learning, and apply single-layer and multilayer perceptrons for problem-solving.

CO3: Acquire advanced skills in back propagation, differentiation, and network pruning, along with a nuanced understanding of the virtues and limitations of supervised learning.

CO4: Apply self-organization maps for feature mapping and adaptive pattern classification, and understand the dynamics of neural networks, including stability, attractors, and recurrent paradigms like Hopfield models.

CO5: **T**he dynamics of neural networks, including stability, attractors, and recurrent paradigms, with a practical application of Hopfield models.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	L	H	L	-	M	-	-	L	L	-	M	M	M
CO2	L3	H	L	M	L	-	-	-	-	L	L	-	L	M	M
CO3	L3	M	H	M	H	-	L	-	-	L	H	-	M	H	M
CO4	L3	M	M	H	M	-	L	-	-	L	M	-	L	H	M
CO5	L2	H	M	L	M	L	-	-	-	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	CO4

BTCSPCCALML602: Machine Learning –II

Course Objectives

- To understand fundamental concepts of machine learning and its various algorithms
- To understand various strategies of generating models from data and evaluating them
- To apply ML algorithms on given data and interpret the results obtained
- To design appropriate ML solution to solve real world problems in AI domain

Course Contents:

Unit I: **Introduction:** Machine learning, Terminologies in machine learning, Types of machine learning: supervised, unsupervised, semi-supervised learning.

Unit II: **Discriminative Models:** Least Square Regression, Gradient Descent Algorithm, Univariate and Multivariate Linear Regression, Prediction Model, probabilistic interpretation, Regularization, Logistic regression, multi class classification,

Unit III: **Support Vector Machines-** Large margin classifiers, Nonlinear SVM, kernel functions, SMO algorithm. Model evaluation and improvement, Regularization, Bias Variance, Hyper- parameter Tuning. Computational Learning theory- Sample complexity, exhausted version space, PAC Learning, agnostic learner, VC dimensions, Sample complexity - Mistake bounds. Gaussian models: Multivariate Gaussian distributions, Maximum Likelihood Estimate, Inferring parameters, Mixture models, EM algorithm for clustering and learning with latent variables.

Unit IV: **Generative models:** Linear Discriminative Analysis, Naıve Bayes classifier, Decision trees, Ensemble models – Bagging and Boosting.

Unit V: **Unsupervised Learning Algorithms:** Dimensionality Reduction Principal Component Analysis (PCA), Singular Value Decomposition (SVD). Clustering – Hierarchical, Partitioned clustering: K-means, PAM, eXplainable AI (XAI), Approaching an ML problem

Text Book / References

1. Tom Mitchell, “Machine Learning”, McGraw Hill, 1997

2. E. Alpaydin, “Introduction to Machine Learning”, PHI, 2005.

3. Andrew Ng, Machine learning yearning, https://www.deeplearning.ai/machine-learningyearning/

4. AurolienGeron,”Hands-On Machine Learning with Scikit-Learn and TensorFlow, Shroff/O’Reilly”, 2017 5. Andreas Muller and Sarah Guido, ”Introduction to Machine Learning with Python: A Guidefor Data Scientists”, Shroff/O’Reilly, 2016

Course Outcomes

CO1: Develop a good understanding of fundamental principles of machine learning
CO2: Formulation of a Machine Learning problem
CO3: Develop a model using supervised/unsupervised machine learning algorithms for classification/prediction/clustering
CO4: Evaluate performance of various machine learning algorithms on various data sets of a domain.
CO5: Design and Concrete implementations of various machine learning algorithms to solve a given problem using languages such as Python

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	L	M	L	-	-	-	-	M	-	L	M	M
CO2	L2	H	M	L	M	L	-	L	-	-	M	-	L	M	M
CO3	L2	H	L	L	L	M	-	-	-	-	L	-	L	M	M
CO4	L2	H	L	L	L	L	-	L	-	-	L	-	L	M	M
CO5	L2	M	L	L	L	-	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3,
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTCSPCC 603: Information Security System

Course Objectives:

- To enhance knowledge and techniques for enforcement of security with some emphasis on cryptography.
- To develop an understanding of security policies (such as authentication, integrity and confidentiality).

Course Contents:

Unit I: Introduction to security attacks: services and mechanism, classical encryption techniques-substitution ciphers and transposition ciphers, cryptanalysis, stream and block ciphers.

Unit II: Modern block ciphers: Block Cipher structure, Data Encryption standard (DES) with example, strength of DES, Design principles of block cipher, AES with structure, its transformation functions, key expansion, example and implementation. Multiple encryption and triple DES, Electronic Code Book, Cipher Block Chaining Mode, Cipher Feedback mode, Output Feedback mode, Counter mode.

Unit III: Public Key Cryptosystems with Applications: Requirements and Cryptanalysis, RSA cryptosystem, Rabin cryptosystem, Elgamal crypto system, Elliptic curve cryptosystem

Unit IV: Cryptographic Hash Functions, their applications: Simple hash functions, its requirements and security, Hash functions based on Cipher Block Chaining, Secure Hash Algorithm (SHA).Message Authentication Codes, its requirements and security, MACs based on Hash Functions, Macs based on Block Ciphers .Digital Signature, its properties, requirements and security, various digital signature schemes (Elgamal and Schnorr), NIST digital Signature algorithm.

Unit V: Key management and distribution: symmetric key distribution using symmetric and asymmetric encryptions, distribution of public keys, X.509 certificates, Public key infrastructure. Remote user authentication with symmetric and asymmetric encryption, Kerberos Web Security threats and approaches, SSL architecture and protocol, Transport layer security, HTTPS and SSH

Text/ Reference Books:

- Stalling Williams: Cryptography and Network Security: Principles and Practices, 4th Edition,Pearson Education, 2006.
- Kaufman Charlie et.al; Network Security: Private Communication in a Public World, 2nd Ed., PHI/Pearson.
- Pieprzyk Josef and et.al; Fundamentals of Computer Security, Springer-Verlag, 2008.
- Trappe & Washington, Introduction to Cryptography, 2nd Ed. Pearson.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand key terms and concepts in cyber law, intellectual property and cyber crimes, trademarks and domain theft.

CO2: Apply computer technologies, digital evidence collection, and evidentiary reporting in forensic acquisition.

CO3: Understand approaches for incident analysis and response.

CO4: Understand Cryptographic Hash Functions and their applications.

CO5: Learn Key management system.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	M	-	-	-	-	-	M	-	M	M	M
CO2	L3	M	M	H	M	-	-	-	-	-	M	-	L	M	M
CO3	L2	M	H	M	H	-	-	-	-	-	H	-	L	H	M
CO4	L2	M	H	M	M	-	-	-	-	-	H	-	L	M	M
CO5	L1	M	H	M	M	-	-	-	-	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Tutorials/Assignments	CO1, CO2, CO3
CD3	Seminars	CO3
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	CO2

BTCSPCC 604: Computer Architecture and Organization

Course Objective:

- To discuss the basic concepts and structure of computers.
- To understand concepts of register transfer logic and arithmetic operations.
- To explain different types of addressing modes and memory organization.
- To learn the different types of serial communication techniques.
- To summarize the Instruction execution stages.

Course Contents:

Unit I: **Computer Data Representation:** Basic computer data types, Complements, Fixed point representation, Register Transfer and Micro-operations: Floating point representation, Register Transfer language, Register Transfer, Bus and Memory Transfers (Tree-State Bus Buffers, Memory Transfer), Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro-Operations, Arithmetic logical shift unit. Basic Computer Organization and Design Instruction codes, Computer registers, computer instructions, Timing and Control, Instruction cycle, Memory-Reference Instructions, Input-output and interrupt, Complete computer description, Design of Basic computer, design of Accumulator Unit

Unit II: **Programming the Basic Computer:** Introduction, Machine Language, Assembly Language, assembler, Program loops, Programming Arithmetic and logic operations, subroutines, I-O Programming. Micro programmed Control: Control Memory, Address sequencing, Micro program Example, design of control

Unit III: **Central Processing Unit:** Introduction, General Register Organization, Stack Organization, Instruction format, Addressing Modes, data transfer and manipulation, Program Control, Reduced Instruction Set Computer (RISC) Pipeline And Vector Processing, Flynn's taxonomy, Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction, Pipeline, RISC Pipeline, Vector Processing, Array Processors

Unit IV: **Computer Arithmetic:** Introduction, Addition and subtraction, Multiplication Algorithms (Booth Multiplication Algorithm), Division Algorithms, Floating Point Arithmetic operations, Decimal Arithmetic Unit. Input-Output Organization, Input-Output Interface, Asynchronous Data Transfer, Modes Of Transfer, Priority Interrupt, DMA, Input-Output Processor (IOP), CPU IOP Communication, Serial communication

Unit V: **Memory Organization:** Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory. Multiprocessors: Characteristics of Multiprocessors, Interconnection Structures, Inter-processor Arbitration, Inter-processor Communication and Synchronization, Cache Coherence, Shared Memory Multiprocessors.

Text & References books:

1. Computer Organization and Architecture - William Stallings (Pearson Education Asia)
2. Computer Organization and Architecture -John P. Hayes (McGraw-Hill)
3. Computer Organization -V. Carl. Hamsacher (McGraw-Hill)
4. Computer System Architecture-M. Morris Mano (PHI)

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Calculate performance of the computer system and decode machine language

CO2: Describe arithmetic and logic unit

CO3: Demonstrate pipelined control units

CO4: Demonstrate parallel processing architectures.

CO5: Learn Memory Organization and Multiprocessors.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	L	H	L	L	-	-	-	-	L	-	L	M	L
CO2	L2	H	L	M	L	L	-	-	-	-	L	-	L	M	L
CO3	L3	M	H	M	H	M	-	-	-	-	H	-	M	M	M
CO4	L3	H	M	H	M	M	-	-	-	-	M	-	L	M	M
CO5	L1	M	H	M	M	-	-	-	-	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Tutorials/Assignments	CO1, CO2, CO3
CD3	Seminars	CO2
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	

BTCSPCCAIML605: Natural Language Processing (NLP)

Course Objective:

- Understand leading trends and systems in natural language processing
- Describe concepts of morphology, syntax, semantics and pragmatics of the language
- Understand Language Models and its evaluation
- Describe and analyse language · POS tagging and context free grammar for English language
- Writing programs in Python to carry out natural language processing
- Implement deep learning algorithms in Python and learn how to train deep networks for NLP

Course Contents:

Unit I: **Introduction -** terminologies - empirical rules – Statistical Properties of words – Probability and NLP – Vector Space Models - Pre-processing- Tokenization, Parts-Of-Speech (POS) tagging, chunking, syntax parsing, Dependency parsing.

Unit II: **NLP Applications:** Named Entity Recognition, Sentiment analysis, Text categorization: Basic supervised text categorization algorithms, including Naive Bayes, k Nearest Neighbor (kNN) and Logistic Regression. Topic modeling: SVD and Latent semantic Indexing, Probabilistic Latent Semantic Indexing (pLSI) and Latent Dirichlet Allocation (LDA).

Unit III: Introduction to Deep Learning: Neural Networks Basics, Feedforward Neural Network, Recurrent Neural Networks, LSTM, An Introduction to Transformers and Sequence-to-Sequence Learning.

Unit IV: Neural Networks for NLP – Vector Representation of words – Contextual Understanding of text – Concurrence of matrix – N-grams – Dense Word Vector. Word2Vec – CBOW and Skip-gram Models – One-word learning architecture-Forward pass for Word2Vec – Reduction of complexity – sub sampling and negative sampling. Continuous Skip-Gram Model, GloVe, BERT, XLNet

Unit V: Historical Approaches to Machine Translation – Statistical Machine Translation – Translation Models – Healthcare Data analysis and Text visualization: Summarizing lengthy blocks of narrative text, such as a clinical note or academic journal article. Answering unique free-text queries that require the synthesis of multiple data sources. Introduce Mathematical and programming tools to visualize a large collection of text documents.

Text Book / References

1. C.D. Manning et al, “Foundations of Statistical Natural Language Processing,” MitPress.MITPress, 1999.isbn: 9780262133609.
2. James Allen, “Natural Language Processing with Python”, O’Reilly Media, July 2009.
3. NiladriSekhar Dash and S. Arulmozi, Features of a Corpus. Singapore: Springer Singapore,2018, pp. 17–34. ISBN: 978-981-10-7458-5.
4. Ian Good fellow, YoshuaBengio, and Aaron Courville, Deep Learning,http://www.deeplearningbook.org. MIT Press, 2016.
5. NitinIndurkhya and Fred J Damerau, ”Handbook of natural language processing,” Chapmanand Hall/CRC, 2010.
6. Daniel Jurafsky and James H. Martin ”Speech and Language Processing: An Introductionto Natural Language Processing, Computational Linguistics, and Speech Recognition,” 1st. Upper Saddle River, NJ, USA: Prentice Hall PTR, 2000. isbn: 0130950696.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.

CO2: Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems

CO3: Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.

CO4: Able to design, implement, and analyze NLP algorithms

CO5: Able to design different language modeling Techniques.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	L	M	L	-	-	-	-	M	-	L	M	M
CO2	L2	H	M	L	M	L	-	L	-	-	M	-	L	M	M
CO3	L2	H	L	L	L	M	-	-	-	-	L	-	L	M	M
CO4	L2	H	L	L	L	L	-	L	-	-	L	-	L	M	M
CO5	L2	M	L	L	L	-	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1,CO2, CO3,
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO1, CO2, CO3, CO4, CO5

BTCSPEC 606A: Distributed System

Course Objectives

- To provide an introduction to the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission.
- To demonstrate the knowledge of the core architectural aspects of distributed systems.

Course Contents:

Unit I: **Distributed Systems:** Features of distributed systems, nodes of a distributed system, Distributed computation paradigms, Model of distributed systems, Types of Operating systems: Centralized Operating System, Network Operating Systems, Distributed Operating Systems and Cooperative Autonomous Systems, design issues in distributed operating systems. Systems Concepts and Architectures: Goals, Transparency, Services, Architecture Models, Distributed Computing Environment (DCE).Theoretical issues in distributed systems: Notions of time and state, states and events in a distributed system, time, clocks and event precedence, recording the state of distributed systems.

Unit II: **Concurrent Processes and Programming:** Processes and Threads, Graph Models for Process Representation, Client/Server Model, Time Services, Language Mechanisms for Synchronization, Object Model Resource Servers, Characteristics of Concurrent Programming Languages (Language not included).Inter-process Communication and Coordination: Message Passing, Request/Reply and Transaction Communication, Name and Directory services, RPC and RMI case studies

Unit III: **Distributed Process Scheduling :** A System Performance Model, Static Process Scheduling with Communication, Dynamic Load Sharing and Balancing, Distributed Process Implementation. Distributed File Systems: Transparencies and Characteristics of DFS, DFS Design and implementation, Transaction Service and Concurrency Control, Data and File Replication. Case studies: Sun network file systems, General Parallel file System and Window's file systems. Andrew and Coda File Systems

Unit IV: **Distributed Shared Memory:** Non-Uniform Memory Access Architectures, Memory Consistency Models, Multiprocessor Cache Systems, Distributed Shared Memory, Implementation of DSM systems. Models of Distributed Computation: Preliminaries, Causality, Distributed Snapshots, Modelling a Distributed Computation, Failures in a Distributed System, Distributed Mutual Exclusion, Election, Distributed Deadlock handling, and Distributed termination detection.

Unit V: **Distributed Agreement:** Concept of Faults, failure and recovery, Byzantine Faults, Adversaries, Byzantine Agreement, Impossibility of Consensus and Randomized Distributed Agreement.Replicated Data Management: concepts and issues, Database Techniques, Atomic Multicast, and Update Propagation. CORBA case study: Introduction, Architecture, CORBA RMI, CORBA Services

Reference/Text Books:

1. Tannenbaum, A, Van Steen. Distributed Systems, Principles and Paradigm, Prentice Hall India, 2002
2. Tannenbaum, A. Distributed Operating Systems, Pearson Education. 2006
3. Attiya, Welch, “Distributed Computing”, Wiley India, 2006
4. AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar, “Introduction to parallel computing”, 2nd Edition, Pearson Education, 2007

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Distinguish distributed computing paradigm from other computing paradigms

CO2: Identify the core concepts of distributed systems

CO3: Illustrate the mechanisms of inter process communication in distributed system

CO4: Apply appropriate distributed system principles in ensuring transparency, consistency and fault-tolerance in distributed file system

CO5: Discuss the Database Techniques and CORBA case studies.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	M	L	H	L	L	-	-	-	L	L	-	L	L	M
CO2	L2	H	L	M	L	L	-	-	-	M	L	-	L	L	M
CO3	L3	M	M	M	M	L	-	-	-	L	M	-	L	M	M
CO4	L3	M	H	M	H	L	-	-	-	M	H	-	M	L	M
CO5	L2	M	H	M	H	M	-	-	-	L	H	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Seminars	CO2, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO5
CD5	Industrial visit	CO2

BTCSPEC 606B: Cloud Computing

Course Objectives:

- To understand the basics of Cloud Computing.
- To understand the movement from a traditional network infrastructure to a Cloud solution.

Course Contents:

Unit I: **Introduction:** Objective, scope and outcome of the course. Introduction Cloud Computing: Nutshell of cloud computing, Enabling Technology, Historical development, Vision, feature Characteristics and components of Cloud Computing. Challenges , Risks and Approaches of Migration into Cloud. Ethical Issue in Cloud Computing, Evaluating the Cloud's Business Impact and economics, Future of the cloud. Networking Support for Cloud Computing. Ubiquitous Cloud and the Internet of Things

Unit II: **Cloud Computing Architecture:** Cloud Reference Model, Layer and Types of Clouds, Services models, Data centre Design and inter connection Network, Architectural design of Compute and Storage Clouds. Cloud Programming and Software: Fractures of cloud programming, Parallel and distributed programming paradigms-Map Reduce, Had oop, High level Language for Cloud. Programming of Google App engine.

Unit III: **Virtualization Technology:** Definition, Understanding and Benefits of Virtualization. Implementation Level of Virtualization, Virtualization Structure/Tools and Mechanisms, Hypervisor VMware, KVM, Xen. Virtualization: of CPU, Memory, I/O Devices,Virtual Cluster and Resources Management, Virtualization of Server, Desktop, Network, and Virtualization of data-centre

Unit IV: **Securing the Cloud:** Cloud Information security fundamentals, Cloud security services, Design principles, Policy Implementation, Cloud Computing Security Challenges, Cloud Computing Security Architecture .Legal issues in cloud Computing. Data Security in Cloud: Business Continuity and Disaster Recovery, Risk Mitigation, Understanding and Identification of Threats in Cloud, SLA-Service Level Agreements, Trust Management

Unit V: **Cloud Platforms in Industry:** Amazon web services, Google App Engine, Microsoft Azure Design, Aneka: Cloud Application Platform-Integration of Private and Public Clouds Cloud applications: Protein structure prediction, Data Analysis, Satellite Image Processing, CRM

Text/ Reference Books:

- " Distributed and Cloud Computing " By Kai Hawang , Geofrey C.Fox, Jack J. Dongarra Pub: Elservier
- Cloud Computing ,Principal and Paradigms, Edited By Rajkumar Buyya, Jemes Broberg, A. Goscinski,
- Pub.- Wiley
- Kumar Saurabh, "Cloud Computing" , Wiley Pub
- Krutz , Vines, "Cloud Security " , Wiley Pub
- Velte, "Cloud Computing- A Practical Approach" ,TMH Pub

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Compute the Cloud computing setup with it's vulnerabilities and applications using different architectures.

CO2: Discuss different workflows according to requirements and apply map reduce programming model.

CO3: Describe suitable Virtualization concept, Cloud Resource Management and design scheduling algorithms.

CO4: Apply combinatorial auctions for cloud resources and design scheduling algorithms for computing clouds

CO5: Describe cloud Storage systems and Cloud Platforms in Industry.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	M	L	H	L	-	-	-	-	-	L	-	M	M	L
CO2	L2	H	L	M	L	-	-	-	-	-	L	-	L	M	L
CO3	L1	H	M	L	M	-	-	-	-	-	M	-	L	M	M
CO4	L3	M	H	M	H	-	-	-	-	-	H	-	M	H	M
CO5	L2	H	H	H	H	-	-	-	-	-	H	-	L	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3,
CD5	Industrial visit	CO5

BTCSPEC 606C: Ecommerce & ERP

Course Objective:

- To give student an overview of all aspects of E-Commerce. Topics include development of the Internet and E-Commerce.
- To give them awareness about options available for doing business on the Internet, features of Web sites and the tools used to build an E-Commerce web site, marketing issues, payment options, security issues, and customer service.

Course Contents:

Unit I: **Introduction to E-Commerce:** Defining Commerce; Main Activities of Electronic Commerce; Benefits of E-Commerce; Broad Goals of Electronic Commerce; Main Components of E-Commerce; Functions of Electronic Commerce–Communication, Process Management, Service Management, Transaction Capabilities; Process of E-Commerce; Types of E-Commerce; Role of Internet and Web in E-Commerce; Technologies Used; E-Commerce Systems; Pre-requisites of E-Commerce; Scope of E-Commerce; E-Business Models.

Unit II: **E-Commerce Activities:** Various Activities of E-Commerce; Various Modes of Operation Associated with E-Commerce; Matrix of E-Commerce Types; Elements and Resources Impacting E-Commerce and Changes; Types of E-Commerce Providers and Vendors; Man Power Associated with E-Commerce Activities; Opportunity Development for E-Commerce Stages; Development of E-Commerce Business Case; Components and Factors for the Development of the Business Case; Steps to Design and Develop an E-Commerce Website.

Unit III: **Internet–The Backbone for E-Commerce:** Early Ages of Internet; Networking Categories; Characteristics of Internet; Components of Internet–Internet Services, Elements of Internet, Uniform Resource Locators, Internet Protocol; Shopping Cart, Cookies and E-Commerce; Web Site Communication; Strategic Capabilities of Internet.

Unit IV: **SP, WWW and Portals:** Internet Service Provider (ISP); World Wide Web(WWW); Portals–Steps to build homepage, Metadata; Advantages of Portal; Enterprise Information Portal (EIP).E-Commerce & Online Publishing: This unit explains the concept of online publishing, strategies and approaches of online publishing, and online advertising

Unit V: **XML and Data Warehousing:** Definition of extensible Markup Language(XML); XML Development Goals; Comparison between HTML and XML; Business importance in using XML Based Technology; Advantages, Disadvantages and Applications of XML; Structure of an XML Document; XHTML and X/Secure; Data Warehousing; Data Marts and Operational Data Stores. E-Marketing: Traditional Marketing; E-Marketing; Identifying Web Presence Goals–Achieving web presence goals, Uniqueness of the web, Meeting the needs of website visitors, Site Adhesion: Content, format and access; Maintaining a Website; Metrics Defining Internet Units of Measurement; Online Marketing; Advantages of Online Marketing.

Refrence/Text Books:

1. A. Lexis Leon, “Enterprise Resource Planning”, TMH

2. Brady, Manu, Wegner, “Enterprise Resource Planning”, TMH

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Demonstrate and understanding of the foundations and importance of E-commerce.

CO2: Demonstrate an understanding of retailing in E-commerce by: analyzing branding and pricing strategies, using and determining the effectiveness of market research assessing the effects of disintermediation.

CO3: Analyze the impact of E-commerce on business models and strategy.

CO4: Describe Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational.

CO5: Describe extensible Markup Language and Website Maintenance.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	L	H	L	-	-	-	-	L	L	-	M	L	L
CO2	L3	H	L	M	L	L	-	-	-	M	L	-	L	M	L
CO3	L4	M	M	H	M	M	-	-	-	M	M	-	L	M	L
CO4	L2	M	M	H	M	M	-	-	-	L	M	-	L	M	M
CO5	L4	M	M	H	M	M	-	-	-	M	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4,CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	

BTCSVAC607: Introduction to Cloud Computing with Amazon Web Services

Course Objective:

- To introduce students to the fundamentals of cloud computing, AWS services, and the importance of cloud technology in business. Students will learn how to create an AWS account.
- To familiarize students with AWS-specific concepts such as regions, availability zones, APIs, SDKs, CLI, and AWS service categories.
- To teach students how to deploy WordPress at scale on AWS with a focus on administration and security. Topics include configuring IAM, setting up CloudTrail, and creating a secure networking configuration.
- To guide students through the process of deploying a server on AWS, including launching an EC2 instance, configuring WordPress, using Amazon Machine Images, and setting up monitoring with CloudWatch.
- To instruct students on deploying a relational database using Amazon RDS, implementing a backup strategy, verifying RDS backups, creating S3 backups, and optimizing storage costs with Amazon Glacier.

Course Contents:

Unit I Introduction to Cloud Computing, The AWS Cloud,The Virtual Private Cloud,The Elastic Compute Cloud service,The Simple Storage Service, Why Cloud Computing Is Important To Your Business,, AWS Web Services, Fundamental Components,AWS Global Infrastructure, Creating An AWS Account

Unit II **AWS specific concepts:** Regions And Availability Zones, Accessing AWS - APIs, SDKs, The CLI, And The Web Management, AWS Service Categories - Administration And Security,Networking And Computer, Storage And Content Delivery,Deployment And Management,Analytics And Database, Application Services And Mobile Services, Enterprise Applications

Unit III Deploying wordpress at scale, creating a strong foundation – Administration and security: Configuring IAM for Our Deployment, Setting UpCloudTrail. Deploying a secure Networking configuration: Creating A Well Structured VPC, Configuring An Elastic Load Balancer,Configuring Route 53 For DNS Services

Unit IV Deploying a server: Launching An EC2 Instance, Configuring WordpressOn Amazon Linux, Using Amazon Machine Images To Simplify Operations, Configuring CloudWatch Logs, Configuring CloudWatch Alarms.

Unit V **Deploying a Relational Database:** Creating A MySQL Database With RDS. Implementing a Backup strategy: Verifying RDS Backups, Creating An S3 Backup, Optimizing S3 Costs With Amazon Glacier

Suggested Text / Reference Books

1. Donald Wilson Cloud Computing: A Brief Introduction to Cloud Computing Oliver Leish
2. Pravin Mishra,Cloud Computing with AWS: Everything You Need to Know to be an AWS Cloud Practitioner Apress
3. Mark Wilkins,Learning Amazon Web Services (Aws), 1/E: A Hands-On Guide To The Fundamentals Of Aws Cloud by Mark Wilkins, PEARSON INDIA
4. MARINESCU ,Cloud Computing : Theory And Practice 2Nd Edition by MARINESCU, ELSEVIER INDIA

Course Outcomes:

At the end of the course, the student will be able to:

CO1: To Gain an introductory understanding of Cloud Computing, AWS services, and the importance of cloud computing for businesses.

CO2: To Develop in-depth knowledge of AWS-specific concepts, including regions, availability zones, access methods, service categories.

CO3: To Learn to deploy WordPress at scale with a focus on administration, security, and networking configurations, including IAM setup.

CO4: To Gain practical experience in deploying servers using EC2 instances, configuring WordPress on Amazon Linux, utilizing Amazon Machine Images.

CO5: To Master the deployment of a relational database with MySQL using RDS, implement a backup strategy with RDS backups

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Experiments, Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L2	H	-	M	-	-	-	-	-	-	M	-	H	M	M
CO2	L2	M	-	-	-	L	-	-	-	-	L	-	M	M	M
CO3	L1	M	-	-	-	-	-	-	-	-	L	-	M	M	L
CO4	L2	M	-	-	-	-	-	-	-	-	L	-	M	H	M
CO5	L2	M	-	-	-	-	-	-	-	-	-	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3, CO4, CO5
CD3	Experiments, Seminars	CO1, CO2, CO3
CD4	Self- learning advice using internets	CO4, CO5
CD5	Industrial visit	CO1, CO5

BTCSPCCAIML608: Machine Learning- II Lab

Course Objective:

- To Make use of Data sets in implementing the machine learning algorithms
- To Analyze and evaluate simple algorithms for pattern classification.
- To implement the machine learning concepts and algorithms in any suitable language of choice.

List of Experiments

1. Implement and demonstrate the FIND-Salgorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample
4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Build intelligent agents for search and games

CO2: Solve AI problems through programming with Python

CO3: Learning optimization and inference algorithms for model learning

CO4: Design and develop programs for an agent to learn and act in a structured environment.

CO5 : Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L6	H	M	H	M	M	-	-	-	L	M	-	L	M	M
CO2	L5	M	M	H	M	L	-	-	-	L	M	-	M	H	M
CO3	L1	H	L	H	L	L	-	-	-	L	L	-	M	H	H
CO4	L6	H	M	H	M	M	-	-	-	M	M	-	L	H	H
CO5	L3	M	M	M	M	L	-	-	-	M	M	L	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4
CD2	Tutorials/Assignments	CO2, CO3,CO5
CD3	Seminars	-
CD4	Self- learning advice using internets	CO2, CO3, CO4
CD5	Industrial visit	-

BTCSPCCAIML 609: Natural Language Processing Lab

Course Objective:

- To develop algorithm for Semantics and Sentiment analysis using NLP.
- Train the students and researchers from basics to advanced NLP tools and techniques.
- To develop a Research ambience for product development and patenting.
- To transfer the novel technology to the industries for the benefit of society.
- Organize open scientific and technological competitions in the field of natural language processing.

List of Experiments

1) **Tokenizing Text and WordNet basics:** Tokenizing text into sentences, Tokenizing sentences into words, Experiments sentences using regular expressions, Filtering stopwords in a tokenized sentence, Looking up synsets for a word in WordNet, Looking up lemmas and synonyms in WordNet, Calculating WordNetsynset similarity Discovering word collocations

2) **Replacing and correcting words:** Stemming words, Lemmatizing words with WordNet, Translating text with Babelfish, Replacing words matching regular expressions, Removing repeating characters, Spelling correction with Enchant ,Replacing synonyms, Replacing negations with antonyms

3) **Creating Custom Corpora :** Setting up a custom corpus ,Creating a word list corpus, Creating a partof-speech tagged word corpus, Creating a chunked phrase corpus, Creating a categorized text corpus, Creating a categorized chunk corpus reader, Lazy corpus loading, Creating a custom corpus view, Creating a MongoDB backed corpus reader, Corpus editing with file locking

4) **Parts-of -Speech Tagging**: Training a unigram part-of-speech tagger, Combining taggers with backoff tagging, Training and combining Ngram taggers ,Creating a model of likely word tags, Tagging with regular expressions ,Affix tagging ,Training a Brill tagger, Training the TnT tagger Using WordNet for tagging, Tagging proper names, Classifier based tagging

5) **Extracting Chunks :** Chunking and chinking with regular expressions ,Merging and splitting chunks with regular expressions ,Expanding and removing chunks with regular expressions, Partial parsing with regular expressions ,Training a tagger-based chunker, Classification-based chunking, extracting named entities, Extracting proper noun chunks, Extracting location chunks, Training a named entity chunker

6) **Transforming Chunks and Trees:** Filtering insignificant words ,Correcting verb forms,Swapping verb phrases, Swapping noun cardinals, Swapping infinitive phrases, Singularizing plural nouns, Chaining chunk transformations, Converting a chunk tree to text, Flattening a deep tree ,Creating a shallow tree, Converting tree nodes

7) **Parsing Specific Data:** Parsing dates and times with Dateutil, Time zone lookup and conversion, Tagging temporal expressions with Timex, Extracting URLs from HTML with lxml, Cleaning and stripping HTML, Converting HTML entities with BeautifulSoup

References

1. Python Text processing with NLTK 2.0 Cookbook, Jacob perkins, PACKT Publishing
2. Natural Languaage Processing with Python, Steven Bird, Ewan Klein, and Edward Loper, Oreilly

BTCSPCC 610: Cyber Security Lab

Course Objectives:

- To Protect data and respond to threats that occur over the Internet
- To Design and implement risk analysis, security policies, and damage assessment

List of Experiments

1. Implement the following Substitution & Transposition Techniques concepts:
   a) Caesar Cipher
   b) Rail fence row & Column Transformation
2. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).
3. Implement the following Attack:
   a) Dictionary Attack
   b) Brute Force Attack
4. Installation of Wire shark, tcpdump, etc and observe data transferred in client server communication using UDP/TCP and identify the UDP/TCP datagram.
5. Installation of rootkits and study about the variety of options.
6. Perform an Experiment to Sniff Traffic using ARP Poisoning.
7. Demonstrate intrusion detection systems using any tool (snort or any other s/w).
8. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures.

PROJECT: In a small area location such as a house, office or in a classroom, there is a small network called a Local Area Network (LAN). The project aims to transfer a file peer-to-peer from one computer to another computer in the same LAN. It provides the necessary authentication for file transferring in the network transmission. By implementing the Server-Client technology, use a File Transfer Protocol mechanism and through socket programming, the end user is able to send and receive the encrypted and decrypted file in the LAN. An additional aim of the project is to transfer a file between computers securely in LANs. Elements of security are needed in the project because securing the files is an important task, which ensures files are not captured or altered by anyone on the same network. Whenever you transmit files over a network, there is a good chance your data will be encrypted by encryption technique.

Any algorithm like AES is used to encrypt the file that needs to transfer to another computer. The encrypted file is then sent to a receiver computer and will need to be decrypted before the user can open the file.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Install, configure, use and manage anti malware software on a working network

CO2: Review and practice computer and network etiquette and ethics found in working environments

CO3: Calculate best practices in security concepts to maintain confidentiality, integrity and availability of computer systems.

CO4: Demonstrate intrusion detection systems.

CO5: Describe

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	**Bloom Level**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L3	H	M	H	M	L	-	-	-	-	M	-	L	M	M
CO2	L2	H	H	M	H	L	-	-	-	-	H	-	L	H	H
CO3	L2	H	M	L	M	M	-	-	-	-	M	-	M	H	H
CO4	L3	H	M	H	M	L	-	-	-	-	M	-	L	M	M
CO5	L1	M	M	L	M	M	-	-	-	-	M	-	M	H	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Tutorials/Assignments	CO2, CO3
CD3	Seminars	CO3
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	CO3

BTCSPROJ 611: Project-I

Course Objective:

- To introduce the concept and methods required for the construction of large software intensive system.
- To develop a broad understanding of the discipline of software engineering and management of software system.
- To provide an understanding of both theoretical and methodological issues involve in modern software engineering project management and focus strongly on practical techniques

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Capability to acquire and apply fundamental principles of engineering.

CO2: Be a multi-skilled engineer with good technical knowledge, management, leadership and entrepreneurship skills.

CO3: Identify, formulate and model problems and find engineering solution based on a systems approach.

CO4: Capability and enthusiasm for self-improvement through continuous professional development and life-long learning.

CO5: Evaluate practical techniques in Projects.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PSO1	PSO2
CO1	L3	M	M	H	L	M	-	-	-	-	M	-	L	M	M
CO2	L3	M	L	H	L	M	-	-	-	-	L	-	L	M	M
CO3	L3	M	M	H	L	M	-	-	-	-	M	-	L	M	M
CO4	L4	M	M	H	L	M	-	-	-	-	M	-	L	M	M
CO5	L5	M	M	H	L	M	-	-	-	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTCSSODECA 612: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Semester–VII

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCCAIML701	Robotics and Control	PCC	30	70	100	3	1	-	4
BTCSPCCAIML702	**Design of Artificial Intelligence Product**	PCC	30	70	100	3	-	-	3
	Elective Subject								
BTCSPEC703A	Big Data Analytics	PEC	30	70	100	3		-	3
BTCSPEC703B	Internet of Things	PEC	30	70	100	3		-	3
BTCSOE704A	Supply Chain Management	OEC	30	70	100	3		0	3
BTCSOE704B	Operation Research	OEC	30	70	100	3		0	3
BTCSOE704C	Micro and Smart System Technology	OEC	30	70	100	3		0	3
BTCSHSMC705	Research and Publication Ethics	HSMC	30	70	100	3	-	-	3
BTCSHSMC706	Leadership & Management Skills	HSMC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCSPCC707A/ BTCSPCC707B	Big Data Analytics Lab / Internet of Things Lab	LC	60	40	100	0	0	1	1
BTCSPCC708	Robotics Lab	LC	60	40	100	0	0	1	1
BTCSPCC709	Industrial Training	PROJ	60	40	100	0	0	1	1
BTCSPROJ710	Project-II	PROJ	60	40	100	0	0	3	3
BTCSHSMC711	Social Outreach, Discipline &Extra Curricular Activities	HSMC	100	-	100	-	-	-	1
	TOTAL		**520**	**580**	**1100**	**17**	**1**	**6**	**25**

BTCSPCCAIML701: Robotics and Control

Course Objective:

- Understand robot configuration, structures, basic components, workspace and generations of robots
- Get acquainted with performing spatial transformations and solve kinematics of the robot
- Get knowledge and analysis skills associated with trajectory planning
- Learn about various sensors, actuators, robot programming
- Understand the present &future applications of a robot.

Course Contents:

Unit I: **Introduction to control problem-** Industrial Control examples. Transfer function. System response. Control hardware and their models: potentiometers, synchros, LVDT, dc and ac servomotors, tacho- generators, electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumatic actuators. Closed-loop systems. Block diagram and signal flow graph analysis. Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness. proportional, integral and derivative systems. Feedforward and multiloop control configurations, stability concept, relative stability, Routh stability criterion.

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Unit II: **Time response of second-order systems-** steady-state errors and error constants. Performance specifications in time-domain. Lead and lag compensation. Frequency-response analysis- Polar plots, Bode plot, stability in frequency domain, Nyquist plots. Nyquist stability criterion. Performance specifications in frequency-domain.. Lead and Lag compensation

Unit III: **ROBOT ARM KINEMATICS:** Introduction, The direct Kinematics Problem, Rotation Matrices, Composite Rotation Matrix, Rotation matrix about an arbitrary axis, Rotation matrix with Euler angle representation, Geometric interpretation of Homogeneous transformation matrices, composite homogeneous transformation matrix, Links joints and their parameters. The Denavit Hartenberg representation. Kinematic equations for manipulators, Other specifications of the locations of the End-Effector, Classification of Manipulators, The inverse Kinematics problem, Inverse Transform Technique for Euler Angles Solution

Unit IV: **Planning of Manipulator Trajectories:** Introduction, General considerations on Trajectory planning, joint-interpolated Trajectories, calculation of a 4-3-4 Joint trajectory, Cubic Spline Trajectory. Sensing: Range sensing, Triangulation, Structured Lighting Approach, Time-of- Flight range finders.

Proximity sensing, Inductive sensors, Hall effect sensors, Capacitive Sensors, Ultrasonic sensors, Optical Proximity Sensors, Touch sensors, Binary sensors,

Analog sensors, Force and Torque sensing, Elements of a Wrist sensor. LOW-LEVEL VISION: Image acquisition, illumination Techniques, imaging geometry, some basic transformations, perspective transformations. Higher-Level Vision: Segmentation, Edge Linking and Boundary detection

Unit V Camera model, camera calibration, stereo imaging, some basic relationships between pixels, Neighbours of a Pixel, connectivity, distance measures, Preprocessing, Spatial-Domain methods, Frequency- Domain methods, Smoothing, Enhancement, Edge detection, Thresholding. Thresholding. Region-oriented segmentation, the use of motion, description, Boundary descriptors, Regional descriptors.

Text/ReferenceBooks:

1. RoboticscontrolsensingVisionandIntelligence-
K.S.Fu,R.C.Gonzalez,C.S.G.Lee,McGrawHill,1987.

2. Ogata, K., “Modern Control Engineering”, Prentice Hall, second edition, 1991.

3. Introduction to Robotics Mechanics and control–JohnJ.Craig,
2ndEdition,Pearsoneducation,2003.

4. Nagrath&Gopal,“ModernControlEngineering”,NewAgeInternational,New
Delhi

5. JamesG.Keramas,“RobotTechnologyFundamentals”,Cengagelearning

Course Outcomes:

1. Demonstrate knowledge of industrial robots, characteristics, end effectors and actuators.
2. Apply spatial transformation to obtain forward and inverse kinematics
3. Solve robot dynamics problems, generate joint trajectory for path planning
4. Describe working principle of various sensors and program different operations
5. Appreciate applications of robots in industry

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	M	H	M	M	-	-	-	L	M	-	L	M	M
CO2	L3	M	M	H	M	L	-	-	-	L	M	-	M	M	M
CO3	L2	M	M	H	M	L	-	-	-	L	M	-	L	H	M
CO4	L3	H	H	H	H	L	-	-	-	L	H	-	M	H	M
CO5	L3	H	M	H	M	M	-	-	-	M	M	-	L	H	M

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO5
CD3	Seminars	-
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	-

BTCSPCCAIML702: Design of Artificial Intelligence Product

Course Objective:

- Students will learn to follow a matchmaking design, user-centered design, and service design process.
- Students will learn to ideate; reframing problematic situations by envisioning many possible products and services.
- Students will learn to iteratively refine and assess their ideas with real users/customers.

Course Content:

Unit I Design of AI Product Experiences Specialization Overview4m: Introduction and Objectives, Design Thinking, Task Analysis, AI User Experience Design Considerations, User Inputs, Transparency

Unit II Data Privacy and AI: Introduction and Objectives, Introduction to Data Privacy, Fair Information Practices (FIPs), U.S. Privacy Regulation, E.U. General Data Protection Regulation (GDPR) Privacy Challenges in AI

Unit III Ethics in AI, Introduction and Objectives, Fair, Accountable & Transparent AI, Types & Sources of Bias, Mitigating Potential Ethical Risks, Detecting & Resolving Fairness Issues

Unit IV **Human and Societal Considerations:** Introduction and Objectives, AI and Human Intelligence, Automation vs. Augmentation, Inspiring Model Trust, Change Management

Unit V **Possible AI opportunities:** AI In Businesses, AI In Product Business, AI In Service Business, In-house AI Usage, AI Solution Landscape, AIaaS - Amazon AWS Machine Learning, AIaaS - Google Cloud AI, Common Cloud AI Solution Layers, AIaaS - IBM Watson, AIaaS - Microsoft Azure, Product or Service?, Democratizing Luxury Car Experience, AI Is Changing Product & Services

Course Outcomes

CO1: Understand the AI product

CO2: Learn the Data Privacy and protection

CO3: Apply AI and Human Intelligence

CO4: Understand the AI and Ehical risk

CO5: Understand and implement Cloud and AI solutions

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1	H	M	M	M	M	M	-	-	-	M	-	M	M	M
CO2	L2	M	M	H	M	L	-	-	-	-	M	-	L	M	M
CO3	L1	M	H	M	H	-	-	-	-	-	H	-	L	H	M
CO4	L3	H	M	H	M	M	-	M	-	-	M	-	L	H	M
CO5	L1	M	H	M	H	-	-	-	-	-	H	-	L	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3
CD3	Seminars	CO3
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	CO4

BTCSPEC703A: Big Data Analytics

Course Objectives:

- 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 Contents:

Unit-I **Introduction to Big Data:** Big data features and challenges, Problems with Traditional Large-Scale System, Sources of Big Data, 3 V's of Big Data, Types of Data. Working with Big Data: Google File System.Hadoop Distributed File System (HDFS) - Building blocks of Hadoop (Namenode.Data node.Secondary Namenode.Job Tracker. Task Tracker), Introducing and Configuring Hadoop cluster (Local. Pseudodistributed mode, Fully Distributed mode). Configuring XML files.

Unit II **Writing MapReduce Programs:** A Weather Dataset. Understanding Hadoop API for MapReduce Framework (Old and New). Basic programs of HadoopMapReduce: Driver code. Mapper code, Reducer code. Record Reader, Combiner, Partitioner.

Unit-III **Hadoop I/O:** The Writable Interface. Writable Comparable and comparators. Writable Classes: Writable wrappers for Java primitives. Text.Bytes Writable.Null Writable, Object Writable and Generic Writable.Writable collections.Implementing a Custom Writable: Implementing a Raw Comparator for speed, Custom comparators.

Unit-IV **Pig:** Hadoop Programming Made Easier Admiring the Pig Architecture, Going with the Pig Latin Application Flow. Working through the ABCs of Pig Latin.Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin.

Unit-V **Applying Structure to Hadoop Data with Hive:** Saying Hello to Hive, Seeing How the Hive is Put Together, Getting Started with Apache Hive.Examining the Hive Clients.Working with Hive Data Types.Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works, Querying and Analyzing Data.

References :

1. "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data" by EMC Education Services
2. "Big Data: Does Size Matter?" by TimandraHarkness
3. "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses" by Michael Minelli

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Describe the key issues in big data management and its associated applications in intelligent business and scientific computing.

CO2: Discuss fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.

CO3: Apply business models and scientific computing paradigms, and apply software tools for big data analytics.

CO4: Describe adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

CO5: Discuss Hadoop Data with Hive

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table :Mapping of Course Outcomes with Program Outcomes

Course Outcomes	**Bloom Level**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**P011**	**PO12**	PSO 1	PSO 2
CO1	L2	M	L	H	L	-	-	-	-	L	L	-	M	M	M
CO2	L2	H	M	M	M	-	-	-	-	M	M	-	M	M	M
CO3	L3	H	M	L	M	-	-	-	-	H	M	-	M	M	M
CO4	L1	M	L	M	L	-	-	-	-	M	L	-	M	H	M
CO5	L2	H	M	M	M	-	-	-	-	M	M	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3,
CD2	Tutorials/Assignments	CO2, CO3
CD3	Seminars	CO3, CO4,
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	-

BTCSPEC 703B: Internet of Things

Course Objectives:

- To explore to the interconnection and integration of the physical world and the cyber space.
- To be able to design & develop IOT Devices.

Course Contents:

Unit I **Introduction:** Objective, scope and outcome of the course.

Unit II **Introduction to IoT:** Definition and characteristics of IOT, Design of IOT: Physical design of IOT, Logical Design of IOT- Functional Blocks, communication models, communication APIs, IOT enabling Technologies- Wireless Sensor Networks, Cloud computing, big data analytics, embedded systems. IOT Levels and deployment templates.

Unit III **IoT Hardware and Software:** Sensor and actuator, Humidity sensors, Ultrasonic sensor, Temperature Sensor, Arduino, Raspberry Pi, LiteOS, RIoTOS, Contiki OS, Tiny OS.

Unit IV **Architecture and Reference Model:** Introduction, Reference Model and architecture, Representational State Transfer (REST) architectural style, Uniform Resource Identifiers (URIs). Challenges in IoT- Design challenges, Development challenges, Security challenges, Other challenges.

Unit V **IOT and M2M:** M2M, Difference and similarities between IOT and M2M, Software defined networks, network function virtualization, difference between SDN and NFV for IoT. Case study of IoT Applications: Domain specific IOTs- Home automation, Cities, environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyles.

Reference Books:

1. Adrian McEwen, “Designing the Internet of Things”, Wiley Publishers, 2013, ISBN: 978-1-118-43062-0 2. Daniel Kellmereit, “The Silent Intelligence: The Internet of Things”. 2013, ISBN 0989973700

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the application areas of IOT

CO2: Discuss the revolution of Internet in Mobile Devices, Cloud & Sensor Networks

CO3: Understand building blocks of Internet of Things and characteristics.

CO4: Demonstrate the Architecture and Reference Model of IOT.

CO5: Describe Case study of IoT Applications.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	**Bloom Level**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	L	H	L	-	-	-	-	L	L	-	M	M	M
CO2	L2	H	L	L	L	-	-	-	-	M	L	-	M	H	M
CO3	L2	H	M	L	M	-	-	-	-	H	M	-	M	H	H
CO4	L3	M	M	L	M	-	-	-	-	M	M	-	M	L	H
CO5	L1	M	L	L	L	-	-	-	-	M	L	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Tutorials/Assignments	CO2, CO3
CD3	Seminars	CO2
CD4	Self- learning advice using internets	CO2
CD5	Industrial visit	

BTCSOE 704A: Supply Chain Management

Course Objectives:

- To learn about the role of supply chain management in value, customers and pricing. Also to understand how to integrate a manufacturing unit with customer.
- Logistics as movement of smooth flow of material movement with optimizing the warehousing, transportation and network of materials transfer.
- To describe the increasing significance of logistics and its impact on both costs and service in business and commerce.

Course Contents:

Unit I **Introduction:** Nature of supply chains, Historical perspective, objectives, importance, decision phases and process views of supply chain. Supply chain performance: competitive and supply chain strategies, achieving strategic fit and its challenges. Supply chain drivers and metrics: Impellers of supply chain, financial measures of performance, derivers of supply chain performance, framework for structuring drivers.

Unit II **Logistics Management:** Scope and definition, historical perspective, Value added nature of logistics, logistics and supply chain management, customer service and logistics, key issues and challenges for logistics. Designing the supply chain network: Designing distribution networks: Role of distribution in supply chain, factors influencing distribution network design, design options for a distribution network, online sales and distribution network. Network design in supply chain: role of network design, factors influencing network design decisions, framework for network design decisions. Impact of globalization on supply chain networks.

Unit III **Demand forecasting in a supply chain, Aggregate planning in a supply chain, Sales and operations are planning in supply chain, Coordination in a supply chain:** Bullwhip effect, effect on performance, obstacles to coordination in a supply chain, continuous replenishment and vendor managed inventories, collaborative planning forecasting and replenishment.

Unit IV **Planning and Managing inventories in a supply chain:** Managing economies of scale in supply chain, managing uncertainty in supply chain, determination of optimal level of product availability

Unit V **Designing and planning transportation network:** Role of transportation in a supply chain, modes of transportation and their performance, transportation infrastructure and policies, design options for a transportation network, tradeoffs, tailored transportation.

Books Recommended

1. Mohanty, Supply chain Management, Pub Wiley, 2016
2. Roberta S Russell and Bernard W Taylor, Operations and supply chain management Pub Wiley, 8th Edition, 2017.
3. Donald J Bowersoy& David J Closs , Logistical Management- - Tata McGrawHill, 2015
4. R P Mohanty& S G Deshmukh, Supply Chain Management- Theories & Practice –- Pub: Biztantra House, 2017
5. Donald Waters, Logistics: An introduction to SCM, pub. Palgrave,McMillan, 1st edition, 2003.

Course Outcomes:

At the end of the course, Students will be able to:

CO1: Develop an understanding of the importance of logistics in the formulation of the business strategy and the conduct of supply chain operations.

CO2: Develop an in-depth understanding of logistics operating areas and their interrelationship.

CO3: Define and establish the strategic importance of logistics to achieve business success by creating value through supply chains.

CO4: Analyzing, comparing and interpreting the combination of customer accommodation, market distribution, procurement, and manufacturing represents the supply chain areas that are linked and supported by logistics and lean management.

CO5: Describe transportation in a supply chain

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	M	M	-	-	-	-	M	L	-	L	L	L
CO2	L2	H	H	M	H	-	-	-	-	L	L	-	L	L	L
CO3	L1	H	H	M	H	-	-	-	-	M	L	-	L	M	M
CO4	L3	H	H	L	H	-	-	-	-	L	L	-	M	M	M
CO5	L3	M	H	H	H	-	-	-	-	L	L	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3,CO4,CO5
CD2	Tutorials/Assignments	CO2, CO3
CD3	Seminars	CO4,CO5
CD4	Self- learning advice using internets	CO3, CO4,CO5
CD5	Industrial visit	-

BTCSOE 704B: Operational Research

Course Objective:

- To equip students with the ability of conceptualization of real life systems in the form of mathematical models.
- To Understand the Principles of model building and basic optimization concepts.
- To develop skills to deploy these concepts in diverse fields of application in manufacturing /service/ distribution systems.

Course Contents:

Unit-I **Introduction to operations research, Overview of OR modeling. Linear Programming (LP):** Assumptions of LP models, LP problem formulation, Graphical methods for solving LP problems. The Simplex method, Big M-method and Two-Phase simplex method,

Duality: Definition of the dual problem, relationship between the primal and dual solutions, Economic interpretation of duality, the dual Simplex method, sensitivity analysis.

Unit-II Transportation and Assignment problems. Integer programming models, Cutting Plane method, Branch and Bound method.

Unit-III **Job Sequencing Models:** Sequencing problems, Johnson's algorithm for processing n jobs on two machines and n jobs on three machines, Processing 2 jobs on n machines using graphical method. Review of Network models, minimal spanning tree algorithm, and shortest route problems: Dijkstra's algorithm, Maximal flow model, maximal flow algorithm, min-cut, min-cut Max-flow theorem.

Unit-IV **Project Scheduling by CPM/PERT:** Designing an activity network, Critical path calculations, Determination of floats, Program Evaluation and Review Technique (PERT). Cost-Time analysis of projects : crashing activities in a project.

Unit-V Queuing systems, Elements of queuing model, role of exponential distribution, birth and death models, steady state measures of performance, single server models ,multiple-server models, machine servicing model, Pollaczek-Khintchine formula, queuing decision models. Multi criteria Decision making, Introduction to Game theory, Zero-sum Game.

Text Books:

1. H. Taha, “Operations Research: An Introduction”, PHI, 8th Ed., 2009.
2. Hilier and Liebermann, “Introduction to Operations Research”, McGraw-Hill, 8th Ed., 2009.
3. Wayne Winston, “Operations Research: Applications and Algorithms”, Cengage, 4th Ed., 2009.

References:

1. J. K. Sharma, “Operation Research Theory and Applications”, 3rd Edition, Macmillan, India.
2. Paul A. Jensen, “Operations Research Models and Methods”, John Wiley, 2003.
3. G. Srinivasan, “Operational Research Principles and Applications”, PHI, 2nd Ed., 2008.
4. A.M. Natarajan, P. Balasubramani, A. Tamilarasi, “Operational Research”, Pearson, 4th Ed., 2009.

Course Outcome

CO1: Create a mathematical model manually as well as using soft resources/software such as solver, TORA etc.

CO2: Understand variety of problems such as assignment, transportation, travelling salesman etc.

CO3: Create the problems mentioned in point 4 using linear programming approach using software.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2
CO1	L6	H	-	H	-	H	M	L	-	-	H	M	M
CO2	L2	M	L	H	-	L	M	L	-	-	H	H	H
CO3	L6	H	M	M	L	L	L	M	M	-	M	M	M

H-High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Tutorials/Assignments	CO2, CO3
CD3	Seminars	CO3
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	CO2

BTCSOE704C: Micro and Smart System Technology

Course Objectives:

- To Gain knowledge of Smart Materials, Sensors & Actuators, Microsystems.
- To Understand the Operation of Smart Devices & Systems, Electronic Circuits & Control for MEMS, Methodology of Micro-manufacturing.

Course Contents:

Unit I **Introduction:** Objective, scope and outcome of the course.

Unit II **Introduction to Micro And Smart Systems**:

(a) **Smart-material systems-** History, Introduction and evolution of smart materials, structures and systems. Components of a smart system. Application areas. Commercial products.

(b) **Microsystems-** Introduction, History and their evolution, Feynman's vision. Micromachined transducers. Evolution of micro-manufacturing. Multi-disciplinary aspects. Applications areas. Commercial products.

Unit III **Micro and Smart Devices and Systems: Principles And Materials:**

a) Definitions and salient features of sensors, actuators, and systems.

b) **Sensors:** silicon capacitive accelerometer, piezo-resistive pressure sensor, blood analyzer, conductometric gas sensor, fiber-optic gyroscope and surface-acoustic-wave based wireless strain sensor.

c) **Actuators:** silicon micro-mirror arrays, piezo-electric based inkjet print head, electrostatic comb-drive and micromotor, magnetic micro relay, shape memory-alloy based actuator, electro-thermal actuator.

d) **Systems:** micro gas turbine, portable clinical analyzer, active noise control in a helicopter cabin.

Unit IV **Micromanufacturing and Material Processing:**

a. Silicon wafer processing, lithography, thin-film deposition, etching (wet and dry), wafer-bonding, and metallization.

b. Silicon micromachining: surface, bulk, moulding, bonding based process flows.

c. Thick-film processing:

d. Smart material processing:

e. Processing of other materials: ceramics, polymers and metals

f. Emerging trends.

Unit V **Modeling:**

a. Scaling issues.

b. Elastic deformation and stress analysis of beams and plates. Residual stresses and stress gradients. Thermal loading. Heat transfer issues. Basic fluids issues.

c. Electrostatics. Coupled electromechanics. Electromagnetic actuation. Capillary electro-phoresis. Piezoresistive modeling. Piezoelectric modeling. Magnetostrictive actuators.

Unit VI **Integration And Packaging Of Microelectro Mechanical Systems:** Integration of microelectronics and micro devices at wafer and chip levels. Microelectronic packaging: wire and ball bonding, flip-chip. Low temperature-cofired-ceramic (LTCC) multi-chip-module technology. Microsystem packaging examples. Examples from smart systems and micromachined accelerometer or a thermal cycler BEL pressure sensor, thermal cycler for DNA amplification, and active vibration control of a beam

Text/Reference Books:

1. MEMS & Microsystems: Design and Manufacture, Tai-Ran Tsu,Tata Mc- Graw-Hill.
2. "Micro and Smart Systems" by Dr. A.K.Aatre, Prof. Ananth Suresh, Prof.K.J.Vinoy, Prof. S. Gopalakrishna,, Prof.K.N.Bhat., John Wiley Publications.
3. Microsystems Design, S. D. Senturia, 2001, Kluwer Academic Publishers, Boston, USA. ISBN 0-7923-7246-8.
4. Analysis and Design Principles of MEMS Devices, Minhang Bao, Elsevier, Amsterdam, The Netherlands, ISBN 0-444-51616-6.
5. Design and Development Methodologies, Smart Material Systems and MEMS: V. Varadan, K. J. Vinoy, S. Gopalakrishnan, Wiley.
6. MEMS- Nitaigour Premchand Mahalik, The Mc-GrawHill 2007.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Describe micro sensors and actuators and smart systems.

CO2: Understand the role of smart actuators in micro machining.

CO3: Make models of micro systems using conventional modeling techniques

CO4: Understand methods for integration of micro and smart systems.

CO5: Define the reliability of electronic circuits and control methods used to develop micro and smart systems.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	**Bloom Level**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	M	M	M	M	-	-	-	-	-	M	-	L	M	M
CO2	L2	M	M	L	M	-	-	-	-	-	M	-	L	M	M
CO3	L3	H	L	H	L	-	-	-	-	-	L	-	M	M	M
CO4	L2	M	L	H	L	-	-	-	-	-	L	-	M	H	M
CO5	L1	H	H	M	H	-	-	-	-	-	H	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO5
CD3	Seminars	CO3, CO4, CO5
CD4	Self- learning advice using internets	CO2, CO3, CO5
CD5	Industrial visit	CO4, CO5

BTCSHSMC 705: Research and Publication Ethics

Course Objectives:

- To identify the concept of research.
- To identify the scientific conduct of research.
- To understand the publication Ethics.
- To understand Open access publications and publication misconduct.
- To understand the Research Data and Research Metrics.

Course Contents:

Unit I: Philosophy Andethics

1. Introduction to Philosophy : definition, nature and Scope, Concept,Branches
2. Ethics: definition, moral philosophy, nature of moral judgements andreaction

Unit II: Scientificconduct

1. Ethics with respect to science andresearch
2. Intellectual honesty and researchintegrity
3. Scientific misconducts: Falsification, Fabrication, andPlagiarism(FFP)
4. Redundant publications: duplicate and overlapping publications, salamislicing
5. Selective reporting and misrepresentation ofdata.

Unit III: Publicationethics

1. Publication ethics: definition, introduction andimportance
2. Best practices /Standards setting initiatives and guidelines: COPE. WAME,etc.,
3. Conflicts ofinterest
4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa,types
5. Violation of publication ethics, authorship andcontributorship
6. Identification of publication misconduct, complaints andappeals
7. Predatory publishers andjournals

Unit IV: Open Accesspublishing and Publicationmisconduct

1. Open access publications andinitiatives
2. SHEERPA/RoMEO online resource to check publisher copyright & Self – archivingpolicies
3. Software tool to identify predatory publications developed by SPPU
4. Journal finder /Journal suggestion tools viz.JANE., Elsevier journal Finder, SpringerJournal Suggester,etc.
5. Subject specific ethical issues, FFP, authorship

6. Conflicts of interest
7. Complaints and appeals: examples and fraud from India andabroad.
8. Use of plagiarism software like Turnitin, Urkund and other open source software tools

Unit V: Databases and Researchmetrics

A. Databases
   1. Indexingdatabases
   2. Citation databases: Web of Science, Scopus,etc.

B. ResearchMetrics
   1. Impact Factor of Journal as per Journal Citation Report, SNIP, SJR, IPP, CiteScore
   2. Metrics: h-index, g index, i10 index,altmetrics

Reference:

1. Bird, A.(2006). Philosophy of Science.Routledge
2. Maclntyre, Alasdair (1967) A Short History of Ethics. London
3. P.Chaddah, (2018) Ethics in Competitive Research: Do not get Scooped; do not get Plagiarized, ISBN : 978-9387480865
4. National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009). On Being a Scientist: A Guide to responsible conduct in Research: Third Edition, National Academies Press.
5. Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance (2019), ISBN:978-81-939482-1-7
   http://www.insaindia.res.in/pdf/Ethics_Book.pdf.

Course Outcomes:

COs	Statement After completion of this course, students will be able to:
CO1	Understand the concept of research.
CO2	Understand the scientific conduct of research.
CO3	Understand the publication Ethics.
CO4	Understand Open access publications and publication misconduct. ct.
CO5	Understand the Research Data and Research Metrics.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	**Bloom's Levels**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2
CO1	L1	**M**	**H**	**L**	**H**	**L**	**H**	**H**	**M**	**L**	**M**		**L**
CO2	L2	**H**	**H**	**M**	**M**	**M**	**L**	**-**	**L**	**-**	**M**	**L**	**-**
CO3	L3	**M**	**H**	**M**	**M**	**M**	**M**	**H**	**L**	**-**	**M**	**-**	**L**
CO4	L4	**H**	**H**	**M**	**M**	**M**	**-**	**H**	**-**	**L**	**M**	**-**	**L**
CO5	L4	**H**	**H**	**H**	**M**	**M**	**-**	**-**	**-**	**L**	**M**	**-**	**L**

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1,CO2,CO3, CO4,CO5
CD3	Seminars	CO2,CO3, CO4,CO5
CD4	Self- learning advice using internets	CO1,CO2,CO3,CO4, CO5
CD5	Industrial visit	CO5

BTCSHSMC 706: Leadership & Management Skills

Course Objectives:

- To develop essential skills to influence and motivate others.
- To inculcate emotional and social intelligence and integrative thinking for effective leadership.
- To create and maintain an effective and motivated team to work for society.
- To nurture a creative and entrepreneurial mindset.
- To make learners understand personal values and apply ethical principles in professional and social contexts.
- To familiarize the learners with the budgeting process and make them conscious of the significance of budgeting, savings, and investment.

Course Content:

Unit I: Leadership Skills
Understanding Leadership and Its Importance, Models of Leadership, Basic Leadership Skills.

Unit II: Managerial Skills
Basic Managerial Skills, Self-management Skills, Emotional Quotient, Developing Self-Awareness with JOHARI Window

Unit III: Entrepreneurial Skills
Basics of entrepreneurship, Creating a Business Plan

Unit IV: Innovative Leadership and Design Thinking
Innovative leadership, Design thinking

Unit V: Ethics and Integrity & Managing Personal Finance
Ethics and Integrity: Learning through biographies, Ethics and Conduct
Managing Personal Finance: Budgeting, Saving and investing

Reference Books:

1. Ashokan, M. S. (2015). Karmayogi: A Biography of E. Sreedharan. Penguin Random House, London, UK
2. Ackerman, C. E. (2022, November 23). 87 self-reflection questions for introspection [+exercises]. PositivePsychology.com. https://positivepsychology.com/introspection-selfreflection.
3. Hisrich, R. D., Peters, M. P., and Shepherd D. A. (2017). Entrepreneurship. 10th Ed. McGraw Hill Education
4. Kelly, D. (2012). How to Build Your Creative Confidence [Video]. TED Talk. https://www.ted.com/talks/david_kelley_how_to_build_your_creative_confidence.
5. Nellickappilly, S. (n.d). Ethics. [Video]. NPTEL. https://nptel.ac.in/courses/109/106/109106117/.
6. Chandra, A. (n.d). NPTEL course on Behavioural and Personal Finance (Lectures 23 and 24). [Video]. NPTEL. https://nptel.ac.in/courses/110/105/110105144/.

Course Outcomes:

	The learners shall be able to:
CO1	Examine various leadership models and understand/assess their skills, strengths and abilities that affect their leadership style and can create their leadership vision.
CO2	Learn and demonstrate a set of practical skills such as time management, self-management, handling conflicts, and team leadership
CO3	Understand the basics of entrepreneurship and develop business plans.
CO4	Apply the design thinking approach for leadership.
CO5	Appreciate the importance of ethics and moral values for the making of a balanced personality. Allocate their available funds judiciously, maintain an account of their current expenses and plan for savings and investments.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	**Bloom's Levels**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L4	-	-	-	-	-	-	-	-	**H**	**L**	**L**	**M**	**M**	**M**
CO2	L3	-	-	**L**	**L**	-	-	-	-	**M**	**M**	**M**	**M**	**M**	**M**
CO3	L3	-	-	-	-	-	-	-	-	-	-	**H**	**H**	**M**	**M**
CO4	L3	-	-	**H**	-	-	-	-	-	**H**	-	-	**H**	**M**	**M**
CO5	L3	-	-	-	-	-	-	-	**H**	-	-	**H**	-	**M**	**M**

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1,CO2,CO3, CO4,CO5
CD2	Tutorials/Assignments	CO1,CO2,CO3, CO4,CO5
CD3	Seminars	CO1,CO2,CO3, CO4,CO5
CD4	Self- learning advice using internets	CO1, CO2,CO3, CO4
CD5	Industrial visit	-

BTCSPCC 707A: Big Data Analytics Lab

Course Objectives:

- To introduce the tools required to manage and analyze big data like Hadoop, NoSql Map Reduce.
- 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.

Lab Experiments:

1 Implement the following Data structures in Java i) Linked Lists ii) Stacks iii) Queues iv) Set v) Map

2 Perform setting up and Installing Hadoop in its three operating modes: Standalone, Pseudo distributed, Fully distributed.

3 Implement the following file management tasks in Hadoop:

- Adding files and directories
- Retrieving files
- Deleting files Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.

4 Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.

5 Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented.

6 Implement Matrix Multiplication with Hadoop Map Reduce

7 Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.

8 Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.

9 Solve some real life big data problems.

Course Outcomes:

At the end of the course, Students will be able to:

CO1: Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.

CO2: Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.

CO3: Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.

CO4: Apply adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

CO5: Describe big data problems.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table :Mapping of Course Outcomes with Program Outcomes

Course Outcomes	**Bloom Level**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**P011**	**PO12**	PSO 1	PSO 2
CO1	L2	M	H	H	H	L	-	-	-	L	M	-	M	M	M
CO2	L5	H	H	M	H	M	-	-	-	M	M	-	M	H	M
CO3	L3	H	M	L	M	M	-	-	-	H	M	-	M	H	M
CO4	L3	M	H	M	H	M	-	-	-	M	M	-	M	H	M
CO5	L2	M	H	H	H	L	-	-	-	L	M	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3,
CD2	Tutorials/Assignments	CO2, CO3
CD3	Seminars	CO3, CO4,
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	-

BTCSPCC 707B: Internet of Things Lab

Course Objectives:

- To focus on research – design and development of IoT enabled technologies which are cost effective and socially relevant.
- To develop trained manpower (through student projects/research) in the field of IoT based application development.

List of Experiments

1 Start Raspberry Pi and try various Linix commands in command terminal window:

ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip, cat, more, less, ps, sudo, cron, chown, chgrp, ping etc.

2 Run some python programs on Pi like:

a) Read your name and print Hello message with name

b) Read two numbers and print their sum, difference, product and division.

c) Word and character count of a given string.

d) Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input.

3 Run some python programs on Pi like:

a) Print a name 'n' times, where name and n are read from standard input, using for and while loops.

b) Handle Divided by Zero Exception.

c) Print current time for 10 times with an interval of 10 seconds.

d) Read a file line by line and print the word count of each line.

4 a) Light an LED through Python program

b) Get input from two switches and switch on corresponding LEDs

c) Flash an LED at a given on time and off time cycle, where the two times are taken from a file.

5 a) Flash an LED based on cron output (acts as an alarm)

b) Switch on a relay at a given time using cron, where the relay's contact terminals are connected to a load.

c) Get the status of a bulb at a remote place (on the LAN) through web.

6 The student should have hands on experience in using various sensors like temperature, humidity, smoke, light, etc. and should be able to use control web camera, network, and relays connected to the Pi.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Describe different types of commands ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip, cat, more, less, ps, sudo, cron, chown,bchgrp, ping .

CO2: Understand to run the programs on Pi

CO3: Implement the programs using different logics.

CO4 : DemonstrateLinix commands.

CO5: Read and apply some python programs on Pi.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	**Bloom Level**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	M	H	M	M	-	-	-	L	M	-	L	H	H
CO2	L2	H	L	M	L	M	-	-	-	L	L	-	L	H	H
CO3	L3	M	M	M	M	L	-	-	-	L	M	-	M	H	H
CO4	L3	M	M	M	M	L	-	-	-	L	M	-	M	H	H
CO5	L3	M	M	M	M	L	-	-	-	L	M	-	M	H	H

H- High, M- Moderate, L- Low, '-' for No correlation

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3
CD2	Tutorials/Assignments	CO2, CO3
CD3	Seminars	CO3
CD4	Self- learning advice using internets	CO2, CO3
CD5	Industrial visit	

BTCSPCCAIML708: Robotics Lab

Course Objective:

- To provide innovative and state-of-the-art solutions solve complex problems in automation, robotics and allied fields, and design high quality systems for diverse applications.
- To develop research oriented analytical ability among students and to prepare them for making technical contribution to the society.
- To continue life-long learning and pursue professional development opportunities like graduate degrees or professional studies to adapt to the evolving technological changes..
- To prepare the students work in diverse, multi-disciplinary teams and possess leadership skills, ethical standards, environmental concerns and social awareness.
- To Re-learn and innovate in ever-changing global economic and technological environments on the 21st century

1. Programming Irb1410 Robot (Serial Manipulator) For Pick And Placing Operation Both In Manual And Automatic Mode.
2. Programming Irb1410 Robot (Serial Manipulator) To Handle Input And Output Modules Using Subroutines
3. Simulating Irb1410 Robot For Machining Operations With Different Work Cell Layout Using Virtual Flexpendant In Robot Studio
4. Programming Irb360 Vision Based Flexpicker Robot (Parallel Manipulator) For Palletising Operations Based On Colour, Shape,Dimensions And Orientation Of An Object
5. A Plug-In Multifunction Data Acquisition (Daq) Device Connected To A Temperature Sensor J Type Thermocouple For The Measurement Of Temperature Attached To The End Effector (Tools) Of The Robot For The Automatic Control Of Coolant Motor Using Labview Simulator.
6. A Myrio Student Embedded Device Connected To A Accelerometer For The Measurement Of Vibration Attached To The End Effector Of The Robot Is Analysed Using Lab View.
7. Device A Bluetooth Communication Based Quadpod Robot For Multi-Terrain Environment
8. Implementation Of Iot Based Electrical Circuits For Factory Automations.
9. Implementation Of Machine Learning Based Image Segmentation Analysis Using Raspberry Pi
10. Build A Control System For A Mobile Robot Using Arduino With Sensors For Obstacle Detection Systems

Course Outcome:

CO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

CO2: 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.

CO3: 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.

CO4: 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.

CO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and software tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Self- learning advice using internets
CD5	Industrial visit

Mapping of Course Outcomes onto Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	P0 11	PO 12	PSO1	PSO2
CO1	L1	H	M	H	M	M	-	-	-	L	M	-	L	M	M
CO2	L3	M	M	H	M	L	-	-	-	L	M	-	M	M	M
CO3	L2	M	M	H	M	L	-	-	-	L	M	-	L	H	M
CO4	L3	H	H	H	H	L	-	-	-	L	H	-	M	H	M
CO5	L3	H	M	H	M	M	-	-	-	M	M	-	L	H	M

Mapping between CO and CD

CD	**Course Delivery methods**	**Course Outcomes**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3, CO4, CO5
CD2	Tutorials/Assignments	CO2, CO3, CO5
CD3	Seminars	-
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	-

BTCSPCC 709: Industrial Training

Course Objectives:

- To acquire and apply fundamental principles of engineering.
- To identify, formulate and present model problems.
- To identify, formulate and model problem sand find engineering solution based on a systems approach.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Capability to discuss and apply fundamental principles of engineering.

CO2: Become master in one's specialized technology

CO3: Interpret all the latest changes in technological world.

CO4: Ability to identify, formulate and model problems find engineering solution based on a systems approach.

CO5: Determine all software modeling approaches.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PSO1	PSO2
CO1	L1, L2	M	H	L	H	L	-	-	-	-	L	-	L	M	M
CO2	L3	M	L	H	H	L	-	-	-	-	L	-	M	H	M
CO3	L4	M	H	M	M	L	-	-	-	-	L	-	M	M	M
CO4	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	H
CO5	L5	M	M	L	M	L	-	-	L	-	M	M	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

BTCSPROJ 710: PROJECT-II

Course Objective:

- To introduce the concept and methods required for the construction of large software intensive system.
- To develop a broad understanding of the discipline of software engineering and management of software system.
- To provide an understanding of both theoretical and methodological issues involve in modern software engineering project management and focus strongly on practical techniques

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Capability to acquire and apply fundamental principles of engineering.

CO2: Be a multi-skilled engineer with good technical knowledge, management, leadership and entrepreneurship skills.

CO3: Identify, formulate and model problems and find engineering solution based on a systems approach.

CO4: Capability and enthusiasm for self-improvement through continuous professional development and life-long learning.

CO5: Evaluate practical techniques in Projects.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PSO1	PSO2
CO1	L3	M	M	H	L	M	-	-	-	-	M	-	L	M	M
CO2	L3	M	L	H	L	M	-	-	-	-	L	-	L	M	M
CO3	L3	M	M	H	L	M	-	-	-	-	M	-	L	M	M
CO4	L4	M	M	H	L	M	-	-	-	-	M	-	L	M	M
CO5	L5	M	M	H	L	M	-	-	-	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTCSHSMC711: Social Outreach, Discipline & Extra Curricular Activities

Course Objective:

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Semester–VIII

PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPROJ801	Project-III	PROJ	360	240	600	-	-	-	12
BTCSHSMC802	Social Outreach, Discipline & Extra Curricular Activities	HSMC	100	-	100	-	-	-	1
	TOTAL		**460**	**240**	**700**	**0**	**0**	**0**	**13**

BTCSPROJ 801: PROJECT-III

Course Objective:

- To introduce the concept and methods required for the construction of large software intensive system.
- To develop a broad understanding of the discipline of software engineering and management of software system.
- To provide an understanding of both theoretical and methodological issues involve in modern software engineering project management and focus strongly on practical techniques

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Capability to acquire and apply fundamental principles of engineering.

CO2: Be a multi-skilled engineer with good technical knowledge, management, leadership and entrepreneurship skills.

CO3: Identify, formulate and model problems and find engineering solution based on a systems approach.

CO4: Capability and enthusiasm for self-improvement through continuous professional development and life-long learning.

CO5: Evaluate practical techniques in Projects.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PSO1	PSO2
CO1	L3	M	M	H	L	M	-	-	-	-	M	-	L	M	M
CO2	L3	M	L	H	L	M	-	-	-	-	L	-	L	M	M
CO3	L3	M	M	H	L	M	-	-	-	-	M	-	L	M	M
CO4	L4	M	M	H	L	M	-	-	-	-	M	-	L	M	M
CO5	L5	M	M	H	L	M	-	-	-	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTCSHSMC 802: Social Outreach, Discipline & Extra Curricular Activities

Course Objective:

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

11. TEACHING-LEARNING PROCESS/ METHODOLOGY (TLM):

The teaching-learning process should be aimed at systematic exposition of basic concepts so as to acquire knowledge of technical program in a canonical manner. In this context, applications of technical program and linkage with the theory constitute a vital aspect of the teaching-learning process. The course offers many modes of learning and assessment methods. Students have great freedom of choice of course which they can study. The various components of teaching learning process are summarized in the following heads.

1. **Class room Lectures:** The most common method of imparting knowledge is through lectures.There are diverse modes of delivering lectures such as through blackboard, power point presentation and other technology aided means. A judicious mix of these means is a key aspect of teaching-learning process.
2. **Tutorials:** To reinforce learning, to monitor progress, and to provide a regular pattern ofstudy, tutorials are essential requirements. During these tutorials, difficulties faced by the students in understanding the lectures, are dealt with. Tutorials are also aimed at solving problems associated with the concepts discussed during the lectures.
3. **Practical:** To provide scientific visualization and obtaining results of Technical program inpractical sessions. These sessions provide vital insights into scientific concepts and drawlearner's attention towards limitations of scientific computations. During practical, scientific models arising in real life problems can also be simulated.
4. **Choice based learning/Open elective:** LOCF in this undergraduate program providesgreat flexibility both in terms of variety of courses and range of references in each course.
5. **Field based learning:** Students may enhance their knowledge through field based learningwhile understanding the practical importance.
6. **Textbooks learning:** A large number of books are included in the list of references of eachcourse for enrichment and enhancement of knowledge.
7. **E-learning:** Learner may also access electronic resources and educational websites for betterunderstanding and updating the concepts.
8. **Self-study materials:** Self-study material provided by the teachers is an integral part oflearning. It helps in bridging the gaps in the classroom teaching. It also provides scope for teachers to give additional information beyond classroom learning.
9. **Assignment/Problem solving:** Assignments at regular intervals involving applications oftheory are necessary to assimilate basic concepts of courses. Hence, it is incumbent on the part of a learner to complete open-ended projects assigned by the teacher.
10. **Internships:** The teaching-learning process needs to be further supported by other activitiesdevoted to subject-specific and interdisciplinary skills, summer and winter internships. During these internships it is expected that a learner will interact with experts and write a report on a topic provided to the learner.

11. **Institute visits:** Institute visit by a learner is also a part of learning process. During suchvisits a learner has access to knowledge by attending academic activities such as seminars, colloquia, library consultation and discussion with faculty members. These activities provide guidance and direction for further study.
12. **Industrial visits:** Industrial visits offer an opportunity to observe applications of scientific concepts. These visits also give an opportunity to realize the power of mathematical ideas and their translation in problem solving.
13. **Training programs:** Training programs organized by various agencies/institutes provide an opportunity to learn various dimensions of courses.

12. ASSESSMENT AND OUTCOME MESUAREMENT METHODS (AOMM):

A range of assessment methods which are appropriate to test the understanding of various concepts of courses will be used. Various learning outcomes will be assessed using time-bound examinations, problem solving, assignments and viva-voce examination. For various courses in this program, the following assessment methods shall be adopted:

i. Scheduled/unscheduled tests
ii. Problem solving sessions aligned with classroom lectures
iii. Practical assignments
iv. Regular chamber consultation with faculty members
v. Mid semester examination and semester end comprehensive examination

Examination and Evaluation:

I. The medium of instructions and examination shall be Bilingual.
II. Candidates shall be examined according to the scheme of examination and syllabus as approved by the BOS and Academic Council from time to time.
III. To pass each semester examination, a candidate must obtain at least 40% marks in each written paper, practical work semester examination.
IV. Each theory paper for the respective semester examination shall be set and evaluation of the answer books shall be done as per the University rules.
V. The assessment of External Evaluation i.e. End Term Semester Examination will be made out of 70 (Seventy) marks in theory Papers and Internal Evaluation of 30 (Thirty) marks.

Criterion for awarding Grading System:

Criterion for Awarding SGPA and CGPA: The criterion for awarding the Semester GradePoint Average (SGPA) and Cumulative Grade Point Average (CGPA) for B.Tech. Program shall be as follows:

a) The criterion for passing in a subject is that a student should secure minimum 40% marks in individual paper.

b) A student obtaining less than pass marks as specified above, in each subject (sum of internal and End-Term examinations) he will be declared fail in that subject and will have to re-appear in a End-Term examination of the course in subsequent odd / even semester end term examination, subject to maximum permissible period of n+4 semesters to complete the course.

c) The University has adopted Absolute Grading System for converting marks into grades. The formula of 10- point grading system for conversion of marks obtained into Letter Grades and converting Letter Grades to Grade Point is given below:

Table: Marks, Letter Grades and Grade Points

Marks	Letter Grade	Grade Points
91-100	O (Outstanding)	10
81-90	A+(Excellent)	9
71-80	A(Very Good)	8
61-70	B+(Good)	7
51-60	B(Above Average)	6
46-50	C(Average)	5
40-45	P (Pass)*	4
0-39	F(Fail)	0
-	AB (Absent)	0

***Pass Mark: 40% in individual paper**

d) While converting the marks into Letter Grade, the rounding off marks must be considered.

e) A student obtaining Grade F shall be considered failed and will be required to reappear in the examination.

f) For noncredit courses "Satisfactory" or Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

Computation of SGPA and CGPA:

The university has adopted UGC recommended procedure for computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

a) The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the papers/ courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

SGPA (Si) = Σ (Ci x Gi) / ΣCi

Where Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th} course. The university shall issue Semester Grade Card to the student.

b) The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.

CGPA = Σ (Ci x Si) / Σ Ci

Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

c) The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Illustration of Computation of SGPA and CGPA and Format for Transcripts:

a) Computation of SGPA and CGPA

Illustration for SGPA

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course/Paper 1	3	A	8	3x8=24
Course/Paper 2	4	B+	7	4x7=28
Course/Paper 3	3	B	6	3x6=18
Course/Paper 4	3	O	10	3x10=30
Course/Paper 5	3	C	5	3x5=15
Course/Paper 6	4	B	6	4x6=24
	20			**139**

Thus, SGPA= 139/20= 6.95

b) Illustration for CGPA

Semester-1	Semester-2	Semester-3	Semester-4	Semester-5	Semester-6	Semester-7	Semester-8
Credit: 20	Credit: 22	Credit: 25	Credit: 26	Credit: 26	Credit: 25	Credit: 24	Credit: 26
SGPA:6.9	SGPA:7.8	SGPA:5.6	SGPA:6.0	SGPA:6.3	SGPA:8.0	SGPA:8.0	SGPA:8.0

Thus, CGPA= $\frac{20x6.9+22x7.8+25x5.6+26x6.0+26x6.3+25x8.0+24x8.0+26x8.0}{}$ = **7.06**

13. TEACHERS TRAINING (TT):

Learning Outcomes Based Curriculum Framework (LOCF) Quality initiative of UGC based on Outcome Based Education (OBE) is being implemented by the University Grants Commission to enhance the Quality of Higher Education and that of Higher Education Learners and Teachers. Therefore, university arrange following activities for teachers training:

1. Workshops for LOCF implementation.
2. Seminar for LOCF implementation.
3. FDP on LOCF.
4. Outcome based higher education and understanding the learning objectives, learning outcomes, new approaches in the area of outcome measurement, preparing future ready teachers and students.
5. Developing a battery of quality speakers/educators to become resource persons to play role for Training of Trainers (TO

14. KEY WORDS:

LOCF, CBCS, Course Learning Outcomes, Employability, Graduate Attributes Communication Skills, Critical Thinking, and Descriptors.

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