Jagannath University

Faculty of Engineering & Technology

Syllabus

For

Bachelor of Technology (B. Tech.)
in
Computer Science & Engineering
(Specialization Data Science)
(Program Code: ET0141DS)
(2022-23)

Approved by the Academic Council vide resolution no 44.03 and dated 30.09.2022

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1. **INTRODUCTION**

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

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

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

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

   ii. Improving learning environment and academic resources.

   iii. Elevating the quality of teaching and research.

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

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

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

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

2. **LEARNING OUTCOME-BASED APPROACH TO CURRICULUM PLANNING**

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

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

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

   i. Modifications of prescribed syllabi.

ii. Teaching-learning methodology.

iii. Assessment technique of students and knowledge levels.

iv. Learning outcomes of courses.

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

2.1. Nature and Extent of Undergraduate Program

As a part of effort to enhance employability of engineering graduates the 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, andinterdisciplinary 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 needof Technology operations.

PEO4. Exhibit strong, independent learning, analytical and problem solving skills withspecial emphasis on design, communication, and ability to work in teams.

PEO5. To have successful career as engineering professional or a researcher throughlifelong 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 engineeringpractice.

GA7: **Self-directed learning with environment:** Ability to work independently and doin-depth study of various problems and requirements of society with natural

available resources which leads to sustainable development.

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

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

GA10: **Communication skills:**

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

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

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

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

GA11: **Project Management and Finance:** Ability to demonstrate knowledge and understanding of the engineering and management principles and apply these to one''s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

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

5. **QUALIFICATION DESCRIPTORS (QDs)**

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

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

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

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

II. Demonstrate educational skills in areas of their program.

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

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

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

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

6. **PROGRAM 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 responsibilitiesrelevant to the professional engineering practice.

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

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

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

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

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

PO12. **Lifelong learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Mapping of Graduate Attributes (GAs) and Program 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 Queuing 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**

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Semester–III

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSBSCDS301	**Probability and Queuing Theory**	Core	30	70	100	3	-	-	3
BTCSPCCDS302	**Foundation of AI & ML**	Core	30	70	100	3	-	-	3
BTCSPCCDS303	**Data Analytics using Python**	Core	30	70	100	3	-	-	3
BTCSPCC304	Data Structures and Algorithms	Core	30	70	100	3	-	-	3
BTCSPCC305	Object Oriented Programming	Core	30	70	100	3	-	-	3
BTCSPCC306	Database Management System	Core	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCC 307	Data Structures and Algorithms Lab	Core	30	20	50	-	-	1	1
BTCSPCC 308	Object Oriented Programming Lab	Core	30	20	50	-	-	1	1
BTCSPCC 309	Database Management System Lab	Core	30	20	50	-	-	1	1
BTCSPCCDS 310	**AI & ML Lab**	Core	30	20	50	-	-	1	1
BTCSPSIT 311	Technical Seminar	Core	50		50	-	-	1	1
BTCSSODECA 312	Social Outreach, Discipline & Extra Curricular Activities		50	-	50	-	-	-	1
BTBSC 313	ANANDAM	AECC	**50**	**50**	100	**1**	**-**	**1**	2
	TOTAL		**450**	**550**	**1000**	**19**	**-**	**6**	**26**

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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**	Core	30	70	100	3	1	0	4
BTCSHSMC402	Technical Communication	AECC	30	70	100	2	0	0	2
BTCSPCC403	**Mathematical Foundations For Data Science**	Core	30	70	100	3	0	0	3
BTCSPCC404	Software Engineering	Core	30	70	100	3	0	0	3
BTCSPCC405	Theory of Computation	Core	30	70	100	3	1	0	4
BTCSPCC406	Data Communication and Computer Networks	Core	30	70	100	3	0	0	3
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCC407	Internet & Web Technology Lab	Core	30	20	50	0	0	1	1
BTCSPCC408	Software Engineering Lab	Core	30	20	50	0	0	1	1
BTCSPCC409	Network Programming Lab	Core	30	20	50	0	0	1	1
BTCSPCC410	Linux Shell Programming Lab	Core	30	20	50	0	0	1	1
BTCSPCCDS 411	**R Lab**	Core	30	20	50	0	0	1	1
BTCSSODECA 412	Social Outreach, Discipline & Extra Curricular Activities		50		50				1
BTBSC 413	ANANDAM	AECC	**50**	**50**	100	**1**	-	**1**	2
	TOTAL		**430**	**570**	**1000**	**18**	**2**	**6**	**27**

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Semester –V

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCC 501	Java Programming	Core	30	70	100	3	-	-	3
BTCSPCCDS 502	**Deep Learning**	Core	30	70	100	3	-	-	3
BTCSPCC 503	Operating System	Core	30	70	100	3	-	-	3
BTCSPCC 504	Computer Graphics & Multimedia	Core	30	70	100	3	-	-	3
BTCSPCC 505	Analysis of Algorithms	Core	30	70	100	3	-	-	3
	Elective								
BTCSPEC 506A	Compiler Design	Elective	30	70	100	3	-	-	3
BTCSPEC 506B	Software Project Management	Elective	30	70	100	3	-	-	3
BTCSPEC 506C	Bioinformatics	Elective	30	70	100	3	-	-	3
BTBSC 507	Professional Skills (Career & Team)JeevanKaushal Modules	AECC	30	70	100	1	-	1	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCSPCC 508	Computer Graphics & Multimedia Lab	Core	30	20	50	-	-	1	1
BTCSPCCDS 509	**Deep Learning Lab**	Core	30	20	50	-	-	1	1
BTCSPCC 510	Analysis of Algorithms Lab	Core	30	20	50	-	-	1	1
BTCSPCC 511	Java Lab	Core	30	20	50	-	-	1	1
BTCSPSIT 512	Industrial Training	Core	30	20	50	-	-	1	1
BTCSSODE CA 513	Social Outreach, Discipline & Extra Curricular Activities		50	-	50				1
BTBSC 514	ANANDAM	AECC	50	50	100	1	-	1	2
	TOTAL		**460**	**640**	**1100**	**20**	**-**	**7**	**28**

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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	1	0	4
BTCSPCC 603	Information Security System	Core	30	70	100	3	0	0	3
BTCSPCC 604	Advance Computer Organization	Core	30	70	100	3	0	0	3
BTCSPCCDS 605	**Natural Language Processing (NLP)**	Core	30	70	100	3	1	0	4
	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		**430**	**570**	**1000**	**19**	**2**	**5**	**27**

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Semester–VII

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCC 701	**Business Intelligence and Data Visualization**	Core	30	70	100	3	1	-	4
BTCSPCC 702	**Social Network Analysis**	Core	30	70	100	3	1	-	4
	Elective Subject								
BTCSOECC703A	Internet of Things	Elective	30	70	100	3	1	0	4
BTCSOE703B	Operation Research	Elective	30	70	100	3	1	0	4
BTCSOE703C	**Research and Publication Ethics**	Elective	30	70	100	3	1	0	4
BTCSOE704A	**Big Data Analytics**	Elective	30	70	100	3	1	-	4
BTCSOECC704B	**Data Forensics**	Elective	30	70	100	3	1	-	4
BTCSOE704C	**Supply Chain Management**	Elective	30	70	100	3	1	-	4
BTBSC705	Leadership and Management Skills	AECC	30	70	100	1	-	1	2
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCC706	**Big Data Analytics Lab**	Core	30	20	50	0	0	1	1
BTCSPCC707	Internet of Things Lab	Elective	30	20	50	0	0	1	1
BTCSPCCCC708	**Data Visualization Lab**	Elective	30	20	50	0	0	1	1
BTCSPSIT 709	Industrial Training	Core	30	20	50	0	0	1	1
BTCSPSIT 710	*Project-I*	Core	60	40	100	0	0	2	2
BTCSSODE CA711	Social Outreach, Discipline &Extra Curricular Activities		50		50				1
BTBSC712	ANANDAM	AECC	50	50	100	1	-	1	2
	TOTAL		**430**	**520**	**950**	**14**	**4**	**8**	**27**

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Semester–VIII

PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPSIT 801	Project-II	Core	300	150	450	2	0	7	9
BTCSSODE CA 802	Social Outreach, Discipline & Extra Curricular Activities		50		50				1
BTBSC 803	ANANDAM	AECC	50	50	100	1	-	1	2
	TOTAL		**400**	**200**	**600**	**3**	**0**	**8**	**12**

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 194. However, the minimum credit required for award of degree shall be 188.
- 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**

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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

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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 Guptaon 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	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

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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 andNon-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 Madhucchanda (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

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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- Primarymemory, and Secondary storage, Random, Direct, Sequential access methods.

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

Unit III: Number system:

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

Unit IV: C Programming:

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

Unit V: Development of C programs using

Arrays, functions, parameter passing,recursion, Programming in C using these statements, Structures,files, pointers and multi file handling.

Text / Reference Books

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

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

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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. Kandya, A. A., Elements of Civil Engineering, Charotar Publishing house
3. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
4. Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house

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

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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	P011	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	P011	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	P011	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-outputstatement.
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

B.Tech. (Data Science)

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	P011	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	-----------

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

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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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
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	---------------------------------

B.Tech. (Data Science)

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 Drawinginstruments, lettering, Conic sections including parabola, hyperbola, RectangularHyperbola (General method only); Scales-Plain, Diagonal and Vernier Scales.

Projections of Point & Lines: Position of Point, Notation System, SystematicApproach for projections of points, front view & Top view of point, Position ofstraight 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 ofthe plane, Distance of a point from plane, Angle between two planes.

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

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

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

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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	P011	PO12	PSO1	PSO2
CO1	L2	H	M	L	M	L	L	-	-	L	M	-	L	L	M
CO2	L4	H	M	L	M	L	L	-	-	-	M	-	L	L	M
CO3	L1	H	M	L	M	L	L	-	-	L	M	-	L	L	L
CO4	L2	H	H	M	H	L	L	-	-	L	H	-	M	M	M
CO5	L2	H	M	M	M	L	L	-	-	L	M	-	M	L	L

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

Mapping between CO and CD

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

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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

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

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

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**

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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, 9thEdition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9thEdit ion, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.

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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/Dulongs formula, proximate analysis & ultimate and combustion of fuel.

Unit III: Corrosion and its control

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

Unit IV: Engineering Materials

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

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Unit V: **Organic reaction mechanism and introduction of drugs**

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

Suggested Text / Reference Books

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

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

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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 andProcess for Value Education**

Understanding the need, basic guidelines, Self Exploration – itscontent and process; 'Natural Acceptance' and Experiential Validation,Continuous Happiness and Prosperity- Human Aspirations, Rightunderstanding, Relationship and Physical Facilities,UnderstandingHappiness and Prosperity correctly- A critical appraisal of the currentscenario.Method to fulfill the above human aspirations: understanding andliving 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' andthe material 'Body'Understanding the needs of Self ('I') and 'Body' - Sukh and SuvidhaUnderstanding the Body as an instrument of 'I',Understanding thecharacteristics and activities of 'I' and harmony in 'I' Understandingthe harmony of I with the Body: Sanyam and Swasthya; correctappraisal of Physical needs, meaning of Prosperity in detail, Programsto ensure Sanyam and Swasthya.

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

Understanding harmony in the Family, Understanding values inhuman-human relationship; meaning of Nyaya and program for itsfulfillment 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 (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- 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 allpervasive 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**

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, 2ndedition, 2015.
3. Mathur, U C CorporateGovernance and business ethics,MacMillan India Ltd, 2009.
4. Baxi, C V: CorporateGovernance, 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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	

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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 thermalengineering, mechanical machine design, industrial engineering andmanufacturing technology.Steam Boilers classification and types of steam boilers and steamturbines. Introduction and Classification of power plants.

Unit II: Pumps and IC Engines:

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

Unit III: Refrigeration and Air Conditioning:

Introduction, classification and types of refrigeration systems andair-conditioning. Applications of refrigeration and Air-conditioning.

Unit IV: Transmission of Power:

Introduction and types of Belt and Rope Drives, Gears.

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

Text Books:
- Agarwal C M, Agarwal Basant "Basic Mechanical Engineering" 2019

Reference Books
- Shanmugam G, Ravindran S "Basic Mechanical Engineering" TMH Publication , 2019
- Bansal R K "Basic Mechanical Engineering" Laxmi Publication 2019

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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	P011	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, Nodevoltage method, Mesh current method, Superposition, Thevenin's, Norton's and Maximum power transfer theorems.

Unit II: **AC Circuits:**

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

Unit III: **Transformers:**

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

Unit IV: **Electrical Machines:**

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

Unit V: **Power Converters:**

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

Suggested Text / Reference Books

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

Course Outcomes:

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

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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 manmadeproblems, 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.

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 basic 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 massage of this course grasped by you. How has this affected you in terms of;

    a. Thought

    b. Behavior

    c. Work and

    d. Relization

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 massage of this course grasped by you.
CO5:	List ac 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 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	P011	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 internets	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 andother metal pieces.
- To develop machining skills in students.

Carpentry Shop

1. T – Lap joint
2. Bridle joint

Foundry Shop

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

Welding Shop

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

Machine Shop Practice

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

Fitting and Sheet Metal Shop

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

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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	P011	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, capacitorsand inductors.

2. Transformers: Observation of the no-load current waveform on anoscilloscope. Loading of a transformer: measurement of primary andsecondary voltages and currents, and power.

3. Three-phase transformers: Star and Delta connections. Voltage and Currentrelationships (line-line voltage, phase-to-neutral voltage, line and phasecurrents).Phase-shifts between the primary and secondary side.

4. Demonstration of cut-out sections of machines: dc machine (commutate orbrusharrangement), induction machine (squirrel cage rotor), synchronous(field winging - slip ring arrangement) and single-phase induction

5. Torque Speed Characteristic of separately excited dc motor.

6. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d)Components of LT switchgear.

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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	P011	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	

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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 ofdimensioning.

Conversion of pictorial views into orthographic views: (1 drawing sheet)Introduction to orthographic prdcojection, concept of first angle and third angleprojection, drawing of simple machine elements in first angle projection, missingview 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 orbroken section, revolved section, removed section, offset section, sectioningconventions-spokes, web rib, shaft, pipes, different types of holes, conventions ofsection lines for different metals and materials.

Fasteners and other mechanical components: (Free hand sketch) Temporaryand 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 knucklejoints. Riveted joints, rivets and riveting, type of rivets, types of riveted joints etc.Bearing: Ball, roller, needle, foot step bearing. Coupling: Protected type, flange, andpin 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 CADsoftware such as: The menu System, Toolbars (Standard, Object Properties, Draw,Modify and Dimension), Drawing Area (Background, Crosshairs, CoordinateSystem), Dialog boxes and windows, Shortcut menus (Button Bars), CommandLine (Where applicable), The Status Bar, Different methods of zoom as used inCAD, Select and erase objects.: Isometric Views of Lines, Planes, Simple andcompound 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	P011	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	P011	PO12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

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

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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.

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Semester–III

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSBSCDS301	**Probability and Queuing Theory**	Core	30	70	100	3	-	-	3
BTCSPCCDS302	**Foundation of AI & ML**	Core	30	70	100	3	-	-	3
BTCSPCCDS303	**Data Analytics using Python**	Core	30	70	100	3	-	-	3
BTCSPCC304	Data Structures and Algorithms	Core	30	70	100	3	-	-	3
BTCSPCC305	Object Oriented Programming	Core	30	70	100	3	-	-	3
BTCSPCC306	Database Management System	Core	30	70	100	3	-	-	3
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCC 307	Data Structures and Algorithms Lab	Core	30	20	50	-	-	1	1
BTCSPCC 308	Object Oriented Programming Lab	Core	30	20	50	-	-	1	1
BTCSPCC 309	Database Management System Lab	Core	30	20	50	-	-	1	1
BTCSPCCDS 310	**AI & ML Lab**	Core	30	20	50	-	-	1	1
BTCSPSIT 311	Technical Seminar	Core	50		50	-	-	1	1
BTCSSODECA 312	Social Outreach, Discipline & Extra Curricular Activities		50	-	50	-	-	-	1
BTBSC 313	ANANDAM	AECC	**50**	**50**	100	**1**	**-**	**1**	2
	TOTAL		**450**	**550**	**1000**	**19**	**-**	**6**	**26**

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BTCSBSCDS301:   Probability and Queuing Theory

Course Objective:

- To learn basics of probability in connection with discrete and continuous instances along with real world phenomenon of standard distributions.
- To understand and apply two dimensional random variables and markov process.
- To understand the queuing models at the end of the course.
- To understand and apply the sampling theory.

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   **Standard Distributions and Two Dimensional Random Variables:** Binomial, Poisson, Geometric, Uniform, Exponential, Weibull and Normal distributions and their properties. Joint distributions - Marginal and conditional distributions – Covariance – Correlation and regression - Transformation of random variables - Central limit theorem

Unit III: **Sampling Theory**: Hypothesis testing, Test of significance, t- test, Chi square test and F- test.

Unit IV   **Random Processes and Markov Chains:** Classification - Stationary process - Markov process - Poisson process - Birth and death process - Markov chains - Transition probabilities - Limiting distributions. Transition Diagram.

Unit-V   **Queuing Theory:** Markovian models – M/M/1, M/M/C, finite and infinite capacity - M/M/∞ queues - Finite source model - M/G/1 queue (steady state solutions only) – Pollaczek – Khintchine formula. Tools for statistical analysis.

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.

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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 Queueing Theory; Wiley Series 2018.

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. ManicavachagomPillay, G. Ramanaiah, *Advanced mathematics for engineering students*, S. Viswanathan Pvt.. Ltd., 1985.

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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. Apply and solve two dimensional random variable problems through joint distributions and central limit theorem
CO3:	Use the sampling theory to determine the significance of the differences.
CO4:	Analyze probabilistic environment using random process and markov chain techniques.
CO5:	Build and implement queuing model associated to stochastic process.

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L3	H	M	H	M	L	M	-	-	M	-	M	H	H	M
CO2	L3	H	M	M	M	L	M	-	-	M	-	M	H	H	M
CO3	L4	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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BTCSPCCDS302: Foundation of AI & ML

Course objective:

- This course is an introduction to the modern AI and ML with equal emphasis on foundational concepts and practice on real world problems.

- To expose foundations of modern AI along with enough attention to the recent explosion of machine learning techniques such as deep learning.

- The content of the course is split into three modules which are delivered in the form lectures, hands-on session, case-studies and real world projects.

Course Contents:

Unit I: Introduction to Data Science and AI & ML, Data Science, AI & ML , Use Cases in Business and Scope , Scientific Method , Modeling Concepts , CRISP-DM Method

Unit II: R Essentials (Tutorial) Programming, Commands and Syntax, Packages and Libraries, Introduction to Data Types , Data Structures in R - Vectors, Matrices, Arrays, Lists, Factors, Data Frames, Importing and Exporting Data.   Control structures and Functions Descriptive Statistics, Data exploration (histograms, bar chart, box plot, line graph, scatter plot) , Qualitative and Quantitative Data , Measure of Central Tendency (Mean, Median and Mode)

Unit III: Statistical Analysis Initial Data Analysis, Relationship between attributes: Covariance, Correlation Coefficient, Chi Square, Measure of Distribution (Skewness and Kurtosis), Box and Whisker Plot (Box Plot and its parts, Using Box Plots to compare distribution) and other statistical graphs

Unit IV: Data Acquisition, Gather information from different sources. Internal systems and External systems. Web APIs, Open Data Sources, Data APIs, Web Scrapping, Relational Database access (queries) to process/access data. Data Pre-processing and Preparation, Data Munging, Wrangling, Plyr packages Cast/Melt Handling Text Data, Bag-of-words,

Unit V: Regular Expressions, Sentence Splitting and Tokenization , Punctuations and Stop words, Incorrect spellings, Properties of words and Word cloud, Data Quality and Transformation, Data imputation , Data Transformation (minmax, log transform, z-score transform etc.,). Binning, Classing and Standardization. Outlier/Noise & Anomalies

Text Books:

1. Artificial Intelligence and Machine Learning Fundamentals: Develop real-world applications powered by the latest AI advances Zsolt Nagy

2. Foundations of Machine Learning MehryarMohri, AfshinRostamizadeh, AmeetTalwalkar MIT Press, 17-Aug-2012

3. Artificial Intelligence – A Modern Approach (3rd Edition)– By Stuart Russell & Peter Norvig

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Course Outcomes:

CO1	Explain the capabilities, strengths and limitations of various artificial intelligence and machine learning techniques
CO2	Explain various AI and machine learning algorithms and their applications
CO3	Describe learning models and algorithms Professional Skill
CO4	Apply selected AI and machine learning algorithms to solve real world problems
CO5	Understand complex ideas and relate them to specific situations, the ability to evaluate available learning methods and select those appropriate to solve a given task

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	P011	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

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BTCSPCCDS303:   Data Analytics using Python

Course Objectives:-

- This course is designed to teach students how to analyze different types of data using Python.
- Students will learn how to prepare data for analysis, perform simple statistical analysis, create meaningful data visualizations and predict future trends from data.

Course Contents:

Unit I: Python Fundamentals for Data Analysis Python data structures, Control statements, Functions, Object Oriented programming concepts using classes, objects and methods, Exception handling, Implementation of user-defined Modules and Package, File handling in python.

Unit II: Introduction to Data Understanding and Preprocessing Knowledge domains of Data Analysis, Understanding structured and unstructured data, Data Analysis process, Dataset generation, Importing Dataset: Importing and Exporting Data, Basic Insights from Datasets, Cleaning and Preparing the Data: Identify and Handle Missing Values.

Unit III: Data Processing and Visualization Data Formatting, Exploratory Data Analysis, Filtering and hierarchical indexing using Pandas. Data Visualization: Basic Visualization Tools, Specialized Visualization Tools, Seaborn Creating and Plotting Maps.

Unit IV: Mathematical and Scientific applications for Data Analysis Numpy and Scipy Package, Understanding and creating N-dimensional arrays, Basic indexing and slicing, Boolean indexing, Fancy indexing, Universal functions, Data processing using arrays, File input and output with arrays**.**

Unit V: Analyzing Web Data, Data wrangling, Web scrapping, Combing and merging data sets, Reshaping and pivoting, Data transformation, String Manipulation, case study for web scrapping. Unit VI: Model Development and Evaluation Introduction to machine learning- Supervised and Unsupervised Learning, Model development using Linear Regression, Model Visualization, Prediction and Decision Making, Model Evaluation: Over-fitting, Under-fitting and Model Selection.

Text Books

1. David Ascher and Mark Lutz, Learning Python, Publisher O'Reilly Media.
2. ReemaThareja, "Python Programming using Problem Solving approach", Oxford University press
3. Wes Mckinney "Python for Data Analysis", First edition, Publisher O'Reilly Media.

Reference Books

1. Allen Downey ,JeffreyElkner ,Chris Meyers,: Learning with Python, Dreamtech Press
2. David Taieb ,"Data Analysis with Python: A Modern Approach " 1st Edition, Packt Publishing

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Course Outcomes:

CO1	Understanding basics of python for performing data analysis
CO2	Understanding the data, performing preprocessing, processing and data visualization to get insights from data.
CO3	Use different python packages for mathematical, scientific applications and for web data analysis.
CO4	Develop the model for data analysis and evaluate the model performance.
CO5	Learning methods development and modeling

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	P011	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

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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	P011	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: 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	P011	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

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

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BTCSPCC 306: 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, Joints, Division, Relation Calculus, Expressive Power of Algebra and Calculus.

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

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

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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", Addision Wesley.

2 Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill

3 Elmasri, Navathe, "Fundamentals of Database Systems", Addision Wesley

4 Leon & Leon, "Database Management System", Vikas Publishing House.

5 Bipin C. Desai, "An introduction to Database Systems", Galgotia Publication

6 Ramakrishnan, Gehrke, "Database Management System", McGraw Hill

7 Kroenke, "Database Processing: Fundamentals, Design and Implementation", Pearson.

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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	P011	PO12	PSO1	PSO2
CO1	L1	H	L	M	L	H	-	-	-	L	L	L	M	M	M
CO2	L2	H	M	M	M	M	-	-	-	-	M	L	L	M	M
CO3	L2	H	L	M	L	H	-	-	-	-	L	L	M	M	M
CO4	L3	H	H	H	H	M	-	-	-	L	H	L	L	H	M
CO5	L2	H	H	M	H	M	-	-	-	L	H	M	L	H	M

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

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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:

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

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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	P011	PO12	PSO1	PSO2
CO1	L1	H	M	H	M	M	-	-	-	L	M	L	L	M	L
CO2	L3	M	M	H	M	L	-	-	-	-	M	L	M	M	L
CO3	L3	M	M	H	M	L	-	-	-	L	M	-	L	H	M
CO4	L3	H	L	H	L	L	-	-	-	-	L	-	M	M	M
CO5	L4	H	M	H	M	M	-	-	-	M	M	L	L	M	L

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.

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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	P011	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

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BTCSPCC 309: 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	P011	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	-

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BTCSPCCDS 310: AI & ML Lab

Course Objectives:

- To provide a strong foundation of fundamental concepts in Artificial Intelligence.
- To provide a basic exposition to the goals and methods of Artificial Intelligence.
- To apply the techniques in applications which involve perception, reasoning and learning.

Course Outcomes: Upon successful completion of the course, the student will be able to:

- Apply the basic principles of AI in problem solving using LISP/PROLOG
- Implement different algorithms using LISP/PROLOG
- Develop an Expert System using JESS/PROLOG

List of Experiments (Artificial Intelligence)

1. Implementation of DFS for water jug problem using LISP/PROLOG

2. Implementation of BFS for tic-tac-toe problem using LISP/PROLOG/Java

3. Implementation of TSP using heuristic approach using Java/LISP/Prolog

4. Implementation of Simulated Annealing Algorithm using LISP/PROLOG

5. Implementation of Hill-climbing to solve 8- Puzzle Problem

6. Implementation of Monkey Banana Problem using LISP/PROLOG

List of Experiments (Machine Learning)

1. Implement and demonstrate FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .csv file.

2. For a given set of training data examples stored in a .csv file, implement and demonstrate the candidate elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

3. Write a program to demonstrate the working of the decision tree classifier. Use appropriate dataset for building the decision tree and apply this knowledge to classify a new sample.

4. Write a program to demonstrate the working of Decision tree regressor. Use appropriate dataset for decision tree regressor.

5. Write a program to demonstrate the working of Random Forest classifier. Use appropriate dataset for Random Forest Classifier.

6. Write a program to demonstrate the working of Logistic Regression classifier. Use appropriate dataset for Logistic Regression.

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Course Outcomes:

CO1.	Explain artificial intelligence, its characteristics and its application areas.
CO 2.	Formulate real-world problems as state space problems, optimization problems or constraint satisfaction problems.
CO 3.	Select and apply appropriate algorithms and AI techniques to solve complex problems.
CO4.	Design and develop an expert system by using appropriate tools and techniques.
CO5.	Implement the Regression Techniques

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	L4	L	M	H	L	L	-	L	-	-	L	-	L	M	L

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

Mapping between CO and CD

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

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BTCSPSIT 311: Technical 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	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	L1	M	H	L	H	L	-	-	-	-	M	-	L	M	M

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

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BTCSSODECA 312: 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	P011	PO12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

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

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BTBSC313: 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**	Core	30	70	100	3	1	0	4
BTCSHSMC402	Technical Communication	AECC	30	70	100	2	0	0	2
BTCSPCC403	**Mathematical Foundations For Data Science**	Core	30	70	100	3	0	0	3
BTCSPCC404	Software Engineering	Core	30	70	100	3	0	0	3
BTCSPCC405	Theory of Computation	Core	30	70	100	3	1	0	4
BTCSPCC406	Data Communication and Computer Networks	Core	30	70	100	3	0	0	3
PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCC407	Internet & Web Technology Lab	Core	30	20	50	0	0	1	1
BTCSPCC408	Software Engineering Lab	Core	30	20	50	0	0	1	1
BTCSPCC409	Network Programming Lab	Core	30	20	50	0	0	1	1
BTCSPCC410	Linux Shell Programming Lab	Core	30	20	50	0	0	1	1
BTCSPCCDS 411	**R Lab**	Core	30	20	50	0	0	1	1
BTCSSODECA 412	Social Outreach, Discipline & Extra Curricular Activities		50		50				1
BTBSC 413	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	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

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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

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BTCSHSMC 402: Technical Communication

Course Objectives: -

- To understand the characteristics of technical writing
- To understand complex engineering ideas for targeted audiences.
- To understand the advance technical writing in professional documents.
- To write effective technical and business documents that are grammatically and stylistically correct

Course Contents:

Unit I **Introduction to Technical Communication-** Definition of technical communication, Aspects of technical communication, forms of technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.

Unit II **Comprehension of Technical Materials/Texts and Information Design & development-** Reading of technical texts, Reading and comprehending instructions and technical manuals, Interpreting and summarizing technical texts, Note-making. Introduction of different kinds of technical documents, Information collection, factors affecting information and document design, Strategies for organization, Information design and writing for print and online media.

Unit III **Technical Writing, Grammar and Editing**- Technical writing process, forms of technical discourse, Writing, drafts and revising, Basics of grammar, common error in writing and speaking, Study of advanced grammar, Editing strategies to achieve appropriate technical style, Introduction to advanced technical communication. Planning, drafting and writing Official Notes, Letters, E-mail, Resume, Job Application, Minutes of Meetings.

Unit IV Technical Reports, types of technical reports, Characteristics and formats and structure of technical reports. Technical Project Proposals, types of technical proposals,

Unit V **Advanced Technical Writing**- Characteristics and formats and structure of technical proposals.Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.

Text/Reference Books:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, M004
2. M. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, M003. (ISBN 031M406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York, M003.
4. Raman Sharma, Technical Communications, Oxford Publication, London, M004.
5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, M004. (ISBN: 078M8357-4)
6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi M00M.
7. Xebec, Presentation Book, TMH New Delhi, M000. (ISBN 040MM13)

B.Tech. (Data Science)

Course Outcomes:

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

CO1:	Define basic communication skills used in technical areas.
CO2:	Understand technical materials, texts and information design & development.
CO3:	Adapt an effective oral presentation, displaying the ability to engage the audience by employing a suitable delivery style, appropriate language and quality visual aids.
CO4:	Explain Technical Reports and its types & features
CO5:	Understand the structure and formats of technical articles and proposals

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

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L1	-	-	-	-	L	L	-	-	L	M	L	H	M	M
CO2	L2	-	-	-	-	M	L	-	-	L	M	L	H	L	M
CO3	L3	-	-	-	-	L	L	-	-	L	M	L	H	M	M
CO4	L2	-	-	-	-	L	L	-	-	L	M	L	H	L	M
CO5	L2	-	-	-	-	M	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 / Presentations	CO3, CO4, CO5
CD4	Project Discussions	CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO2, CO4, CO5

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BTCSPCC403: Mathematical Foundations For Data Science

Course Objective:

- To introduce with Stochastic Process.
- To learn multivariate analysis.
- To know classification methods, factor analysis, cluster analysis and graphical representations of multivariate data.

Course Content:

Unit I: Stochastic Process: Markov chains with stationary transition probabilities, properties of transition functions, classification of states, Stationary distribution of a Markov chain, existence and uniqueness, convergence to the stationary distribution. Methods based on Markov chains for simulation of random vectors. MCMC algorithm. Random Walks, queueing processes, branching processes. Gambler's ruin problem, transient states.

Unit II: Multivariate Analysis: Multivariate distributions :multivariate normal distribution and its properties, distributions of linear and quadratic forms, tests for partial and multiple correlation coefficients and regression coefficients and their associated confidence regions.

Unit III: Data analytic illustrations. Wish art distribution (definition, properties), construction of tests, union- intersection and likelihood ratio principles, inference on mean vector, Hotelling's T2.MANOVA- Inference on covariance matrices.

Unit IV: Classification methods: Discriminant analysis, principal component analysis andfactor analysis, Canonical Correlation analysis, Correspondence Analysis, Multidimensional Scaling,

Unit V: Cluster analysis. Non parametric and robust methods of multivariate analysis. Graphical representation of multivariate data.

References:

1. W.Feller: An Introduction to Probability Theory and itsApplications,Vol.-II.
2. S.Karlin andH.M.Taylor, A First Course in Stochastic Processes.
3. WilliamJ. Stewart,Probability, Markov Chains, Queues and Simulation.
4. P.G.Hoel,S.C.PortandC.J.Stone, Introduction to Stochastic Processes.
5. S. Ross, Introduction to Probability Models.
6. T.W.Anderson,An Introduction to Multivariate Statistical Analysis

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Course Outcomes:

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

CO1:	Analyze the Stochastic Process.
CO2:	Understand the multivariate analysis, distributions.
CO3:	Understand the inferences concept.
CO4:	Understand the classification methods.
CO5:	Understand the cluster analysis and graphical representation of multivariate data..

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L4	H	H	H	H	M	H	M	M	H	M	H	H	H	M
CO2	L4	H	H	M	H	M	H	M	M	H	M	H	H	H	M
CO3	L4	H	H	M	H	M	H	M	M	H	M	H	H	H	M
CO4	L4	H	H	M	H	M	H	M	M	H	M	H	H	H	M
CO5	L4	H	H	M	H	M	H	M	M	H	M	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	CO1,CO2, CO3, CO4, CO5
CD3	Seminars / Presentations	CO1,CO2, CO3, CO4, CO5
CD4	Project Discussions	CO1,CO2, CO3, CO4, CO5
CD5	Self- learning advice using internets	CO1,CO2,CO4,CO5

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BTCSPCC 404: 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	P011	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

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BTCSPCC 405: Theory of Computation

Course Objectives:

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

Course Contents:

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

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, Un-decidability, examples of these problems like vertex cover problem, Hamiltonian path problem, traveling sales man problem.

References:

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

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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

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L3	H	L	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

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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	P011	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

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

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BTCSPCC 407: Internet and 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 <span> 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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BTCSPCC 408: 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.

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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	P011	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	-

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	P011	PO12	PSO1	PSO2
CO1	L3	H	M	H	M	M	_	-	-	-	M	L	L	M	M
CO2	L2	M	M	H	M	L	-	-	-	-	M	L	M	M	M
CO3	L2	M	M	H	M	L	-	-	-	-	M	L	L	H	M
CO4	L2	H	H	H	H	-	-	-	-	-	H	L	M	H	M
CO5	L3	H	M	H	M	M	-	-	-	-	M	L	L	H	M

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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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, dfspace, du, ulimit.

2. Commands related to inode, I/O redirection and piping, process control commands, mails.

3. Shell Programming: Shell script based on control structure -If-then-fi, if-then-else-if, nested if -else, to find:

    3.1 Greatest among three numbers.

    3.2 To find a year is leap year or not.

    3.3 To input angles of a triangle and find out whether it is valid triangle or not.

    3.4 To check whether a character is alphabet, digit or special character.

    3.5 To calculate profit or loss.

4. Shell Programming Looping-while, until, for loops

    4.1 Write a shell script to print all even and odd number from 1 to 10.

    4.2 Write a shell script to print table of a given number

    4.3 Write a shell script to calculate factorial of a given number.

    4.4 Write a shell script to print sum of all even numbers from 1 to 10.

    4.5 Write a shell script to print sum of digit of any number.

5. Shell Programming - case structure, use of break

    5.1 Write a shell script to make a basic calculator which performs addition, subtraction, Multiplication, division

    5.2 Write a shell script to print days of a week.

    5.3 Write a shell script to print starting 4 months having 31 days.

6. Shell Programming -Functions

    6.1 Write a shell script to find a number is Armstrong or not.

    6.2 Write a shell script to find a number is palindrome or not.

    6.3 Write a shell script to print Fibonacci series.

    6.4 Write a shell script to find prime number.

    6.5 Write a shell script to convert binary to decimal and decimal to binary

7. Write a shell script to print different shapes -Diamond, triangle, square, rectangle, hollow square etc.

8. Shell Programming –Arrays

    8.1 Write a C program to read and print elements of array.

    8.2 Write a C program to find sum of all array elements.

    8.3 Write a C program to find reverse of an array.

    8.4 Write a C program to search an element in an array.

    8.5 Write a C program to sort array elements in ascending or descending order.

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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	P011	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	-

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BTCSPCCDS411:   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	P011	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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BTCSSODECA 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	P011	PO12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

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

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BTBSC413: 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 –V

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCC 501	Java Programming	Core	30	70	100	3	-	-	3
BTCSPCCDS 502	**Deep Learning**	Core	30	70	100	3	-	-	3
BTCSPCC 503	Operating System	Core	30	70	100	3	-	-	3
BTCSPCC 504	Computer Graphics & Multimedia	Core	30	70	100	3	-	-	3
BTCSPCC 505	Analysis of Algorithms	Core	30	70	100	3	-	-	3
	Elective								
BTCSPEC 506A	Compiler Design	Elective	30	70	100	3	-	-	3
BTCSPEC 506B	Software Project Management	Elective	30	70	100	3	-	-	3
BTCSPEC 506C	Bioinformatics	Elective	30	70	100	3	-	-	3
BTBSC 507	Professional Skills (Career & Team)JeevanKaushal Modules	AECC	30	70	100	1	-	1	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCSPCC 508	Computer Graphics & Multimedia Lab	Core	30	20	50	-	-	1	1
BTCSPCCDS 509	**Deep Learning Lab**	Core	30	20	50	-	-	1	1
BTCSPCC 510	Analysis of Algorithms Lab	Core	30	20	50	-	-	1	1
BTCSPCC 511	Java Lab	Core	30	20	50	-	-	1	1
BTCSPSIT 512	Industrial Training	Core	30	20	50	-	-	1	1
BTCSSODECA 513	Social Outreach, Discipline & Extra Curricular Activities		50	-	50				1
BTBSC 514	ANANDAM	AECC	50	50	100	1	-	1	2
	TOTAL		**460**	**640**	**1100**	**20**	**-**	**7**	**28**

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BTCSPCC 501:   Java Programming

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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.

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	P011	PO12	PSO1	PSO2
CO1	L2	H	M	M	M	-	-	-	-	M	L	-	L	L	L
CO2	L2	H	H	M	H	-	-	-	-	L	L	-	L	L	L
CO3	L1	H	H	M	H	-	-	-	-	M	L	-	L	M	M
CO4	L3	H	H	L	H	-	-	-	-	L	L	-	M	M	M
CO5	L3	M	H	H	H	-	-	-	-	L	L	-	M	H	M

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

Mapping between CO and CD

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

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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	P011	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 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	P011	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, Addision , 1999
- David F.Rogers, Procedural Elements for Computer Graphics, McGraw Hill Book Company
- D.Heam and P.Baker, Computer Graphics, Prentice Hall 1986
- R.Plastock and G.Kalley, Theory and Problems of Computer Graphics, Schaum's Series., 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	P011	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 Np, Np-Hard And Np-Complete: Definitions of P, NP-Hard and NP-Complete Problems. Decision Problems.Cook's Theorem.Proving NP Complete Problems - Satisfiability problem and Vertex Cover Problem. Approximation Algorithms for Vertex Cover and Set Cover Problem

Text/Reference Books:

- Design and Analysis of Algorithm; Horowitz and Sahani
- Introduction to Algorithm Design ; Corman
- Design and Analysis of Computer Algorithms ; Aho, Pearson

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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 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	P011	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

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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 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	P011	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	P011	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	-

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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 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	P011	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	-

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BTBSC507: 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 between Objectives and Outcomes

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 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	P011	PO12	PSO1	PSO2
CO1	L3	H	H	M	H	L	-	-	-	-	H	-	L	M	M
CO2	L3	H	L	M	L	M	-	-	-	-	L	-	M	H	M
CO3	L2	H	H	M	H	L	-	-	-	-	H	-	L	H	M
CO4	L1	H	M	H	M	H	-	-	-	-	M	-	L	H	M
CO5	L1	H	M	M	M	H	-	-	-	-	L	-	L	H	M

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

Mapping between CO and CD

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

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	P011	PO12	PSO1	PSO2
CO1	L2	H	M	L	M	L	L	-	-	L	M	-	L	L	M
CO2	L4	H	M	L	M	L	L	-	-	-	M	-	L	L	M
CO3	L1	H	M	L	M	L	L	-	-	L	M	-	L	L	L
CO4	L2	H	H	M	H	L	L	-	-	L	H	-	M	M	M
CO5	L2	H	M	M	M	L	L	-	-	L	M	-	M	L	L

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

Mapping between CO and CD

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

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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	P011	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	-

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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 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	P011	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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BTCSPSIT 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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BTCSSODECA 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	P011	PO12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

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

BTBSC514: 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–VI

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCCDS601	**Business Process Management**	Core	30	70	100	3	-	-	3
BTCSPCCDS602	**Data Privacy & Security**	Core	30	70	100	3	1	0	4
BTCSPCC 603	Information Security System	Core	30	70	100	3	0	0	3
BTCSPCC 604	Advance Computer Organization	Core	30	70	100	3	0	0	3
BTCSPCCDS605	**Natural Language Processing (NLP)**	Core	30	70	100	3	1	0	4
	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**
BTCSPCCDS607	**Business Process Management Lab**	Core	**30**	**20**	**50**	**0**	**0**	**1**	**1**
BTCSPCCDS608	**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
BTCSSODECA611	Social Outreach, Discipline & Extra Curricular Activities		50		50				1
BTBSC 612	ANANDAM	AECC	50	50	100	1	-	1	2
	TOTAL		**430**	**570**	**1000**	**19**	**2**	**5**	**27**

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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	P011	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	P011	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

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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	P011	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,

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BTCSPCC 604: Advance Computer Organization

Course Objective:

- To introduce the students to the recent trends in the field of Computer Architecture and identify performance related parameters.
- To learn the different multiprocessor issues.
- To expose the different types of multicore architectures.
- To understand the design of the memory hierarchy.

Course Contents:

Unit I: Fundamentals of Computer Design – Measuring and Reporting Performance – Instruction Level Parallelism and its Exploitation – Concepts and Challenges – Exposing ILP - Advanced Branch Prediction - Dynamic Scheduling - Hardware-Based Speculation - Exploiting ILP - Instruction Delivery and Speculation - Limitations of ILP – Multithreading

Unit II: Introduction – Optimizations of Cache Performance – Memory Technology and Optimizations – Protection: Virtual Memory and Virtual Machines – Design of Memory Hierarchies – Case Studies.

Unit III: Introduction- Centralized, Symmetric and Distributed Shared Memory Architectures –Cache Coherence Issues – Performance Issues – Synchronization – Models of Memory Consistency – Case Study-Interconnection Networks – Buses, Crossbar and Multi-stage Interconnection Networks

Unit IV: Homogeneous and Heterogeneous Multi-core Architectures – Intel Multicore Architectures – SUN CMP architecture – IBM Cell Architecture. Introduction to Warehouse-scale computers Architectures- Physical Infrastructure and Costs- Cloud Computing –Case Study- Google Warehouse-Scale Computer.

Unit V: Introduction-Vector Architecture – SIMD Extensions for Multimedia – Graphics Processing Units – Case Studies – GPGPU Computing – Detecting and Enhancing Loop Level Parallelism-Case Studies.

Text & References books:

1. Darryl Gove, ―Multicore Application Programming: For Windows, Linux, and Oracle Solaris‖, Pearson, 2011

2. David B. Kirk, Wen-mei W. Hwu, ―Programming Massively Parallel Processors‖, Morgan Kauffman, 2010

3. David E. Culler, Jaswinder Pal Singh, ―Parallel computing architecture : A hardware/software approach‖ , Morgan Kaufmann /Elsevier Publishers, 1999

4. John L. Hennessey and David A. Patterson, ―Computer Architecture – A Quantitative Approach‖, Morgan Kaufmann / Elsevier, 5th edition, 2012.

5. Kai Hwang and Zhi.WeiXu, ―Scalable Parallel Computing‖, Tata McGraw Hill, NewDelhi, 2003

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Course Outcomes:

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

CO1 :	Identify the limitations of ILP.
CO2 :	Discuss the issues related to multiprocessing and suggest solutions
CO3 :	Point out the salient features of different multicore architectures and how they exploit parallelism.
CO4 :	Discuss the various techniques used for optimising the cache performance
CO5:	Point out how data level parallelism is exploited in architectures

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

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	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,CO4,CO5
CD2	Tutorials/Assignments	CO1, CO2, CO3
CD3	Seminars	CO2
CD4	Self- learning advice using internets	CO2, CO3,CO4,CO5
CD5	Industrial visit	

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BTCSPCCDS 605: Natural Language Processing

Course Objective:

- Understand leading trends and systems in natural language processing
- Describe concepts of morphology, syntax, semantics and pragmatics of the language
- Understand Language Models and its evaluation
- Describe and analyse language · POS tagging and context free grammar for English language
- Writing programs in Python to carry out natural language processing
- Implement deep learning algorithms in Python and learn how to train deep networks for NLP

Course Contents:

Unit I: Introduction - terminologies - empirical rules – Statistical Properties of words – Probability and NLP – Vector Space Models - Pre-processing- Tokenization, Parts-Of-Speech (POS) tagging, chunking, syntax parsing, Dependency parsing.

Unit II: NLP Applications: Named Entity Recognition, Sentiment analysis, Text categorization: Basic supervised text categorization algorithms, including Naive Bayes, k Nearest Neighbor (kNN) and Logistic Regression. Topic modeling: SVD and Latent semantic Indexing, Probabilistic Latent Semantic Indexing (pLSI) and Latent Dirichlet Allocation (LDA).

Unit III: Introduction to Deep Learning: Neural Networks Basics, Feedforward Neural Network, Recurrent Neural Networks, LSTM, An Introduction to Transformers and Sequence-to-Sequence Learning.

Unit IV: Neural Networks for NLP – Vector Representation of words – Contextual Understanding of text – Concurrence of matrix – N-grams – Dense Word Vector. Word2Vec – CBOW and Skip-gram Models – One-word learning architecture-Forward pass for Word2Vec – Reduction of complexity – sub sampling and negative sampling. Continuous Skip-Gram Model, GloVe, BERT, XLNet

Unit V: Historical Approaches to Machine Translation – Statistical Machine Translation – Translation Models – Healthcare Data analysis and Text visualization: Summarizing lengthy blocks of narrative text, such as a clinical note or academic journal article. Answering unique free-text queries that require the synthesis of multiple data sources. Introduce Mathematical and programming tools to visualize a large collection of text documents.

Text Book / References

1. C.D. Manning et al, "Foundations of Statistical Natural Language Processing," MitPress.MITPress, 1999.isbn: 9780262133609.

2. James Allen, "Natural Language Processing with Python", O'Reilly Media, July 2009.

3. NiladriSekhar Dash and S. Arulmozi, Features of a Corpus. Singapore: Springer Singapore,2018, pp. 17–34. ISBN: 978-981-10-7458-5.

4. Ian Good fellow, YoshuaBengio, and Aaron Courville, Deep Learning,http://www.deeplearningbook.org. MIT Press, 2016.

5. NitinIndurkhya and Fred J Damerau, "Handbook of natural language processing," Chapmanand Hall/CRC, 2010.

6. Daniel Jurafsky and James H. Martin "Speech and Language Processing: An Introductionto Natural Language Processing, Computational Linguistics, and Speech Recognition," 1st. Upper Saddle River, NJ, USA: Prentice Hall PTR, 2000. isbn: 0130950696.

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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	P011	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	P011	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

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BTCSPEC 606B: Cloud Computing

Course Objectives:

- To understand the basics of Cloud Computing.
- To understand the movement from a traditional network infrastructure to a Cloud solution.

Course Contents:

Unit I: Introduction: Objective, scope and outcome of the course. Introduction Cloud Computing: Nutshell of cloud computing, Enabling Technology, Historical development, Vision, feature Characteristics and components of Cloud Computing. Challenges , Risks and Approaches of Migration into Cloud. Ethical Issue in Cloud Computing, Evaluating the Cloud's Business Impact and economics, Future of the cloud. Networking Support for Cloud Computing. Ubiquitous Cloud and the Internet of Things

Unit II: Cloud Computing Architecture: Cloud Reference Model, Layer and Types of Clouds, Services models, Data centre Design and inter connection Network, Architectural design of Compute and Storage Clouds. Cloud Programming and Software: Fractures of cloud programming, Parallel and distributed programming paradigms-Map Reduce, Had oop, High level Language for Cloud. Programming of Google App engine.

Unit III: Virtualization Technology: Definition, Understanding and Benefits of Virtualization. Implementation Level of Virtualization, Virtualization Structure/Tools and Mechanisms, Hypervisor VMware, KVM, Xen. Virtualization: of CPU, Memory, I/O Devices,Virtual Cluster and Resources Management, Virtualization of Server, Desktop, Network, and Virtualization of data-centre

Unit IV: Securing the Cloud: Cloud Information security fundamentals, Cloud security services, Design principles, Policy Implementation, Cloud Computing Security Challenges, Cloud Computing Security Architecture .Legal issues in cloud Computing. Data Security in Cloud: Business Continuity and Disaster Recovery, Risk Mitigation, Understanding and Identification of Threats in Cloud, SLA-Service Level Agreements, Trust Management

Unit V: Cloud Platforms in Industry: Amazon web services, Google App Engine, Microsoft Azure Design, Aneka: Cloud Application Platform-Integration of Private and Public Clouds Cloud applications: Protein structure prediction, Data Analysis, Satellite Image Processing, CRM

Text/ Reference Books:

- " Distributed and Cloud Computing " By Kai Hawang , Geofrey C.Fox, Jack J. Dongarra Pub: Elservier
- Cloud Computing ,Principal and Paradigms, Edited By Rajkumar Buyya, Jemes Broberg, A. Goscinski, Pub.- Wiley
- Kumar Saurabh, "Cloud Computing" , Wiley Pub
- Krutz , Vines, "Cloud Security " , Wiley Pub
- Velte, "Cloud Computing- A Practical Approach" ,TMH Pub

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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	P011	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	P011	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	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	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

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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 Languaage 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 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	P011	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	-

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BTCSPCC 609: Cyber Security Lab

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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 Cipherb) 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	P011	PO12	PSO1	PSO2
CO1	L3	H	M	H	M	L	-	-	-	-	M	-	L	M	M
CO2	L2	H	H	M	H	L	-	-	-	-	H	-	L	H	H
CO3	L2	H	M	L	M	M	-	-	-	-	M	-	M	H	H
CO4	L3	H	M	H	M	L	-	-	-	-	M	-	L	M	M
CO5	L1	M	M	L	M	M	-	-	-	-	M	-	M	H	H

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

Mapping between CO and CD

CD	Course Delivery methods	Course Outcomes
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, CO2, CO3,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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BTCSPCC 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	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	L1	M	H	L	H	L	-	-	-	-	M	-	L	M	M

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

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BTCSSODECA 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	P011	PO12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

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

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.

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Semester–VII

Code	Subject/Paper	Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPCC 701	**Business Intelligence and Data Visualization**	Core	30	70	100	3	1	-	4
BTCSPCC 702	**Social Network Analysis**	Core	30	70	100	3	1	-	4
	Elective Subject								
BTCSOECC703A	Internet of Things	Elective	30	70	100	3	1	0	4
BTCSOE703B	Operation Research	Elective	30	70	100	3	1	0	4
BTCSOE703C	**Research and Publication Ethics**	Elective	30	70	100	3	1	0	4
BTCSOE704A	**Big Data Analytics**	Elective	30	70	100	3	1	-	4
BTCSOECC704B	**Data Forensics**	Elective	30	70	100	3	1	-	4
BTCSOE704C	**Supply Chain Management**	Elective	30	70	100	3	1	-	4
BTBSC705	Leadership and Management Skills	AECC	30	70	100	1	-	1	2
PRACTICALS/ VIVA VOCE		**Type**	**Internal Marks**	**External Marks**	**Total**	**L**	**T**	**P**	**Credits**
BTCSPCC706	**Big Data Analytics Lab**	Core	30	20	50	0	0	1	1
BTCSPCC707	Internet of Things Lab	Elective	30	20	50	0	0	1	1
BTCSPCCCC708	**Data Visualization Lab**	Elective	30	20	50	0	0	1	1
BTCSPSIT 709	Industrial Training	Core	30	20	50	0	0	1	1
BTCSPSIT 710	*Project-I*	Core	60	40	100	0	0	2	2
BTCSSODE CA711	Social Outreach, Discipline &Extra Curricular Activities		50		50				1
BTBSC712	ANANDAM	AECC	50	50	100	1	-	1	2
	TOTAL		**430**	**520**	**950**	**14**	**4**	**8**	**27**

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	P011	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

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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

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	P011	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

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BTCSPCC 703A: 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 Kellmereit, "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	P011	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

BTCSOE 703B: 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	P011	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	-

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BTCSOE703C: 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 andreaction

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, salamislicing
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.

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. Maclntyre, Alasdair (1967) A Short History of Ethics. London

3. P.Chaddah, (2018) Ethics in Competitive Research: Do not get Scooped; do not get Plagiarized, ISBN : 978-9387480865

4. National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009). On Being a Scientist: A Guide to responsible conduct in Research: Third Edition, National Academies Press.

5. Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance (2019), ISBN:978-81-939482-1-7
http://www.insaindia.res.in/pdf/Ethics_Book.pdf.

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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	P011	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

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BTCSOE704A: 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	P011	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	

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BTCSOECC704B: Data Forensics

Course Objectives:-

- Describe digital forensics and relate it to an investigative process.
- Explain the legal issues of preparing for and performing digital forensic analysis based on the investigator's position and duty.
- Perform basic digital forensics.
- Demonstrate use of digital forensics tools.

Course Contents:

Unit I: **Introduction:** Understanding of forensic science, digital forensic, The digital forensic process, Locard's exchange principle, Scientific models, Basic computer organization, File system, Memory organization concept, Data storage concepts.

Unit II: **Digital Forensics Process Model:** Introduction to cybercrime scene, Documenting the scene and evidence, maintaining the chain of custody, forensic cloning of evidence, Live and dead system forensic, Hashing concepts to maintain the integrity of evidence, Report drafting.

Unit III: **Computer Operating system Artifacts:** Finding deleted data, hibernating files, examining window registry, recycle bin operation, understanding of metadata, Restore points and shadow copies, Legal aspects of digital forensics: Understanding of legal aspects and their impact on digital forensics, Electronics discovery.

Unit IV: Understanding of digital Forensic tools Quality assurance, Tool validation, Tool selection, Hardware and Software tools 3 6 Case Study: Understanding of Internet resources, Web browser, Email header forensic, social networking sites .

Unit V: Binary Code Analysis (Guest lecturer: Alex Berry), Evidence: collection, preservation, testimony.

Legal Community Panel, Research Challenges, TBD , Media Analysis: disk structure, file systems (NTFS, EXT 2/3, HFS), and physical layer issues, Live Collection

Reference Books:

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Course Outcomes:

CO1:	Describe Forensic science and Digital Forensic concepts
CO2:	Determine various digital forensic Operandi and motive behind cyber attacks .
CO3:	Interpret the cyber pieces of evidence, Digital forensic process model and their legal perspective.
CO4:	Demonstrate various forensic tools to investigate the cybercrime and to identify the digital pieces of evidence.
CO5:	Analyze the digital evidence used to commit cyber offences.

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	P011	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

BTCSOE 704C: Supply Chain Management

Course Objectives:

• To learn about the role of supply chain management in value, customers and pricing. Also to understand how to integrate a manufacturing unit with customer.

• Logistics as movement of smooth flow of material movement with optimizing the warehousing, transportation and network of materials transfer.

• To describe the increasing significance of logistics and its impact on both costs and service in business and commerce.

Course Contents:

Unit I   Introduction: Nature of supply chains, Historical perspective, objectives, importance, decision phases and process views of supply chain. Supply chain performance: competitive and supply chain strategies, achieving strategic fit and its challenges. Supply chain drivers and metrics: Impellers of supply chain, financial measures of performance, derivers of supply chain performance, framework for structuring drivers.

Unit II   Logistics Management: Scope and definition, historical perspective, Value added nature of logistics, logistics and supply chain management, customer service and logistics, key issues and challenges for logistics. Designing the supply chain network: Designing distribution networks: Role of distribution in supply chain, factors influencing distribution network design, design options for a distribution network, online sales and distribution network. Network design in supply chain: role of network design, factors influencing network design decisions, framework for network design decisions. Impact of globalization on supply chain networks.

Unit III   Demand forecasting in a supply chain, Aggregate planning in a supply chain, Sales and operations are planning in supply chain, Coordination in a supply chain: Bullwhip effect, effect on performance, obstacles to coordination in a supply chain, continuous replenishment and vendor managed inventories, collaborative planning forecasting and replenishment.

Unit IV   Planning and Managing inventories in a supply chain: Managing economies of scale in supply chain, managing uncertainty in supply chain, determination of optimal level of product availability

Unit V   Designing and planning transportation network: Role of transportation in a supply chain, modes of transportation and their performance, transportation infrastructure and policies, design options for a transportation network, tradeoffs, tailored transportation.

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	P011	PO12	PSO1	PSO2
CO1	L2	H	M	M	M	-	-	-	-	M	L	-	L	L	L
CO2	L2	H	H	M	H	-	-	-	-	L	L	-	L	L	L
CO3	L1	H	H	M	H	-	-	-	-	M	L	-	L	M	M
CO4	L3	H	H	L	H	-	-	-	-	L	L	-	M	M	M
CO5	L3	M	H	H	H	-	-	-	-	L	L	-	M	H	M

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

Mapping between CO and CD

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

BTBSC 705: 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 pportunities?

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 Bbiography 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

Refrence 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 between Objectives and Outcomes

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	

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BTCSPCC706: 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	P011	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	

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BTCSPCC707: Internet of Things Lab

Course Objectives:

- To focus on research – design and development of IoT enabled technologies which are cost effective and socially relevant.

- To develop trained manpower (through student projects/research) in the field of IoT based application development.

List of Experiments

1. Start Raspberry Pi and try various Linix commands in command terminal window:

   ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip, cat, more, less, ps, sudo, cron, chown, chgrp, ping etc.

2. Run some python programs on Pi like:
   a) Read your name and print Hello message with name
   b) Read two numbers and print their sum, difference, product and division.
   c) Word and character count of a given string.
   d) Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input.

3. Run some python programs on Pi like:
   a) Print a name 'n' times, where name and n are read from standard input, using for and while loops.
   b) Handle Divided by Zero Exception.
   c) Print current time for 10 times with an interval of 10 seconds.
   d) Read a file line by line and print the word count of each line.

4. a) Light an LED through Python program

   b) Get input from two switches and switch on corresponding LEDs

   c) Flash an LED at a given on time and off time cycle, where the two times are taken from a file.

5. a) Flash an LED based on cron output (acts as an alarm)

   b) Switch on a relay at a given time using cron, where the relay's contact terminals are connected to a load.

   c) Get the status of a bulb at a remote place (on the LAN) through web.

6. The student should have hands on experience in using various sensors like temperature, humidity, smoke, light, etc. and should be able to use control web camera, network, and relays connected to the Pi.

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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	P011	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	

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BTCSPCCCC708: 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	P011	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	

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BTCSPSIT 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	P01 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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BTCSPSIT 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	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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BTCSSODECA711: 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	P011	PO12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

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

B.Tech. (Data Science)

<div align="center">

BTBSC 712: ANANDAM

</div>

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–VIII

PRACTICALS/ VIVA VOCE		Type	Internal Marks	External Marks	Total	L	T	P	Credits
BTCSPSIT 801	Project-II	Core	300	150	450	2	0	7	9
BTCSSODE CA 802	Social Outreach, Discipline & Extra Curricular Activities		50		50				1
BTBSC 803	ANANDAM	AECC	50	50	100	1	-	1	2
	TOTAL		**400**	**200**	**600**	**3**	**0**	**8**	**12**

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BTCSPSIT 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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BTCSSODECA 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	P011	PO12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

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

BTBSC 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 ofstudy, tutorials are essential requirements. During these tutorials, difficulties faced by the students in understanding the lectures, are dealt with. Tutorials are also aimed at solving problems associated with the concepts discussed during the lectures.

3. **Practical:** To provide scientific visualization and obtaining results of Technical program inpractical sessions. These sessions provide vital insights into scientific concepts and drawlearner's attention towards limitations of scientific computations. During practical, scientific models arising in real life problems can also be simulated.

4. **Choice based learning/Open elective:** LOCF in this undergraduate program providesgreat flexibility both in terms of variety of courses and range of references in each course.

5. **Field based learning:** Students may enhance their knowledge through field based learningwhile understanding the practical importance.

6. **Textbooks learning:** A large number of books are included in the list of references of eachcourse for enrichment and enhancement of knowledge.

7. **E-learning:** Learner may also access electronic resources and educational websites for betterunderstanding and updating the concepts.

8. **Self-study materials:** Self-study material provided by the teachers is an integral part oflearning. It helps in bridging the gaps in the classroom teaching. It also provides scope for teachers to give additional information beyond classroom learning.

9. **Assignment/Problem solving:** Assignments at regular intervals involving applications oftheory are necessary to assimilate basic concepts of courses. Hence, it is incumbent on the part of a learner to complete open-ended projects assigned by the teacher.

10. **Internships:** The teaching-learning process needs to be further supported by other activitiesdevoted to subject-specific and interdisciplinary skills, summer and winter internships. During these internships it is expected that a learner will interact with experts and write a report on a topic provided to the learner.

11. **Institute visits:** Institute visit by a learner is also a part of learning process. During suchvisits a learner has access to knowledge by attending academic activities such as seminars, colloquia, library consultation and discussion with faculty members. These activities provide guidance and direction for further study.

12. **Industrial visits:** Industrial visits offer an opportunity to observe applications of scientific concepts. These visits also give an opportunity to realize the power of mathematical ideas and their translation in problem solving.

13. **Training programs:** Training programs organized by various agencies/institutes provide an opportunity to learn various dimensions of courses.

12. ASSESSMENT AND OUTCOME MESUAREMENT METHODS (AOMM):

A range of assessment methods which are appropriate to test the understanding of various concepts of courses will be used. Various learning outcomes will be assessed using time-bound examinations, problem solving, assignments and viva-voce examination. For various courses in this program, the following assessment methods shall be adopted:

i Scheduled/unscheduled tests

ii. Problem solving sessions aligned with classroom lectures

iii. Practical assignments

iv. Regular chamber consultation with faculty members

v. 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

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.

$$\text{SGPA } (Si) = \Sigma (Ci \times Gi) / \Sigma Ci$$

Where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith 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.

$$CGPA = \Sigma (C_i \times S_i) / \Sigma C_i$$

Where S_i is the SGPA of the ith 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, SGPA= 139/20= 6.95

b) **Illustration for CGPA**

Semester -1	Semester -2	Semester -3	Semester -4	Semester -5	Semester -6	Semester -7	Semester -8
Credit: 20	Credit: 22	Credit: 25	Credit: 26	Credit: 26	Credit: 25	Credit: 24	Credit: 26
SGPA:6.9	SGPA:7.8	SGPA:5.6	SGPA:6.0	SGPA:6.3	SGPA:8.0	SGPA:8.0	SGPA:8.0

Thus, CGPA=

$$\frac{20\times6.9+22\times7.8+25\times5.6+26\times6.0+26\times6.3+25\times8.0+24\times8.0+26\times8.0}{} = \textbf{7.06}$$

13.   TEACHERS TRAINING (TT):

Learning Outcomes Based Curriculum Framework (LOCF) Quality initiative of UGC based on Outcome Based Education (OBE) is being implemented by the University Grants Commission to enhance the Quality of Higher Education and that of Higher Education Learners and Teachers. Therefore, university arrange following activities for teachers training:

1.   Workshops for LOCF implementation.

2.   Seminar for LOCF implementation.

3.   FDP on LOCF.

4.   Outcome based higher education and understanding the learning objectives, learning outcomes, new approaches in the area of outcome measurement, preparing future ready teachers and students.

5.   Developing a battery of quality speakers/educators to become resource persons to play role for Training of Trainers (TO

14.   KEY WORDS:

LOCF, CBCS, Course Learning Outcomes, Employability, Graduate Attributes Communication Skills, Critical Thinking, and Descriptors.

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