



Faculty of Engineering & Technology

Syllabus

For

Bachelor of Technology (B. Tech.)

in

Computer Science & Engineering

(Specialization Data Science)

(Program Code: ET0141DS)

(2022-26)

***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.

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- 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 outcomes based curriculum are 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:

- i. Create deep interest in Practical learning. Develop broad and balanced knowledge and understanding of definitions, concepts and principles.
- ii. Familiarize the students with suitable tools related to designing, modeling etc.
- iii. Enhance the ability of learners to apply the knowledge and skills acquired by them during the program to solve specific problems of their courses.
- iv. Provide learners sufficient knowledge and skills enabling them to undertake higher studies in technical field.
- v. 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 is to produce engineers who later take the responsibility of engineering professionals and researchers with following qualities:

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- 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 knowledge of 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 analyze the results and apply them in various problems appearing 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 do in-depth study of various problems and requirements of society with natural

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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:**
- Ability to communicate various concepts of technical education effectively using practical approach and their geometrical visualizations.
 - Ability to use courses as a precise language of communication in other branches of human knowledge.
 - Ability to resolve unsolved problems and requirements of industries and societies.
 - 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:

- Level of knowledge
- Understanding
- Skills
- Competencies and attitudes
- 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:

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- 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 OUTCOMES (POs)

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

- 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.

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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 Outcomes (POs):

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
PO1	■											
PO2		■										
PO3			■									
PO4				■								
PO5					■							
PO6						■						
PO7							■					
PO8								■				
PO9									■			
PO10										■		
PO11											■	
PO12												■

7. PROGRAM SPECIFIC OUTCOMES (PSOs) :

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.

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8. TYPE 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.

- Engineering Mathematics-I
- Engineering Physics
- Introduction to Data Analytics
- Engineering Physics Lab
- Data Analytics Lab
- Advanced Excel Lab
- Engineering Mathematics-II
- Engineering Chemistry
- Digital Logic & Computer Architecture
- Engineering Chemistry Lab
- Manufacturing Practices Workshop
- Computer Aided Machine Drawing
- Probability and Optimization Theory
- Foundation of AI & ML
- Data Analytics using Python
- Data Structures and Algorithms
- Object Oriented Programming
- Software Engineering
- Data Structures and Algorithms Lab
- Object Oriented Programming Lab
- Software Engineering Lab
- AI & ML Lab
- Technical Seminar
- Data Science with R Programming
- Technical Communication
- Mathematical Foundations For Data Science
- Database Management System
- Theory of Computation
- Data Communication and Computer Networks
- Internet & Web Technology Lab
- Database Management System Lab
- Network Programming Lab
- Linux Shell Programming Lab
- R Lab
- Java Programming

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- Deep Learning
- Operating System
- Computer Graphics & Multimedia
- Analysis of Algorithms
- Computer Graphics & Multimedia Lab
- Deep Learning Lab
- Analysis of Algorithms Lab
- Java Lab
- Industrial Training
- Business Process Management
- Data Privacy & Security
- Information Security System
- Advance Computer Architecture
- Natural Language Processing (NLP)
- Business Process Management Lab
- Natural Language Processing Lab
- Cyber Security Lab
- Seminar
- Business Intelligence and Data Visualization
- Social Network Analysis
- Cloud Security Lab
- Industrial Training
- Project-I
- Project-II

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 the main discipline/subject of study are referred to as Discipline Centric/Specific.

- Compiler Design
- Software Project Management
- Distributed System
- Cloud Computing
- Ecommerce & ERP
- Internet of Things
- Operation Research
- Optimization Techniques

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- Big Data Analytics
- Data Forensics
- Supply Chain Management
- Internet of Things Lab
- Big Data Analytics Lab
- Data Visualization Lab

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

- Bioinformatics
- Research and Publication Ethics

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.

- Communication Skills
- Universal Human Value
- Environmental Studies
- Human Values Activities
- ANANDAM
- Technical Communication
- Professional Skills (Career & Team)
- Leadership and Management Skills

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.

- Programming for Problem Solving
- Language Lab
- Computer Programming Lab
- Basic Electrical Engineering Lab/ Basic Civil Engineering Lab
- Social Outreach, Discipline & Extra Curricular Activities

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

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9. PROGRAM STRUCTURE B. Tech. (CSE- Data Science)

PROGRAM STRUCTURE B. Tech. in Data Science

Semester - I

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC101	Engineering Mathematics-I	Core	30	70	100	3	1	-	4
BTBSC102	Engineering Physics	Core	30	70	100	3	1	-	4
BTHSMC103	Communication Skills	AECC	30	70	100	2	-	-	2
BTESC104	Programming for Problem Solving	SEC	30	70	100	3	-	-	3
BTESC 105	Basic Civil Engineering	Elective	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC106	Engineering Physics Lab	Core	30	20	50	-	-	1	1
BTHSMC107	Language Lab	SEC	30	20	50	-	-	1	1
BTESC108	Computer Programming Lab	SEC	30	20	50	-	-	1	1
BTESC 109	Basic Civil Engineering Lab	Elective	30	20	50	-	-	1	1
BTESC110	Computer Aided Engineering Graphics	SEC	30	20	50	-	-	1	1
BTSODECA11	Social Outreach, Discipline &Extra Curricular Activities		50		50	-	-	-	1
BTBSC 112	ANANDAM	AECC	50	50	100	1		1	2
Total			400	500	900	14	2	6	23

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Semester - II

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC 201	Engineering Mathematics-II	Core	30	70	100	3	1	-	4
BTBSC 202	Engineering Chemistry	Core	30	70	100	3	1	-	4
BTHSMC203	Human Values	AECC	30	70	100	2	-	-	2
BTESC204	Basic Mechanical Engineering	SEC	30	70	100	2	-	-	2
BTESC205	Basic Electrical Engineering	Elective	30	70	100	2	-	-	2
BTHSMC206	Environment Studies	AECC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC 207	Engineering Chemistry Lab	Core	30	20	50	-	-	1	1
BTHSMC208	Human Values Activities	AECC	30	20	50	-	-	1	1
BTESC209	Manufacturing Practices Workshop	SEC	30	20	50	-	-	1	1
BTESC210	Basic Electrical Engineering Lab	Elective	30	20	50	-	-	1	1
BTESC211	Computer Aided Machine Drawing	SEC	30	20	50	-	-	1	1
BTSODECA212	Social Outreach, Discipline & Extra Curricular Activities		50	-	50	-	-	-	1
BTBSC 213	ANANDAM	AECC	50	50	100	1	-	1	2
Total			430	570	1000	15	2	6	24

B.Tech. (Data Science)**Semester–III**

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCBSC301	Discrete Mathematics Structure	BSC	30	70	100	3	-	-	3
BTCSPCC302	Object Oriented Programming	PCC	30	70	100	3	-	-	3
BTCSPCCDS303	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
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCC307	Data Structures and Algorithms Lab	LC	30	20	50	-	-	1	1
BTCSPCC308	Object Oriented Programming Lab	LC	30	20	50	-	-	1	1
BTCSPCC309	Software Engineering Lab	LC	30	20	50	-	-	1	1
BTCSPCCDS 310	Python Lab	LC	30	20	50	-	-	1	1
BTCSPCC311	Internet & Web Technology Lab	LC	30	20	50	-	-	1	1
BTCSPROJ312	Industrial Training / Seminar	PROJ	30	20	50	-	-	1	1
BTCSHSMC313	Social Outreach, Discipline & Extra Curricular Activities	HSMC	50	-	50	-	-	-	1
BTHSMC314	ANANDAM	AECC	50	50	100	1	-	1	2
TOTAL			460	590	1050	19	0	7	27

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Semester-IV

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCCDS401	Data Science with R Programming	PCC	30	70	100	3	1	0	4
BTCSPCC402	Probability & Optimization Theory	PCC	30	70	100	3	0	0	3
BTCSPCC403	Web Development	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
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCC407	Web Development Lab	LC	30	20	50	0	0	1	1
BTCSPCC408	Database Management System Lab	LC	30	20	50	0	0	1	1
BTCSPCC409	Network Programming Lab	LC	30	20	50	0	0	1	1
BTCSPCC410	Linux Shell Programming Lab	LC	30	20	50	0	0	1	1
BTCSPCCDS 411	R Lab	LC	30	20	50	0	0	1	1
BTCSHSMC 412	Social Outreach, Discipline & Extra Curricular Activities	HSMC	50	-	50	-	-		1
BTHSMC413	ANANDAM	AECC	50	50	100	1	-	1	2
TOTAL			430	570	1000	18	2	6	27

B.Tech. (Data Science)**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
BTCSPCCDS 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	Compiler Design	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	HSM C	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	30	20	50	-	-	1	1
BTCSPCCDS 509	Deep Learning Lab	LC	30	20	50	-	-	1	1
BTCSPCC 510	Analysis of Algorithms Lab	LC	30	20	50	-	-	1	1
BTCSPCC 511	Java Lab	LC	30	20	50	-	-	1	1
BTCSPROJ 512	Industrial Training/ Seminar	PROJ	30	20	50	-	-	1	1
BTCSHSMC 513	Social Outreach, Discipline & Extra Curricular Activities	HSM C	50	-	50				1
BTHSMC514	ANANDAM	AECC	50	50	100	1	-	1	2
	TOTAL		460	640	1100	21	-	6	28

B.Tech. (Data Science)**Semester–VI**

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCCDS 601	Business Process Management	Core	30	70	100	3	-	-	3
BTCSPCCDS 602	Data Privacy & Security	Core	30	70	100	3	0	0	3
BTCSPCC 603	Information Security System	Core	30	70	100	3	0	0	3
BTCSPCC 604	Computer Architecture and Organization	Core	30	70	100	3	0	0	3
BTCSPCCDS 605	Natural Language Processing (NLP)	Core	30	70	100	3	0	0	3
	Elective Subject								
BTCSPEC 606A	Distributed System	Elective	30	70	100	3	0	0	3
BTCSPEC 606B	Cloud Computing	Elective	30	70	100	3	0	0	3
BTCSPEC 606C	Ecommerce & ERP	Elective	30	70	100	3	0	0	3
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCCDS 607	Business Process Management Lab	Core	30	20	50	0	0	1	1
BTCSPCCDS 608	Natural Language Processing Lab	Core	30	20	50	0	0	1	1
BTCSPCC 609	Cyber Security Lab	Core	30	20	50	0	0	1	1
BTCSPCC 610	Seminar	Core	30	20	50	0	0	1	1
BT CSSODE CA 611	Social Outreach, Discipline & Extra Curricular Activities		50		50				1
BTBSC 612	ANANDAM	AECC	50	50	100	1	-	1	2
	TOTAL		400	550	950	19	0	5	25

B.Tech. (Data Science)**Semester–VII**

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCC701	Business Intelligence and Data Visualization	PCC	30	70	100	3	1	-	4
BTCSPCC 702	Social Network Analysis	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	30	20	50	0	0	1	1
BTCSPCCDS708	Data Visualization Lab	LC	30	20	50	0	0	1	1
BTCSPCC709	Industrial Training	PROJ	30	20	50	0	0	1	1
BTCSPROJ710	Project-I	PROJ	30	20	50	0	0	3	3
BTCSHSMC711	Social Outreach, Discipline &Extra Curricular Activities	HSMC	50	-	50	-	-	-	1
BTHSMC712	ANANDAM	AECC	50	50	100	1	-	1	2
	TOTAL		400	550	950	18	1	7	27

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Semester–VIII

PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPROJ801	Project-II	PROJ	360	240	600	-	-	-	12
BTCSHSMC802	Social Outreach, Discipline & Extra Curricular Activities	HSMC	50	-	50	-	-	-	1
BTHSMC803	ANANDAM	AECC	50	50	100	-	-	-	2
	TOTAL		460	290	750	-	-	-	15

Note:

- A student is required to obtain min. 40% marks in individual paper to pass.
- The total credit of B.Tech. (Data Science) Programme is 196. However, the minimum credit required for award of degree shall be 190.
- 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.

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

PROGRAM STRUCTURE B. Tech. (Common for All)

Semester - I

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC101	Engineering Mathematics-I	Core	30	70	100	3	1	-	4
BTBSC102	Engineering Physics	Core	30	70	100	3	1	-	4
BTHSMC103	Communication Skills	AECC	30	70	100	2	-	-	2
BTESC104	Programming for Problem Solving	SEC	30	70	100	3	-	-	3
BTESC 105	Basic Civil Engineering	Elective	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC106	Engineering Physics Lab	Core	30	20	50	-	-	1	1
BTHSMC107	Language Lab	SEC	30	20	50	-	-	1	1
BTESC108	Computer Programming Lab	SEC	30	20	50	-	-	1	1
BTESC 109	Basic Civil Engineering Lab	Elective	30	20	50	-	-	1	1
BTESC110	Computer Aided Engineering Graphics	SEC	30	20	50	-	-	1	1
BTSODECA11	Social Outreach, Discipline & Extra Curricular Activities		50		50	-	-	-	1
BTBSC 112	ANANDAM	AECC	50	50	100	1		1	2
	Total		400	500	900	14	2	6	23

BTBSC101: Engineering Mathematics-I (Common for All)

Course Objectives:

- 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
- To understand Vector Calculus with three important theorems.

Course Content:

Unit I: Differential Calculus:

Partial derivatives, directional derivatives, total derivative, Jacobians and properties. Leibnitz's Rule of differentiation under integral sign. Maxima And Minima , saddle points; Method of Lagrange multipliers,

Unit II: Integral Calculus:

Improper integrals (Beta and Gamma functions), Applications of definite integrals to evaluate surface areas and volumes of revolutions. Double integrals (Cartesian), change of order of integration Change of variables (Cartesian to), areas and volumes by double integration, Triple integrals (Cartesian), Simple applications

Unit III: Differential Equations:

First Order and First degree ordinary differential equations: Linear and Bernoulli's equations, Exact equations, Linear Differential Equations of Higher order with constant coefficients.

Unit IV: Differential equations with variable Coefficients:

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy- Euler equation; Power series solutions including Legendre differential equation and Bessel differential equations.

Unit V: Vector Calculus:

Scalar line integrals, vector line integrals, scalar surface integrals, surface integrals, 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. Erwinkreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006. F201
3. Veerarajan T., Engineering Mathematics for firstyear, Tata Mc Graw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata Mc Graw Hill New Delhi, 11th Reprint, 2010.
5. N.P. Baliand Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.

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Course Outcomes:

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

CO1:	Apply the Concepts of the differential calculus.
CO2:	Understand the calculation and Applications of Multi variable integrals.
CO3:	Understand and apply the concept of differential equations with constant coefficients.
CO4:	Understand and apply the concept of differential equations with variable coefficients and power series.
CO5:	Understand and apply the concept of vector calculus.

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	PS O1	PS O2
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
CD3	Seminars	CO1, CO2, CO4, CO5
CD4	Self- learning advice using internets	CO1, CO2, CO3, CO4, CO5
CD5	Industrial visit	CO3, CO4, CO5

BTBSC102: 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 Gupta on NPTEL

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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	PO1 0	PO1 1	PO1 2	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

BTHSMC103 Communication Skills

Course Objectives:

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

Course Contents

Unit I Listening

Techniques of effective listening, Listening and comprehension, Probing questions, Barriers to listening

Unit II Speaking and Non-verbal communication

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

Meaning of non-verbal communication, Introduction to modes of non-verbal communication, Breaking the misbeliefs, Open and Closed Body language, Eye Contact and Facial Expression

Hand Gestures, Do's and Don'ts, Learning from experts, Activities-Based Learning

Unit III Reading

Techniques of effective reading, Gathering ideas and information from a given text: Identify the main claim of the text, Identify the purpose of the text, Identify the context of the text, Identify the concepts mentioned, Evaluating these ideas and information: Identify the arguments employed in the text, Identify the theories employed or assumed in the text, Interpret the text: To understand what a text says, To understand what a text does, To understand what a text means.

Unit IV Writing and different modes of writing

Clearly state the claims, Avoid ambiguity, vagueness, unwanted generalisations and oversimplification of issues, Provide background information, Effectively argue the claim, Provide evidence for the claims, Use examples to explain concepts, Follow convention, Be properly sequenced, Use proper signposting techniques, Be well structured: Well-knit logical sequence, Narrative sequence, Category groupings, Different modes of Writing: E-mails, Proposal writing for Higher Studies, Recording the proceedings of meeting: Any other mode of writing relevant for learners

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Unit V Digital Literacy and Effective use of Social Media

Role of Digital literacy in professional life: Trends and opportunities in using digital technology in workplace, Internet Basics, Introduction to MS Office tools: Paint, Office, Excel, PowerPoint

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, Introduction to Digital Marketing

Text Books:

1. Sen Madhuchanda (2010), *An Introduction to Critical Thinking*, Pearson, Delhi
2. Silvia P. J. (2007), *How to Read a Lot*, American Psychological Association, Washington DC

Suggested Readings:

1. Public Speaking, Michael Osborn and Suzanne Osborn, Biztantra
2. Handbook of Practical Communication Skills-Chrissie Wrought, published by Jaico Publishing House.

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Course Outcomes:

COs	Statement
	After completion of this course, students will be able to:
CO1	Adapt effective listening skills
CO2	Learn and demonstrate effective speech.
CO3	Learn and demonstrate effective reading skills
CO4	Know and practice effective writing skills
CO5	Understand and recognize the importance of digital literacy and social media

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	M	L	-	-	-	-	M	H	H	M	-	-	-
CO2	L3	H	M	L	L	-	M	-	M	M	H	M	-	-	-
CO3	L3	-	H	M	M	-	L	-	-	M	H	M	-	-	-
CO4	L3	M	M	M	M	-	L	-	-	-	H	L	-	-	L
CO5	L2	L	L	M	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	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 of numbers in radix r with special cases of $r=2, 8, 10$ and 16 with conversion from radix r_1 to r_2 , r 's and $(r-1)$'s complement, Binary addition, Binary subtraction, Representation of alphabets.

Unit IV: C Programming:

Problem specification, flow chart, data types, assignment statements, input output statements, developing simple C programs, If statement, 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

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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	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PS O1	PS O2
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

BTESC 105: 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

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

Unit II 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 III 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

Unit IV 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 V Environment

Environmental Pollution, Environmental Acts and Regulations, Air & Noise Pollution: Primary and Secondary air pollutants, Harmful effects of Air Pollution, Control of Air Pollution. Noise Pollution, Harmful Effects of noise pollution, control of noise pollution, Global warming & Climate Change, Ozone depletion, Green House effect

Text Books:

1. Gopi, S., Basic Civil Engineering, Pearson Publishers
2. Kandy, 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

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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

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

BTBSC106: 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.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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	-----

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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.

Detailed 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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 109: 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 lines using 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.

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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	PO1 0	PO1 1	PO1 2	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	-----

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.

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 to both the Planes-Auxiliary Views.

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

Overview of Computer Graphics : 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.

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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	PO11	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

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BTSODECA111: 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

Cours e Outco me	Bloo m Leve l	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
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

BTBSC 112: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of CommUnity based motivation videos, CommUnity based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

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Semester - II

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC 201	Engineering Mathematics-II	Core	30	70	100	3	1	-	4
BTBSC 202	Engineering Chemistry	Core	30	70	100	3	1	-	4
BTHSMC203	Human Values	AECC	30	70	100	2	-	-	2
BTESC204	Basic Mechanical Engineering	SEC	30	70	100	2	-	-	2
BTESC205	Basic Electrical Engineering	Elective	30	70	100	2	-	-	2
BTHSMC206	Environment Studies	AECC	30	70	100	2	-	-	2
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTBSC 207	Engineering Chemistry Lab	Core	30	20	50	-	-	1	1
BTHSMC208	Human Values Activities	AECC	30	20	50	-	-	1	1
BTESC209	Manufacturing Practices Workshop	SEC	30	20	50	-	-	1	1
BTESC210	Basic Electrical Engineering Lab	Elective	30	20	50	-	-	1	1
BTESC211	Computer Aided Machine Drawing	SEC	30	20	50	-	-	1	1
BTSODECA212	Social Outreach, Discipline & Extra Curricular Activities		50	-	50	-	-	-	1
BTBSC 213	ANANDAM	AECC	50	50	100	1	-	1	2
	Total		430	570	1000	15	2	6	24

BTBSC201: 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 the course is an introduction to partial differential equations.
- To understand the various numerical methods and techniques used to find solutions to differential equations and linear programming problems.

Course Content:

Unit I: Partial Differential Equations –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 II: Linear Algebra: Vectors and Matrices, Addition and Multiplication, Norms, Linear Independence, Linear Transformation, Bases, Dimensions, Inner Product, Rank, Inverse, Orthogonality, Matrix factorizations, Translation, Dilation, Rotation, Reflection in a point, line and plane. Matrix form of basic geometric transformations.

Unit III: Linear Algebra: Rank of matrix System of linear equations; Symmetric, skew symmetric and orthogonal matrices; Eigen values and Eigen vectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Unit IV: Numerical Methods: Finite differences, Relation between operators, Methods to solve algebraic and transcendental equations, numerical methods to solve ordinary differential equations, finite difference methods, Finite element method.

Unit V: Linear Programming Problems: Linear Programming Problems, Graphical Approach, simplex method, Assignment and Transportation problems

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.
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, 11th Reprint, 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.

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Course Outcomes:

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

CO1:	Determine the solutions to partial differential equations.
CO2:	Understand the concepts of vector space and linear transformations.
CO3:	Understand and to solve the matrices, Rank of a matrix, Eigen values and Eigen vectors, System of linear equations.
CO4:	Use various numerical methods and techniques to solve algebraic and differential equations.
CO5:	Understand and to solve linear programming problems.

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	PS O1	PS O2
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	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,CO2,CO4,CO5

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BTBSC202: 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/Dulong's 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.

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Unit V: Organic reaction mechanism and introduction of drugs

Organic reaction mechanism: Substitution; SN1, SN2, Electrophilic 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 & Boyd 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.

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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	PO 0	PO1 1	PO1 2	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

BTHSMC203: Human Values

Course Objective:

- To Know the basic guidelines, content and Process for Value Education
- To develop understanding different Harmony concept.
- To understand professional ethics and natural acceptance of human values.

Course Contents:

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

Understanding the need, basic guidelines, Self Exploration – its content and process; ‘Natural Acceptance’ and Experiential Validation, Continuous Happiness and Prosperity- Human Aspirations, Right understanding, Relationship and Physical Facilities, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

Unit II: Understanding Harmony in the Human Being - Harmony in Myself

Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’ Understanding the needs of Self (‘I’) and ‘Body’ - Sukh and Suvidha Understanding the Body as an instrument of ‘I’, Understanding the characteristics and activities of ‘I’ and harmony in ‘I’ Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

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

Understanding harmony in the Family, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman), meaning of Vishwas; Difference between intention and competence, meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, harmony in the society, Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha) - from family to world family.

Unit IV: Understanding Harmony in the Nature and Existence – Whole existence as Coexistence

Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting Units in all pervasive Space. Holistic perception of harmony at all levels of existence

Unit V: Implications of the above Holistic Understanding of Harmony on Professional Ethics. Natural acceptance of human values

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Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models. Strategy for transition from the present state to Universal Human Order: At the level of individual: as socially and ecologically responsible engineers, technologists and managers. Case studies related to values in professional life and individual life.

Suggested Text / Reference Books

1. Gaur R.R., Sangal R. and. Bagaria, G.P: "A Foundation Course in Human Values Professional Ethics," Excel Books, 2010.
2. Sadri S & Sadri, J Business Excellence Through Ethics & Governance, 2nd edition, 2015.
3. Mathur, U C Corporate Governance and business ethics, MacMillan India Ltd, 2009.
4. Baxi, C V: Corporate Governance, Excel Books, 2009
5. Sadri S, Sinha A K and Bonnerjee, P: Business Ethics: concepts and cases, TMH, 1998.

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Course Outcomes:

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

CO1:	Understand and analyze Basic Guidelines, Content and Process for Value Education.
CO2:	Understand Harmony in the Human Being - Harmony in Myself.
CO3:	Understand Harmony in the Family and Society- Harmony in Human-Human Relationship.
CO4:	Understand Harmony in the Nature and Existence – Whole existence as Coexistence.
CO5:	Understand of Harmony on Professional Ethics. Natural acceptance of human values.

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	PO11	PO12	PSO 1	PSO 2
CO1	L2	-	-	-	-	L	L	M	H	L	M	-	L	M	M
CO2	L2	-	-	-	-	-	L	M	M	M	M	-	L	M	M
CO3	L2	-	-	-	-	-	L	M	H	L	M	-	L	M	L
CO4	L2	-	-	-	-	L	L	L	M	M	L	L	H	M	M
CO5	L2	L	-	-	-	-	M	M	H	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	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 IC Engines, Working of IC Engines and its components.

Unit III: Refrigeration and Air Conditioning:

Introduction, classification and types of refrigeration systems and air-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 to Forging, Rolling, Extrusion, Drawing. Metal Joining Processes: Introduction to various types of Welding, Gas Cutting, Brazing, and Soldering.

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

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

BTESC205: 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, Nodal voltage 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 star and 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 of a three-phase induction motor, Significance of torque-slip characteristic. Starting and speed control of induction motor, single phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited DC motor. Construction and working of synchronous generators.

Unit V: Power Converters:

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

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:

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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	PO 0	PO1 1	PO1 2	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

BTHSMC206: Environmental Studies

Course Objective:

- To understand the basics of ecosystem and environment
- To understand about different types of pollution.
- To learn about waste, energy sources and sustainable energy.

Course Contents:

Unit-I Basics of Environment: Components and types of ecosystem, Structure and functions of ecosystem, Energy flow in ecosystem .Type and levels of Biodiversity, Values, Causes of extension, and Conservation methods of biodiversity.

Unit-II Pollution: Types of Pollutants, air pollution, harmful effects of air pollution, control of air pollution, water pollution, harmful effects of water pollution, control of water pollution, noise Pollution harmful effects of noise pollution, control of noise pollution, radioactive pollution, harmful effects of radioactive pollution, control of radioactive pollution.

Unit-III Solid Waste Management: Classification of solid waste, Collection, transportation, treatment, and disposal methods of solid waste, economic recovery of solid waste.

Unit-IV Renewable Energy Sources:Introduction, renewable sources of energy: solar energy, wind energy, energy from ocean, energy from biomass, geothermal energy and nuclear Energy.

Unit-V Issues of Environment: Sustainable development, water conservation, environmental education, environmental acts. Types of disasters, their causes, impact and preventive measures.

Recommended Books:

1. A.K. De, Environmental Chemistry, Wiley Eastern Ltd.
2. D.K.Sinha, Towards Basics of Natural Disaster Reduction, Research co Book Center, Delhi.
3. M.N.Rao and H.V.N.Rao, Air Pollution, Tata McGraw-Hill, ISBN-13 978-0-07-451871-7, 2013.
4. Ranjeeta Soni, Environmental Studies and Disaster management New India Publication Agency (NIPA), New Delhi, ISBN: 978-93-91383-02-2, October 2021.
5. R.C.Gaur, Basic Environmental Engineering New Age International Publication.

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Course Outcomes

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

CO1:	To understand the basic concepts and components of ecosystem and environment. Ecosystem Links between environmental components and their role.
CO2:	To understand the basic concepts of pollution and their sources and effects and to apply the control technologies related pollutions.
CO3:	To understand the types of wastes and their generation sources and to also know disposal technologies of waste and reuse and recycle of the waste.
CO4:	To know the concepts of renewable energy resources and their types and create the various applications of renewable resources and current potentials of energy resources.
CO5:	To understand the concept of sustainable development and create the methods for water conservation and apply the disaster control technologies.

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	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	L2	L	-	L	H	-	-	M	H	H	-	-	M	-	L
CO2	L3	H	H	H	H	H	H	H	M	H	M	M	H	H	H
CO3	L2	H	H	H	M	H	H	M	M	H	L	M	M	H	H
CO4	L6	L	L	H	L	H	H	H	L	M	L	H	H	M	H
CO5	L3	L	H	H	L	M	H	H	M	L	H	H	H	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

BTBSC 207: 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 $K_2Cr_2O_7$ solution by using diphenyl amine indicator
5. Determination of the strength of $CuSO_4$ solution iodometrically by using hypo solution
6. Determination of the strength of $NaOH$ and Na_2CO_3 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

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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
CO5:	Determine quantitative estimation of dissolve chemicals in water.

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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
CO5	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	-
CD2	Tutorials/Assignments	CO1,CO2, CO3, CO4, CO5
CD3	Seminars	-
CD4	Self- learning advice using internets / Experiments	CO1, CO2, CO3, CO4, CO5
CD5	Industrial visit	-

BTHSM208: Human Values Activities

Course Objective:

- To Understand the basic guidelines, content and process for value education.
- To develop understanding different Harmony concept.
- To understand professional ethics and natural acceptance of human values.

Course Contents:

PS 1:

Introduce yourself in detail. What are the goals in your life? How do you set your goals in your life? How do you differentiate between right and wrong? What have been your salient achievements and shortcomings in your life? Observe and analyze them.

PS 2:

Now-a-days, there is a lot of talk about many technogenic maladies such as energy and material resource depletion, environmental pollution, global warming, ozone depletion, deforestation, soil degradation, etc. - all these seem to be manmade problems, threatening the survival of life Earth - What is the root cause of these maladies & what is the way out in opinion? On the other hand, there is rapidly growing danger because of nuclear proliferation, arms race, terrorism, breakdown of relationships, generation gap, depression & suicidal attempts etc. - what do you think, is the root cause of these threats to human happiness and peace - what could be the way out in your opinion?

PS 3:

1. Observe that each of us has the faculty of 'Natural Acceptance', based on which one can verify what is right or not right for him. (As such we are not properly trained to listen to our 'Natural Acceptance' and may a time it is also clouded by our strong per-conditioning and sensory attractions). Explore the following:
 - (i) What is 'Naturally Acceptable' to you in relationship the feeling of respect or disrespect for yourself and for others?
 - (ii) What is 'naturally Acceptable' to you - to nurture or to exploit others? Is your living in accordance with your natural acceptance or different from it?
2. Out of the three basic requirements for fulfillment of your aspirations – right understanding, relationship and physical facilities - observe how the problems in your family are related to each. Also observe how much time & effort you devote for each in your daily routine.

PS 4:

List down all your important desires. Observe whether the desire is related to Self (I) the Body. If it appears to be related to both, visualize which part of it is related to Self (I) and which part is related to Body.

PS 5:

1.
 - a. Observe that any physical facility you use, follows the given sequence with time: Necessary and tasteful - unnecessary but still tasteful - unnecessary and tasteless - intolerable
 - b. In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If not acceptable, you want it continuously and if not acceptable, you do not want it any moment!
2. List down all your important activities. Observe whether the activity is of 'I' or of Body or with the participation of both or with the participation of both 'I' and Body.

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3. Observe the activities within 'i'. Identify the object of your attention for different moments (over a period of sy 5 to 10 minutes) and draw a line diagram connecting these points. Try observe the link between any two nodes.

PS 6:

1. Chalk out some programs towards ensuring your harmony with the body – in terms of nurturing, protection and right utilization of the body.
2. Find out the plants and shrubs growing in and around your campus, which can be useful in curing common diseases.

PS 7:

Form small groups in the class and make them carry out a dialogue focusing on the following eight questions related to 'TRUST';

- 1a. Do I want to make myself happy?
- 2a. Do I want to make the other happy?
- 3a. Does the other want to make himself/herself happy?
- 4a. Does the other want to make me happy?

What is the answer?

Intention (Natural Acceptance)

- 1b. Am I able to always make myself happy?
- 2b. Am I able to always make the other happy?
- 3b. Is the other able to always make himself/herself happy?

What is the answer?

Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate yourself and others on the basis of intention/competence.

PS 8:

1. Observe, on how many occasions, you are able to respect your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under-evaluation, over-evaluation or otherwise evaluation.
2. Also, observe whether your feeling of respect is based on treating the other as you would treat yourself or on differentiations based on body, physical facilities or beliefs.

PS 9:

1. Write a narration in the form of a story, poem, skit or essay to clarify a salient Human Value to the children.
2. Recollect and narrate an incident in your life where you were able to exhibit willful adherence to values in a difficult situation.

PS 10:

List down some common Units (things) of Nature which you come across in your daily life and classify them in the four orders of Nature. Analysis and explain the aspect of mutual fulfillment of each Unit with other orders.

PS 11:

Make a chart to show the whole existence as co-existence. With the help of this chart try to identify the role and the scope of some of the courses of your study. Also indicate the areas which are being either over-emphasized or ignored in the present context.

PS 12:

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Identify any two important problems being faced by the society today and analyze the root cause of these problems. Can these be solved on the basis of natural acceptance of human values. If so, how should one proceed in this direction from the present situation?

PS 13:

1. Suggest ways in which you can use your knowledge of Science/Technology/Management etc. for moving towards a universal human order.
2. Propose a broad outline for humanistic Constitution at the level of Nation.

PS 14:

The course is going to be over now. It is time to evaluate what difference in your thinking it has made. Summarize the core message of this course grasped by you. How has this affected you in terms of;

- a. Thought
- b. Behavior
- c. Work and
- d. Realization

What practical steps are you able to visualize for the transition of the society from its present state.

Project:

Every student required to take-up a social project e.g. educating children in needy/weaker section, services in hospitals, NGO's and other such work i.e. social work at villages adopted by respective institute/ college.

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Course Outcomes:

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

CO1:	Analyze Basic Guidelines, Content and Process for Value Education.
CO2:	Understanding Harmony in the Human Being - Harmony in Myself.
CO3:	Understand Harmony in the Family and Society- Harmony in Human-Human Relationship. Recollect and narrate an incident in your life.
CO4:	Understand Harmony in the Nature and Existence – Whole existence as Coexistence. Summarize the core message of this course grasped by you.
CO5:	List and Implicate the above Holistic Understanding of Harmony on Professional Ethics. Natural acceptance of human values.

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

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L4	-	-	-	-	L	L	M	H	L	M	-	L	M	L
CO2	L2	-	-	-	-	-	L	M	M	M	M	-	L	M	M
CO3	L2	-	-	-	-	L	L	M	H	L	M	-	L	M	M
CO4	L2	-	-	-	-	L	L	L	M	M	L	L	H	M	L
CO5	L1	-	-	-	-	L	M	M	H	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 internet	CO1,CO2, CO3, CO4,CO5
CD5	Industrial visit	

BTESC 209: 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 and other 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

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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	

BTESC 210: 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 (commutator or brush arrangement), induction machine (squirrel cage rotor), synchronous (field winding - 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.

B.Tech. (Data Science)

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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	

BTESC 211: 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.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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	-----

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BTSODECA212: 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	PO11	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

BTBSC213: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of CommUnity based motivation videos, CommUnity based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

B.Tech. (Data Science)**Semester–III**

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCBSC301	Discrete Mathematics Structure	BSC	30	70	100	3	-	-	3
BTCSPCC302	Object Oriented Programming	PCC	30	70	100	3	-	-	3
BTCSPCCDS303	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
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCC307	Data Structures and Algorithms Lab	LC	30	20	50	-	-	1	1
BTCSPCC308	Object Oriented Programming Lab	LC	30	20	50	-	-	1	1
BTCSPCC309	Software Engineering Lab	LC	30	20	50	-	-	1	1
BTCSPCCDS 310	Python Lab	LC	30	20	50	-	-	1	1
BTCSPCC311	Internet & Web Technology Lab	LC	30	20	50	-	-	1	1
BTCSPROJ312	Industrial Training / Seminar	PROJ	30	20	50	-	-	1	1
BTCSHSMC313	Social Outreach, Discipline & Extra Curricular Activities	HSMC	50	-	50	-	-	-	1
BTHSMC314	ANANDAM	AECC	50	50	100	1	-	1	2
TOTAL			460	590	1050	19	0	7	27

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BTBSC301: 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 enhance 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 contra positive, 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.

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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	PO 10	PO 11	PO 12	PS O1	PS O2
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 of OOP, 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.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

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

BTCSPCCDS 303: 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 Python 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'Reilly, Noad Gift

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Course Outcomes:

CO1: Define and learn basics of Python

CO2: develop console application in python

CO3: Implement Data structures using python.

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 III: 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 IV: 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-V: 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.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

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

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’, 2ndEdition ,SAMS
3. Ethan Cerami, “Web Services”, O'Reilly Media, 2002.
4. Achyut S Godbole and Atul Kahate, “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 Guide by Wendy 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.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L2	H	-	M	-	M	-	M	-	-	H	L	M	L	L
CO2	L3	M	-	L	-	M	-	H	-	-	H	L	M	L	L
CO3	L2	L	-	L	-	M	-	H	-	-	M	-	M	M	M
CO4	L1	M	-	M	-	H	-	M	-	-	M	L	M	L	L
CO5	L2	M	-	M	-	M	L	L	L	-	H	L	L	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

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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.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

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

BTCSPCC 307: 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:

<i>S.No.</i>	<i>List of Exercises</i>
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.

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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 between Objectives and Outcomes

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	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

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	-
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO5

BTCSPCC 308: 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 this Pointer.
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.

B.Tech. (Data Science)

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

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	CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO5

BTCSPCC 309: 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.

B.Tech. (Data Science)

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

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	CO2, CO3,CO4,CO5
CD5	Industrial visit	-

BTCSPCCDS 310: 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.

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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	PO1 0	PO1 1	PO1 2	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	-

BTCSPCC 311: 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.

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Course Outcomes:

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

CO1:	List various tags in html and use these, apply Cascaded style sheet to create web page the help of HTML and Javascript.
CO2:	Explain usage of web servers and use this to develop webpage and store data in database on Web server.
CO3:	Understand and Install Web server to run the web application.
CO4:	Apply with web forms to develop dynamic web applications using ADO.net.
CO5:	Experiment with web technologies.

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	PSO1	PSO2
CO1	L1	H	-	M	-	M	H	H	L	-	H	L	L
CO2	L2	M	-	H	-	M	H	M	-	-	H	M	M
CO3	L2	H	-	H	-	H	M	H	-	L	H	M	M
CO4	L3	H	-	H	-	H	M	H	-	L	H	M	M
CO5	L4	H	-	H	-	H	M	H	-	L	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
CD2	Tutorials/Assignments	CO1,CO2, CO3
CD3	Seminars	CO2
CD4	Self- learning advice using internets	CO1, CO2,CO5
CD5	Industrial visit	CO3

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BTCSPROJ 312: Industrial Training / Seminar

Course Objectives:

- To acquire and apply fundamental principles of engineering.
- To update with a 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	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

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BTC SHSMC 313: 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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

BTBSC 314: ANANDAM

Objectives:

- To instill the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

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Semester-IV

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCCDS401	Data Science with R Programming	PCC	30	70	100	3	1	0	4
BTCSPCC402	Probability & Optimization Theory	PCC	30	70	100	3	0	0	3
BTCSPCC403	Web Development	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
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCC407	Web Development Lab	LC	30	20	50	0	0	1	1
BTCSPCC408	Database Management System Lab	LC	30	20	50	0	0	1	1
BTCSPCC409	Network Programming Lab	LC	30	20	50	0	0	1	1
BTCSPCC410	Linux Shell Programming Lab	LC	30	20	50	0	0	1	1
BTCSPCCDS 411	R Lab	LC	30	20	50	0	0	1	1
BTCSHSMC 412	Social Outreach, Discipline & Extra Curricular Activities	HSMC	50	-	50	-	-		1
BTHSMC413	ANANDAM	AECC	50	50	100	1	-	1	2
	TOTAL		430	570	1000	18	2	6	27

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BTCSPCCDS401: Data Science with R Programming

Course Objectives:

- To Describe what Data Science is and the skill sets needed to be a data scientist..

Course Content:

Unit I: What is Data Science, What does Data Science involve, Era of Data Science, Business Intelligence vs Data Science, Life cycle of Data Science, Tools of Data Science, Introduction to Big Data and Hadoop, Introduction to R, Introduction to Spark, Introduction to Machine Learning.

Unit II: Statistics: Describing a Single Set of Data, Central Tendencies, Dispersion, Correlation, Simpson's Paradox, Some Other Correlational Caveats, Correlation and Causation. Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Normal Distribution, Binary distribution.

Unit III: R Programming, What is R, Installing R and RStudio, RStudio Overview, Working in the Console , Writing data, Reading from csv files, Data Types, Operators, Functions, Vectors, Data Frames, Factors, Sorting Numeric, Character, and Factor Vectors, Special Values, Installing and loading packages, Setting up your working directory, Downloading and importing data, Working with missing data , Extracting a subset of a data frame, Writing R scripts, Creating reports, Flow Control, while loops, for loops, If / else, Debugging tools, Data Analysis Pipeline, Data Extraction, Types of Data, Raw and Processed, Data Wrangling

Unit IV: Data Manipulation in R, List Management, Data Transformation, Merging Data Frames, Outlier Detection, Combining multiple vectors, Logical Regression, Hierarchical Clustering, PCA for Dimensionality Reduction, Data Import Techniques, Exploratory Data Analysis, Visualization of Data, Loading different types of dataset in R, Arranging the data, Plotting the graphs, Statistical graphs, Creating bar chart and dot plot, Creating histogram and box plot, Plotting with base graphics, Plotting and coloring in R

Unit V: Machine Learning using R: Modeling, Linear Regression, Logistic Regression, K-Means, K-Means++, Hierarchical Clustering – Agglomerative, CART, Random forest, Naïve Bayes, Implementing Support Vector Machine in R,

Reference Books:

1. R for Data Analysis in Easy Steps by Mike Mc Grath .
2. Beginning Data Science in R: Data Analysis, Visualization, and Modelling for the Data Scientist by Thomas Mailund.
3. The Elements of Statistical Learning, 2nd edition. — Springer, 2009. Hastie, T., Tibshirani, R., Friedman, J.
4. Statistical Analysis with R For Dummies by: Joseph Schmuller.
5. Machine Learning: A Probabilistic Perspective. Murphy, K. - MIT Press, 2012.
6. “Practical Data Science with R”. Nina Zumel, John Mount. Manning, 2014.
7. Advanced R: Data Programming and the Cloud by by: Matt Wiley,Joshua F. Wiley.
8. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython ,2nd edition, Wes McKinney, O'Reilly Media (2017)

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Course Outcomes:

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

CO1:	To Explain basic Statistics and Basics of Data Science,.
CO2:	To identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data.
CO3:	To Using R to carry out basic statistical modeling and analysis.
CO4:	To Explain the significance of exploratory data analysis (EDA) in data science. Apply basic tools (plots, graphs, summary statistics) to carry out EDA.
CO5:	To Describe the Data Science Process and how its components interact via machine learning 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	M	M	-	-	-	-	M	-	M	M	L
CO2	L1	H	H	H	H	L	-	-	-	-	H	-	L	M	M
CO3	L1	H	L	L	L	L	-	-	-	-	L	-	H	H	M
CO4	L6	H	H	H	H	L	-	-	-	-	H	-	L	M	L
CO5	L2	H	L	L	L	M	-	-	-	-	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, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO2

BTCSPCC 402: Probability & Optimization Theory

Course Objective:

- To learn basics of probability.
- To understand and apply discrete and continuous instances along with real world phenomenon of standard distributions.
- To understand the concept of correlation and analysis of regression.
- To understand and apply the optimization theory.
- To understand Transportation and assignment problems.

Course Content:

Unit I : PROBABILITY AND RANDOM VARIABLES: Introduction to probability, Axioms of probability - Conditional probability - Total probability – Baye’s theorem, Random variable - Probability mass function - Probability density function - Properties – Moments - Moment generating functions and their properties.

Unit II :Distributions: Binomial, Poisson, Geometric, Uniform, Exponential, Weibull and Normal distributions and their properties. Joint distributions - Marginal and conditional distributions. Transformation of random variables - Central limit theorem

Unit III: Correlation and Regression Analysis:– Covariance – Correlation and regression , Curve fitting. Line of Regression, Curve fitting. Line of Regression

Unit IV : Linear Programming: Simplex method, Two Phase Method and Duality in Linear Programming.

UnitV: Application of Linear Programming: Transportation Problems, North-West Corner rule, Vogle’s approximation method, and Assignment Problems: Hungarian Method. Job Sequencing.

Text Books:

1. Ross, S., “A first course in probability”, 9th Edition, Pearson Education, Delhi, 2019.
2. Medhi J., “Stochastic Processes”, New Age Publishers, New Delhi, 2017. (Chapters 2, 3,4)
3. T. Veerarajan, “Probability, Statistics and Random process”, Second Edition, Tata McGraw Hill, New Delhi, 2017.

Reference Books:

1. Allen A.O., “Probability, Statistics and Queuing Theory”, Academic press, New Delhi, 2010.
2. Taha H. A., “Operations Research-An Introduction”, Seventh Edition, Pearson Education Edition Asia, Delhi, 2014.
3. John F. Shortle , James M. Thompson, Donald Gross, Carl M. Harris Fundamentals of Queuing Theory; Wiley Series 2018.

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4. Meyer P.L. “*Introduction to probability and statistical applications*”, 2nd edn., American Publishing Co.
5. Hogg and craig , *Introduction to mathematical statistics*, 6th Edn,2012, Pearson education, New Delhi.
6. Ross Sheldon M, “*Introduction to Probability and Statistics for Engineers and Scientists*”, Elseveir, 2010.
7. William J. Stewart, *Probability, Markov Chains, Queues and Simulation*.
8. S. Narayanan, T. K. Manicavachagom Pillay, G. Ramanaiah, *Advanced mathematics for engineering students*, S. Viswanathan Pvt. Ltd., 1985.

Course Outcomes:

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

CO1: Explain the basic perceptions of probability of an event and associated random variables.

CO2: Compare and contrast various standard distributions with suitable statistical analysis and solve two dimensional random variable problems .

CO3: Analyse the concept of correlation and regression.

CO4: Understand the concept of Optimization theory.

CO5: Apply various methods to solve Transportation and assignment problems.

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

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BTCSPCC 403: 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:

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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	PO1 0	P01 1	PO1 2	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 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: 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.

Unit II: Introduction to database systems: 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, Joins, 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.

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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", Addison Wesley.
- 2 Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill
- 3 Elmasri, Navathe, "Fundamentals of Database Systems", Addison 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.

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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	PO11	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

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, 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 undecidability.

Course Contents:

Unit I: Introduction: Basic machine, Finite state machine, Transition graph, Transition matrix, Deterministic and nondeterministic finite automation, Equivalence of DFA and NFA, Decision properties, minimization of finite automata, Mealy & Moore machines.

Unit II: Finite Automata & Regular Expression: 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, Undecidability, 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.

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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

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Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	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

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, 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: Network hardware, Network software, topologies, Protocols and standards, OSI model, TCP model, TCP/IP model

Unit II: 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.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L2	H	L	M	L	-	-	-	-	-	L	-	M	L	L
CO2	L3	H	M	M	M	-	-	-	-	-	M	-	L	L	L
CO3	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

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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 407: 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 an ODBC link, Compile & execute JAVA JDBC 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.

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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 session 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	PO1 0	P01 1	PO1 2	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 408: 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.

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

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	-
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	-

BTCSPCC 409: 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.
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

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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 between Objectives and Outcomes

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	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

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	-
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	-

BTCSPCC 410: 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, df, space, 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.

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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
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	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

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	-
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	-

BTCSPCCDS 411: R Lab

Course Objectives:

- To Describe what Data Science is and the skill sets needed to be a data scientist

List of Experiments:

1. Write an R script, to create R objects for calculator application and save in a specified location in disk.
2. Write an R script to find basic descriptive statistics using summary, str, quartile function on sample datasets.
3. Write an R script to find subset of dataset by using subset (), aggregate () functions on sample dataset.
4. Write an R script for Reading different types of data sets (.txt, .csv) from web and disk and writing in file in specific disk location.
5. Write an R script for Reading Excel data sheet and XML dataset.
6. Find the data distributions using box and scatter plot of sample dataset.
 - a. Find the outliers using plot.
 - b. Plot the histogram, bar chart and pie chart on same data.
7. How to find a corelation matrix and plot the correlation on sample data set.
 - a. Plot the correlation plot on dataset and visualize giving an overview of relationships among data
 - b. Analysis of covariance: variance (ANOVA), if data have categorical variables
8. Import a data from web storage. Name the dataset and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in a institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not. require (foreign), require(MASS).
9. Apply multiple regressions, if data have a continuous independent variable. Apply on above dataset (in Que 8).
10. Apply regression Model techniques to predict the data on above dataset (in Que 8).

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Course Outcomes:

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

CO1:	Install and use R for simple programming tasks. Extend the functionality of R by using add-on packages.
CO2:	Implement page replacement and memory management algorithms. Extract data from files and other sources and perform various data manipulation tasks on them.
CO3:	Use R Graphics and Tables to visualize results of various statistical operations on data.
CO4:	Apply the knowledge of R gained to data Analytics for real life applications.
CO5:	Apply Code statistical functions in R.

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	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	L2	H	H	H	H	L	-	-	-	L	H	-	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, CO5
CD3	Seminars	-
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	-

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BTC SHSMC 412: 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 of build friendships and participating 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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

BTBSC 413: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

B.Tech. (Data Science)**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
BTCSPCCDS 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	Compiler Design	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	30	20	50	-	-	1	1
BTCSPCCDS 509	Deep Learning Lab	LC	30	20	50	-	-	1	1
BTCSPCC 510	Analysis of Algorithms Lab	LC	30	20	50	-	-	1	1
BTCSPCC 511	Java Lab	LC	30	20	50	-	-	1	1
BTCSPROJ 512	Industrial Training/ Seminar	PROJ	30	20	50	-	-	1	1
BTCSHSMC 513	Social Outreach, Discipline & Extra Curricular Activities	HSMC	50	-	50				1
BTHSMC514	ANANDAM	AECC	50	50	100	1	-	1	2
	TOTAL		460	640	1100	21	-	6	28

BTCSPCC 501: Java Programming

Course Objective:

- This course introduces fundamental structured and object-oriented programming concepts and techniques, using Java, and is intended for all who plan to use computer programming in their studies and careers.
- Topics covered include variables, arithmetic operators, control structures, arrays, functions, recursion, dynamic memory allocation, files, class usage, arrays, recursion, polymorphism, exceptions, Applet Programming and class writing. Program design and testing are also covered, in addition to more advanced object-oriented concepts including inheritance and exceptions as time permits.

Course Contents:

Unit I: 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 Associativity, 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.

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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)

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Course Outcomes:

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

CO1:	To understand the basic concepts and principles of structured programming.
CO2:	To understand the basic concepts and principles of object oriented programming.
CO3:	To Produce sample use-cases, pseudo-code, and an incremental coding plan for a given problem specification.
CO4:	To Design, write, and test a Java program to implement a solution to a given problem specification.
CO5:	To 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	-

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BTCSPCCDS 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 Good fellow, Yoshua Bengio and Aeron Courville,” Deep Learning”, MIT Press, First Edition, 2016.
2. Adam Gibson and Josh Patterson,” Deep Learning, A practitioner’s approach”, O’Reilly, First Edition, 2017.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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, Addison , 1999
- David F.Rogers, Procedural Elements for Computer Graphics, McGraw Hill Book Company
- D.Heam and P.Baker, Computer Graphics, Prentice Hall 1986
- R.Plstock and G.Kalley, Theory and Problems of Computer Graphics, Schaum's Series., Mc Graw Hill.
- Ralf Steinmetz & Klara Nahrstedt - Multimedia: computing, Communication & Applications, Pearson Education Asia.
- PrabhatK. Andleigh-Multimedia System Design, Prentice Hall, Kiran Thaukrar.

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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 between Objectives and Outcomes

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	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 N_p , N_p -Hard And N_p -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

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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	CO2,C05
CD4	Self- learning advice using internets	CO3,CO4
CD5	Industrial visit	CO4

BTCSPEC 506A: Compiler Design

Course Objective:

- To understand and list the different stages in the process of compilation.
- To identify different methods of lexical analysis
- To design top-down and bottom-up parsers
- To identify synthesized and inherited attributes
- To develop syntax directed translation schemes
- To develop algorithms to generate code for a target machine

Course Contents:

Unit I: Introduction: Objective, scope and outcome of the course. Compiler, Translator, Interpreter definition, Phase of compiler, Bootstrapping, Review of Finite automata lexical analyzer, Input, Recognition of tokens, Idea about LEX: A lexical analyzer generator, Error handling.

Unit II: Review of CFG Ambiguity of grammars: Introduction to parsing. Top down parsing, LL grammars & passers error handling of LL parser, Recursive descent parsing predictive parsers, Bottom up parsing, Shift reduce parsing, LR parsers, Construction of SLR, Conical LR & LALR parsing tables, parsing with ambiguous grammar. Operator precedence parsing, Introduction of automatic parser generator: YACC error handling in LR parsers.

Unit III: Syntax directed definitions; Construction of syntax trees, S Attributed Definition, L-attributed definitions, Top down translation. Intermediate code forms using postfix notation, DAG, Three address code, TAC for various control structures, Representing TAC using triples and quadruples, Boolean expression and control structures.

Unit IV: Storage organization; Storage allocation, Strategies, Activation records, Accessing local and non-local names in a block structured language, Parameters passing, Symbol table organization, Data structures used in symbol tables.

Unit V: Definition of basic block control flow graphs; DAG representation of basic block, Advantages of DAG, Sources of optimization, Loop optimization, Idea about global data flow analysis, Loop invariant computation, Peephole optimization, Issues in design of code generator, A simple code generator, Code generation from DAG.

Text/Reference Books:

- 'Compilers Principles, Techniques and Tools', Aho, Pearson Education.
- 'Modern Compiler Design', Galles, Pearson Education.
- 'The Essence of Compilers', Hunter, Pearson Education

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Course Outcomes:

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

CO1:	Understand grammar specification to develop the lexical analyzer
CO2:	Understand parser specification design top-down and bottom-up Parsers
CO3:	Practice syntax directed translation schemes
CO4:	Apply algorithms to generate code for a target machine
CO5:	Understand DAG representation

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	H	M	-	-	-	-	L	M	-	L	M	M
CO2	L2	H	M	M	M	L	-	-	-	-	M	-	L	M	M
CO3	L3	H	M	M	M	L	-	-	-	L	M	-	L	H	M
CO4	L3	H	M	M	M	L	-	-	-	-	M	-	L	H	M
CO5	L2	H	M	H	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	CO2, CO3,CO4
CD3	Seminars	CO3,CO4
CD4	Self- learning advice using internets	CO2,CO3, CO4
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.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	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.

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Course Outcomes:

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

CO1:	Describe 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1	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	-

BTC SHSMC 507: Professional Skills

Objectives:

- To acquire career skills and fully pursue to partake in a successful career path
- To prepare good resume, prepare for interviews and group discussions
- To explore desired career opportunities in the employment market in consideration of an individual SWOT.
- Understand the significance of Team Skills and help them in acquiring them
- To help them design, develop and adapt to situations as an individual and as a team.

Course Contents

Unit I: Resume Skills & Interview Skills: Resume Skills : Preparation and Presentation, Introduction of resume and its importance, Difference between a CV, Resume and Bio data, Essential components of a good resume, Resume skills : common errors, Common errors people generally make in preparing their resume, Prepare a good resume of her/his considering all essential components

Interview Skills : Preparation and Presentation, Meaning and types of interview (F2F, telephonic, video, etc.), Dress Code, Background Research, Do's and Don'ts, Situation, Task, Approach and Response (STAR Approach) for facing an interview, Interview procedure (opening, listening skills, closure, etc.), Important questions generally asked in a job interview (open and closed ended questions), Interview Skills : Simulation, Observation of exemplary interviews, Comment critically on simulated interviews, Interview Skills : Common Errors, Discuss the common errors generally candidates make in interview, Demonstrate an ideal interview

Unit II: Group Discussion Skills & Exploring career opportunities: Meaning and methods of Group Discussion, Procedure of Group Discussion, Group Discussion- Simulation, Group Discussion - Common Errors, 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 their potentials and availability of opportunities

Unit III: Presentation Skills, Trust and Collaboration: Types of presentations, Internal and external presentation, Knowing the purpose, Knowing the audience, Opening and closing a presentation, Using presentation tools, Handling questions, Presentation to heterogenic group, Ways to improve presentation skills over time, Explain the importance of trust in creating a collaborative team, Agree to Disagree and Disagree to Agree – Spirit of Team work, Understanding fear of being judged and strategies to overcome fear

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Unit IV: Listening as a Team Skill & Brainstorming: Advantages of Effective Listening, Listening as a team member and team leader. Use of active listening strategies to encourage sharing of ideas (full and undivided attention, no interruptions, no prethink, use empathy, listen to tone and voice modulation, recapitulate points, etc.), Use of group and individual brainstorming techniques to promote idea generation., Learning and showcasing the principles of documentation of team session outcomes

Unit V: Social and Cultural Etiquette & Internal Communication: Need for etiquette (impression, image, earn respect, appreciation, etc), Aspects of social and cultural/corporate etiquette in promoting teamwork, Importance of time, place, propriety and adaptability to diverse cultures, Use of various channels of transmitting information including digital and physical, to team members.

Course Outcomes:

CO	Statement
	After the completion of this course, students will be able to:
CO1	Prepare their resume in an appropriate template without grammatical and other errors and using proper syntax and Participate in a simulated interview
CO2	Actively participate in group discussions towards gainful employment, Capture a se interview simulation video regarding the job role concerned and Enlist the common er generally made by candidates in an interview.
CO3	Perform appropriately and effectively in group discussions and Explore sources (online/offline) of career opportunities
CO4	Use common technology messaging tools that are used in enterprises for flow of informati and transition from command and control to informal communication during an online/offline team session & Actively use and operate online team communication tools: Webinar, Skype, Zoom, Google hangout etc
CO5	Appreciate and demonstrate Team Skills & Generate, share and maximise 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

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

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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	L	H	L	M	L	H	H	M	-	H	M	-	L	L
CO2	L3	L	H	L	M	L	H	H	M	-	H	M	-	L	L
CO3	L3	L	H	L	M	L	H	H	M	-	H	M	-	L	M
CO4	L3	L	H	L	M	L	H	H	M	-	H	M	-	L	M
CO5	L3	L	H	L	M	L	H	H	M	-	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

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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	PO11	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	

BTCSPCCDS 509: 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.

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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.
CO5:	Compare Deep learning 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 Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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

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.

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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 between Objectives and Outcomes

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	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

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	-

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

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

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	-
CD4	Self- learning advice using internets	CO2, CO3, CO5
CD5	Industrial visit	-

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BTCSPROJ 512: Industrial Training / Seminar

Course Objectives:

- To acquire and apply fundamental principles of engineering.
- To update with a 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	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

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BTC SHSMC 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 participating 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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

BTBSC 514: ANANDAM

Objectives:

- To instill the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

B.Tech. (Data Science)**Semester–VI**

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCCDS 601	Business Process Management	Core	30	70	100	3	-	-	3
BTCSPCCDS 602	Data Privacy & Security	Core	30	70	100	3	0	0	3
BTCSPCC 603	Information Security System	Core	30	70	100	3	0	0	3
BTCSPCC 604	Computer Architecture and Organization	Core	30	70	100	3	0	0	3
BTCSPCCDS 605	Natural Language Processing (NLP)	Core	30	70	100	3	0	0	3
	Elective Subject								
BTCSPEC 606A	Distributed System	Elective	30	70	100	3	0	0	3
BTCSPEC 606B	Cloud Computing	Elective	30	70	100	3	0	0	3
BTCSPEC 606C	Ecommerce & ERP	Elective	30	70	100	3	0	0	3
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCCDS 607	Business Process Management Lab	Core	30	20	50	0	0	1	1
BTCSPCCDS 608	Natural Language Processing Lab	Core	30	20	50	0	0	1	1
BTCSPCC 609	Cyber Security Lab	Core	30	20	50	0	0	1	1
BTCSPCC 610	Seminar	Core	30	20	50	0	0	1	1
BT CSSODE CA 611	Social Outreach, Discipline & Extra Curricular Activities		50		50				1
BTBSC 612	ANANDAM	AECC	50	50	100	1	-	1	2
	TOTAL		400	550	950	19	0	5	25

B.Tech. (Data Science)

BTCSPCCDS 601: Business Process Management

Course Objectives:

- To introduces and understand the Service Management, System Administration and Business Process in Cloud Computing.

Course Content:

Unit I: Cloud Computing Services: Cloud Computing Administration, Cloud Computing Solution for Enterprise, Public and Private Cloud for Enterprise.

Service Catalog Management: Service Catalog-Value to the Business, Basic Troubleshooting Techniques, Configuration Management –Principles.

Unit II: Cloud computing BPM: Market Benefits Business Process Management Life Cycle Business model, Business process modeling tools.

Introduction to BPM: Motivation and Definitions. Business Process-Process Designer .Administration and Stakeholders. Classification of Business Processes. Goals, Structure, and Organization.

Unit III: PC Health Check: What slows down a computer?, Running a PC Health Check, Patching and Updates, Tools for patch management, Patching demands proper due Diligence, Patch Management

BPM Life Cycle Methodology: Business Process Management Activities BPM suites Practice BPM technology Managing end-to-end, customer-facing processes Establishing a common language for business IT alignment.

Unit IV: Business Process Management Overview: Business process management overview. Overview of process modeling, Building processes in IBM BPM Reusing items in Process Designer. Creating a business process definition (BPD) Building services.

Unit V: Creating User Interfaces: Creating user interfaces. Coaches .Developing reusable Coach Views Templates. Stock controls.

Dashboards and Reports Business value: Solution overview. IBM Solution for Collaborative Lifecycle Management. Designing process interactions for business users

Reference Books:

1. IBM Student Guide on “Managing the Cloud”.
2. IBM Student Guide on “Business Process Management”.
3. Rajkumar Buyya “Mastering Cloud Computing”.

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Course Outcomes:

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

CO1:	To Understand basics of cloud computing services& services management.
CO2:	To explain the technologies and approaches for the business related issues.
CO3:	To Understand the Business Process Management Activities of cloud management.
CO4:	To Create a business process definition (BPD) Building services.
CO5:	To Design process interactions interface for business users.

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	M	M	-	-	-	-	M	-	M	M	L
CO2	L1	H	H	H	H	L	-	-	-	-	H	-	L	M	M
CO3	L1	H	L	L	L	L	-	-	-	-	L	-	H	H	M
CO4	L6	H	H	H	H	L	-	-	-	-	H	-	L	M	L
CO5	L2	H	L	L	L	M	-	-	-	-	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, CO5
CD3	Seminars	CO3, CO4
CD4	Self- learning advice using internets	CO2, CO3, CO4, CO5
CD5	Industrial visit	CO2

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BTCSPCCDS 602: Data Privacy & Security

Course Objectives:

- To introduce data privacy to a wide audience and help each participant see how data privacy has evolved as a compelling concern to public and private organizations as well as individuals. In this course, you will hear from legal and technical experts and practitioners who encounter data privacy issues.

Course Content:

- Unit I:** Introduction to Data Privacy, types of privacy attacks, Data linking and profiling, access control models, role based access control, privacy policies, their specifications, privacy policy languages, privacy in different domains-medical, financial, etc.
- Unit II:** Mathematical model for comparing real-world data sharing practices, computing privacy and risk measurements. Demographics and Uniqueness. Protection Models-Null-map, k-map, Wrong map. Survey of techniques-Protection models (null-map, k-map, wrong map), Disclosure control, Inferring entity identities, entry specific databases. Computation systems for protecting delimited data-Min Gen, Datafly, Mu-Argus, k-Similar.
- Unit III:** Introduction to Security: The OSI Security Architecture, Security Attacks, Services and Mechanisms, Model for Network Security, Number theory, Cryptographic Hash Functions, Digital Signatures,
- Unit IV:** System Security, Symmetric Encryption and Message Confidentiality, Substitution ciphers, Stream ciphers, Public-key cryptography and Message Authentication, Key Distribution and Authentication, Transport Layer Security, Wireless Network Security, E-mail Security, IP Security, Security Management Systems, Need for IT Security, Intrusion Prevention and Detection Systems, Cyber Security.
- Unit V:** Security metrics: Design, Data sources, Analysis of security metrics data, Measuring security cost and value, Different context for security process management. Acquisition and Duplication: Sterilizing Evidence Media, Acquiring Forensics Images, Acquiring Live Volatile Data, Data Analysis, Metadata Extraction, and File System Analysis.

References:

1. Ronald Leenes , Rosamunde van Brakel , Serge Gutwirth , De Hert, Paul, Data Protection and Privacy: The Age of Intelligent Machines (Computers, Privacy and Data Protection), (1e), Hart Publishing, 2017.
2. B. Raghunathan, The Complete Book of Data Anonymization: From Planning to Implementation,(1e), Auerbach Pub, 2016.
3. L. Sweeney, Computational Disclosure Control: A Primer on Data Privacy Protection, MIT Computer Science,(1e), 2017
4. William Stallings, Cryptography and Network Security: Principles and Practice, (7e), Pearson Education, 2017.
5. William Stallings, Network Security Essentials: Applications and Standards, (6e),Pearson Education, 2014.

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Course Outcomes:

CO1.	Understanding basics of Data Privacy and privacy attacks for performing data analysis
CO2.	Understanding the data, performing preprocessing for protection models-Null-map, k-map
CO3.	Use different Computation systems for protecting delimited data-Min Gen and Data fly
CO4.	Develop the model for data analysis and evaluate for IT Security and Wireless Network Security
CO5.	Learning methods for different context for security process management

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

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.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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,CO4,CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3,CO5
CD3	Seminars	CO3,CO5
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)

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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,CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3
CD3	Seminars	CO2
CD4	Self- learning advice using internets	CO2, CO3,CO5
CD5	Industrial visit	CO4

BTCSPCCDS 605: 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. NitinIndurkha 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.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

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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

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

BTCESPEC 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 , Geoffrey C.Fox, Jack J. Dongarra
Pub: Elsevier
- Cloud Computing ,Principal and Paradigms, Edited By Rajkumar Buyya, James 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

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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.

Reference/Text Books:

1. A. Lexis Leon, “Enterprise Resource Planning”, TMH
2. Brady, Manu, Wegner, “Enterprise Resource Planning”, TMH

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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	

BTCSPCCDS 607: Business Process Management Lab

Course Objectives:

- To introduces the Management of Cloud in terms of IT service Management and monitors the performance of data centers with the help of cloud computing simulators.
1. Performance evaluation of services over Cloud.
 2. Management of cloud resources using Cloud Analyst.
 3. Simulation of large scale Cloud computing data centers with Cloud Analyst.
 4. Creating a Super User on Linux OS and learn access control.
 5. Creating a Warehouse Application in Salesforce.com.
 6. Stop and start Amazon EC2 instances at regular intervals using Lambda.
 7. Installation & Hands on practice on CloudSim
 8. Create smart AWS diagrams using CloudCraft for a business process.
 9. Building an Amazon CloudWatch dashboard outside of the AWS Management Console.
 10. Create an IAM User with Full Access to Amazon S3 and CloudWatch Logs

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Course Outcomes:

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

CO1:	Analyze different cloud programming platforms and tools.
CO2:	Develop scalable applications using AWS features.
CO3:	Demonstrate the working of Cloud Sim.
CO4:	Building an Amazon Cloud Watch dashboard.
CO5:	Create an IAM User.

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	PSO 1	PSO 2
CO1	L2	H	M	M	M	M	-	-	-	-	M	-	M	M	L
CO2	L1	H	H	H	H	L	-	-	-	-	H	-	L	M	M
CO3	L1	H	L	L	L	L	-	-	-	-	L	-	H	H	M
CO4	L3	H	H	H	H	L	-	-	-	-	H	-	L	M	L
CO5	L2	H	L	L	L	M	-	-	-	-	L	-	M	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

BTCSPCCDS 608: 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 WordNet synset 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 Language Processing with Python, Steven Bird, Ewan Klein, and Edward Loper, Oreilly

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Course outcomes:

CO1:	Understand the filtering technique in NLP
CO2:	Develop methods for NLP tools.
CO3:	Apply Training and Tagging program on Tools
CO4:	Analyze the syntax, semantics, and pragmatics of a statement written in a natural language.
CO5:	Apply machine learning algorithms to natural language processing.

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	L1	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	L2	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	-

BTCSPCC 609: 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.

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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:	Demonstrate how to provide secure data storage.

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	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,CO4
CD2	Tutorials/Assignments	CO1, CO2, CO3 ,CO4 CO5
CD3	Seminars	CO3 ,CO4 CO5
CD4	Self- learning advice using internets	CO2, CO3 ,CO4,CO5
CD5	Industrial visit	CO3

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BTCSPROJ 610: 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

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BTC SHSMC 611: 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 To helping to build confidence and self-esteem circle of the regular classroom.

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	PO11	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

BTBSC 612: ANANDAM

Objectives:

- To instill the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

B.Tech. (Data Science)**Semester–VII**

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCC701	Business Intelligence and Data Visualization	PCC	30	70	100	3	1	-	4
BTCSPCC 702	Social Network Analysis	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	30	20	50	0	0	1	1
BTCSPCCDS708	Data Visualization Lab	LC	30	20	50	0	0	1	1
BTCSPCC709	Industrial Training	PROJ	30	20	50	0	0	1	1
BTCSPROJ710	Project-I	PROJ	30	20	50	0	0	3	3
BTCSHSMC711	Social Outreach, Discipline &Extra Curricular Activities	HSMC	50	-	50	-	-	-	1
BTHSMC712	ANANDAM	AECC	50	50	100	1	-	1	2
	TOTAL		400	550	950	18	1	7	27

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BTCSPCC 701: Business Intelligence and Data Visualization

Course Objectives:

- To Introduce Business values from corporate data
- To Learn Business Strategy
- To Define System Privacy and Data Modeling

Course Contents:

Unit I Concept of business value from corporate data, the exploitation of information for advantage, types and sources of information value
Nature and value of business intelligence, the business intelligence environment, and how types of data processing can add value to corporate data sources

Unit II Knowledge discovery, data mining, data warehousing, Business analytics, OLAP analysis, metadata, Data visualization, visualization techniques, dashboard

Unit III The relationship between corporate strategy, IS strategy and business intelligence strategy, BI links to enterprise systems, CRM (Customer Relationships Management), SCM (Supply Chain Management) Structured & unstructured data, content management

Unit IV Systems Privacy, ethical, legal issues associated with BI Implementation
BI, Decision Support Systems, Expert Systems and Executive Information Systems

Unit V Data modeling, star schemas, Using select and complementary BI/BA tools to provide insights in decision making scenarios

Reference Books:

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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,CO4,CO5
CD2	Tutorials/Assignments	CO2, CO3,CO4,CO5
CD3	Seminars	CO2
CD4	Self- learning advice using internets	CO2
CD5	Industrial visit	CO5

BTCSPCC 702: Social Network Analysis

Course Objectives:

- To understand the concept of semantic web and related applications.
- To learn knowledge representation using ontology.
- To understand human behavior in social web and related communities.
- To learn visualization of social networks.

Course Contents:

Unit I Introduction: Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

Unit II Modelling, Aggregating and Knowledge Representation: Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.

Unit III Extraction and Mining Communities in Web Social Networks: Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.

Unit IV Predicting Human Behaviour and Privacy Issues: Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

Unit V Visualization and Applications of Social Networks: Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and

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Node-Link Diagrams - Hybrid representations - Applications - Cover networks -
Community welfare - Collaboration networks - Co-Citation networks.

Text Books:

1. Peter Mika, —Social Networks and the Semantic Web, First Edition, Springer 2007.
2. Borko Furht, —Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.

References

1. Guandong Xu ,Yanchun Zhang and Lin Li, —Web Mining and Social Networking – Techniques and applications, First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo, —Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, —Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling, IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, —The Social Semantic Web, Springer, 2009.

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Course Outcomes:

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

CO1:	Develop semantic web related applications.
CO2:	Represent knowledge using ontology.
CO3:	Extraction and mining communities in web social networks
CO4:	Predict human behavior in social web and related communities.
CO5:	Visualize social networks

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	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,CO4,CO5
CD2	Tutorials/Assignments	CO2, CO3,CO5
CD3	Seminars	CO5
CD4	Self- learning advice using internets	CO4
CD5	Industrial visit	CO1

BTCSPEC 703A: 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, NoSqlMap 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

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-5 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.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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,CO4,CO5
CD2	Tutorials/Assignments	CO1, CO2,CO3,CO4,CO5
CD3	Seminars	
CD4	Self- learning advice using internets	CO1, 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. Introduction to IoT: Definition and characteristics of IOT

Unit II 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-5 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 Kellmerein, "The Silent Intelligence: The Internet of Things". 2013, ISBN 0989973700

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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,CO4,CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3,CO4,CO5
CD3	Seminars	CO1, CO2, CO3,CO4
CD4	Self- learning advice using internets	CO1, CO2, CO3,CO4,CO5
CD5	Industrial visit	CO4, CO5

BTC SOE 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, drivers 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.

References:

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.

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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	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	-

BTC SOE 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.

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Course Outcome

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

CO1:	Create a mathematical model of Linear Programming problems and to solve the problems using various techniques
CO2:	Solve problems related to assignment, transportation, travelling salesman, Integer Programming.
CO3:	Solve the job sequencing problems and networking problems.
CO4:	Design and analyze project scheduling problems using CPM and PERT Techniques.
CO5:	Solve the optimization problems using Queuing models and Game Theory.

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	PO11	PO12	PSO1	PSO2
CO1	L4	H	H	H	M	H	M	L	-	M	M	M	H	H	M
CO2	L3	H	H	H	M	H	M	L	-	M	M	M	H	H	M
CO3	L3	H	H	H	M	H	M	L	-	M	M	M	H	H	M
CO4	L4	H	H	H	M	H	M	L	-	M	M	M	H	H	M
CO5	L4	H	H	H	M	H	M	L	-	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	-
CD4	Self- learning advice using internets	CO1, CO2, CO3,CO4,CO5
CD5	Industrial visit	-

BTCOE 704C: 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 TO MICRO AND SMART SYSTEMS: (b) Microsystems-Introduction, History and their evolution, Feynman's vision. Micromachined transducers. Evolution of micro-manufacturing. Multi-disciplinary aspects. Applications areas. Commercial products.

Unit-II 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-III Micro Manufacturing 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-IV 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.

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Unit-V 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.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

BTC SHSMC 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 and Ethics

1. Introduction to Philosophy : definition, nature and Scope, Concept, Branches
2. Ethics: definition, moral philosophy, nature of moral judgements and reaction

Unit II: Scientific Conduct

1. Ethics with respect to science and research
2. Intellectual honesty and research integrity
3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)
4. Redundant publications: duplicate and overlapping publications, salami slicing
5. Selective reporting and misrepresentation of data.

Unit III: Publication Ethics

1. Publication ethics: definition, introduction and importance
2. Best practices /Standards setting initiatives and guidelines: COPE, WAME, etc.,
3. Conflicts of interest
4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types
5. Violation of publication ethics, authorship and contributorship
6. Identification of publication misconduct, complaints and appeals
7. Predatory publishers and journals

Unit IV: Open Access Publishing and Publication Misconduct

1. Open access publications and initiatives
2. SHEERPA/RoMEO online resource to check publisher copyright & Self – archiving policies
3. Software tool to identify predatory publications developed by SPPU
4. Journal finder /Journal suggestion tools viz. JANE., Elsevier journal Finder, Springer Journal Suggester, etc.

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5. Subject specific ethical issues, FFP, authorship
6. Conflicts of interest
7. Complaints and appeals: examples and fraud from India and abroad.
8. Use of plagiarism software like Turnitin, Urkund and other open source software tools

Unit V: Databases and Research Metrics

A. Databases

1. Indexing databases
2. Citation databases: Web of Science, Scopus, etc.

B. Research Metrics

1. Impact Factor of Journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score
2. Metrics: h-index, g index, i10 index, alt metrics

Reference:

1. Bird, A.(2006). Philosophy of Science.Routledge
2. MacIntyre, 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.

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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 Outcomes	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L1	M	H	L	H	L	H	H	M	L	L	-	-	H	H
CO2	L2	H	H	M	M	M	L	-	L	-	L	-	M	M	M
CO3	L3	M	H	M	M	M	M	H	L	-	L	-	-	H	M
CO4	L4	H	H	M	M	M	-	H	-	L	M	-	M	M	M
CO5	L4	H	H	H	M	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	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 help students 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 the society
- To nurture a creative and entrepreneurial mindset
- To make students understand the personal values and apply ethical principles in professional and social contexts.

Course Contents:

Unit I Leadership Skills: Understanding Leadership and its Importance: What is leadership? Why Leadership required? Whom do you consider as an ideal leader? Traits and Models of Leadership: Are leaders born or made? Key characteristics of an effective leader, Leadership styles, Perspectives of different leaders. Basic Leadership Skills: Motivation, Team work, Negotiation, Networking. Innovative Leadership. Concept of emotional and social intelligence, Synthesis of human and artificial intelligence, Why does culture matter for today's global leaders.

Unit II Managerial Skills: Basic Managerial Skills, Planning for effective management, How to organise teams? Recruiting and retaining talent, Delegation of tasks, Learn to coordinate, Conflict management, Self Management Skills, Understanding self concept, Developing self-awareness, Self-examination, Self-regulation.

Unit III Entrepreneurial Skills: Basics of Entrepreneurship: Meaning of entrepreneurship, Classification and types of entrepreneurship, Traits and competencies of entrepreneur, Creating Business Plan, Problem identification and idea generation, Idea validation, Pitch making.

Unit IV Design Thinking: Design Thinking: What is design thinking? Key elements of design thinking: Discovery, Interpretation, Ideation- Experimentation – Evolution, How to transform challenges into opportunities?
How to develop human-centric solutions for creating social good?

Unit V Ethics and Integrity: Learning through Biographies: What makes an individual great? Understanding the persona of a leader for deriving holistic inspiration, Drawing insights for leadership, How leaders sail through difficult situations? Ethics and Conduct, Importance of ethics, Ethical decision making, Personal and professional moral codes of conduct, Creating a harmonious life

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Text Books:

1. Ashokan, M. S. (2015). *Karmayogi: A Biography of E. Sreedharan*. Penguin, UK.
2. Brown, T. (2012). *Change by Design*. Harper Business
3. Kalam A. A. (2003). *Ignited Minds: Unleashing the Power within India*. Penguin Books India
4. Kelly T., Kelly D. (2014). *Creative Confidence: Unleashing the Creative Potential Within Us All*. William Collins
5. McCormack M. H. (1986). *What They Don't Teach You at Harvard Business School: Notes From A Street-Smart Executive*. RHUS

Reference Books:

1. Sternberg R. J., Sternberg R. J., & Baltes P. B. (Eds.). (2004). *International Handbook of Intelligence*. Cambridge University Press.
2. E-Resources
3. India's Hidden Hot Beds of Invention Ted Talk by Anil Gupta - https://www.ted.com/talks/anil_gupta_india_s_hidden_hotbeds_of_invention
4. Knowledge@Wharton Interviews Former Indian President APJ Abdul Kalam - . "A Leader Should Know How to Manage Failure" <https://www.youtube.com/watch?v=laGZaS4sdeU>
5. NPTEL Course on Leadership - <https://nptel.ac.in/courses/122105021/9>

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Course Outcomes:

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

CO1:	Examine various leadership models and understand/assess their skills, strengths and abilities that affect their own 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, team leadership, etc.
CO3:	Understand the basics of entrepreneurship and develop business plans
CO4:	Apply the design thinking approach for leadership
CO5:	Discuss the importance of ethics and moral values for making of a balanced personality

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	L4	M	M	-	-	M	M	M	H	-	L	L	-	M	M
CO2	L3	M	M	M	M	M	M	L	M	-	M	M	-	M	M
CO3	L2	M	M	M	H	M	M	M	M	-	L	L	-	M	M
CO4	L3	M	M	M	M	M	M	M	H	-	L	L	-	M	M
CO5	L1	-	M	L	H	H	H	M	M	-	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	
CD4	Self- learning advice using internets	CO1, CO2,CO3, CO4, CO5
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.

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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, 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	

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 Linux 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.

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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:	Demonstrate Linux 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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 ,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	

BTCSPCCDS 708: Data Visualization Lab

Course Objectives:

- This course will introduce the main concepts of visual analytics with a hands-on tutorial using Tableau, a leading self-service data visualization tool.
- This course aims at learning about how to create effective charts and interactive dashboards will provide the student a very useful skill applicable in many business scenarios.

List of Experiments:

Experiment 1: Introduction to Tableau

- Course introduction
- Dataviz best practices
- Getting started with Tableau Desktop
- Connecting to the tutorial dataset
- Creating the first charts
- Filtering and sorting data

Experiment 2: Common charts

- Creating common visualizations (bar charts, line charts etc.)
- Assembling a dashboard layout
- Using dashboard filters

Experiment 3: Transform the data

- Dataviz best practices
- Creating simple calculations in Tableau
- Using table calculations

Experiment 4: Interactions

- Interactivity with text and visual tooltips
- Interactivity with actions (filter, highlight, URL)
- Drilldown between dashboards

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Experiment 5: Advanced visualizations

- Dataviz best practices
- Creating more advanced chart types
- Using multiple source tables

Experiment 6: Data Storytelling

- Intro to data storytelling
- Creating a data story in Tableau
- Overview of the Tableau ecosystem
- Further learning opportunities

System Requirements:

- System requirements are listed here under Tableau Desktop and Tableau Prep:
<https://www.tableau.com/products/techspecs>
- The latest version of Tableau Desktop as well as Tableau Prep should be downloaded and installed from here: <https://www.tableau.com/tft/activation>

Text Book:

1. Visualization Analysis & Design by Tamara Munzner (2014) (ISBN 9781466508910)

References Books:

1. Interactive Data Visualization for the Web by Scott Murray 2nd Edition (2017)
2. D3.js in Action by Elijah Meeks 2nd Edition (2017)
3. Semiology of Graphics by Jacques Bertin (2010)
4. The Grammar of Graphics by Leland Wilkinson
5. Ggplot2 Elegant Graphics for Data Analysis by Hadley Wickham

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Course Outcomes:

The student will be able to:

CO1:	Understand and describe the main concepts of data visualization
CO2:	Create ad-hoc reports, data visualizations, and dashboards using Tableau Desktop
CO3:	Publish the created visualizations to Tableau Server and Tableau Public
CO4:	Create a data story in Tableau
CO5:	Create more advanced chart types

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 between Objectives and Outcomes

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	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	CO1, CO2, CO3 ,CO4, CO5
CD3	Seminars	
CD4	Self- learning advice using internets	CO1, 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 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 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	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
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

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BTCSPROJ 710: 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

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BTC SHSMC 711: 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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

BTHSMC 712: ANANDAM

Objectives:

- To instil the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

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Semester–VIII

PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPROJ801	Project-II	PROJ	360	240	600	-	-	-	12
BTCSHSMC802	Social Outreach, Discipline & Extra Curricular Activities	HSMC	50	-	50	-	-	-	1
BTHSMC803	ANANDAM	AECC	50	50	100	-	-	-	2
	TOTAL		460	290	750	-	-	-	15

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BTCSPROJ 801: 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	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

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BTC SHSMC 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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

BTHSMC 803: ANANDAM

Objectives:

- To instill the joy of giving in young people, turning them into responsible citizens to build up a better society.
- To inculcate the habit of service in students across the University.
- A compulsory course of 2 credits per semester to be included in each program of University.
- Students to be expected to engage in individual and group acts of service and goodness.

Action Plan:

Students will be expected to

- Do at least one act of individual service each day
- Record this act of service in a dedicated Register / Personal Diary
- Share this Register / Personal Diary day in the Anandam Class scheduled per week. The class interaction will include Personal Diary check, Showing of Community based motivation videos, Community based presentations by students, Role playing etc.
- Undertake one group service project for 64 hours every semester (outside college hours)
- Upload the report on the group project on the Anandam platform
- Participate in a sharing and presentation on the group service in the discussion sessions held once in week
- There will be some suggested projects and organizations that students can work with. Students can also suggest their own projects which others can join

Each student will finish the year with a portfolio of giving. This will include their Register / Personal Diaries and their reports on group service projects.

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 of study, 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 in practical sessions. These sessions provide vital insights into scientific concepts and draw learner'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 provides great 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 learning while understanding the practical importance.
6. **Textbooks learning:** A large number of books are included in the list of references of each course for enrichment and enhancement of knowledge.
7. **E-learning:** Learner may also access electronic resources and educational websites for better understanding and updating the concepts.
8. **Self-study materials:** Self-study material provided by the teachers is an integral part of learning. 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 of theory 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 activities devoted 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.

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11. **Institute visits:** Institute visit by a learner is also a part of learning process. During such visits 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 MEASUREMENT 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. Class Tests 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 Grade Point 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

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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.

$$\text{SGPA (Si)} = \frac{\sum (C_i \times G_i)}{\sum C_i}$$

Where C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course. The university shall issue Semester Grade Card to the student.

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- 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.

$$\text{CGPA} = \frac{\sum (C_i \times S_i)}{\sum C_i}$$

Where S_i is the SGPA of the i th semester and C_i 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, $\text{SGPA} = 139/20 = 6.95$

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, $\text{CGPA} = \frac{20 \times 6.9 + 22 \times 7.8 + 25 \times 5.6 + 26 \times 6.0 + 26 \times 6.3 + 25 \times 8.0 + 24 \times 8.0 + 26 \times 8.0}{20 + 22 + 25 + 26 + 26 + 25 + 24 + 26} = 7.06$

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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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