- Approval Date of the BOS Meeting for the Present Syllabus

Name of the program	Program Code	Dates of Revision
B.Tech CSE (AI)	350	18/01/2021

SCHOOL OF EGINEERING SCIENCES AND TECHNOLOGY

Vision Statement (School Level): To become the best institution in the national and international map in terms of quality of teaching and research, technical knowledge and academics in the field Computer Science & Engineering, Electronics & Communication Engineering, Bioinformatics with sincere honesty adding values in the core aspect of students' life.

Mission Statements (3 to 4) (School Level):

MS1: To offer state-of-the-art undergraduate, postgraduate and doctoral programs in Computer Science & Engineering, Electronics and Communication Engineering & Engineering and Bioinformatics.

MS 2: To provide one of the best working environments to motivate faculty and students to work towards vision of the Department.

MS 3: To develop association with industry, other Universities/Institute/Research Laboratories and work in collaboration with them.

MS 4: To use our expertise in all the relevant disciplines for helping society in solving its real life problem.

MS 5: To develop entrepreneurship skills in the students so that they can become problem solver and innovative developer and contribute to the society by providing employment to others.

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Vision Statement (Department/Centre Level): To become the best institution in the national and international map in terms of quality of teaching and research, technical knowledge and academics in the field Computer Science & Engineering, Electronics & Communication Engineering, Bioinformatics with sincere honesty adding values in the core aspect of students' life.

Mission Statements (3 to 4) (Department/Centre Level):

MS1: To offer state-of-the-art undergraduate, postgraduate and doctoral programs in Computer Science & Engineering, Electronics and Communication Engineering & Engineering and Bioinformatics.

MS 2: To provide one of the best working environments to motivate faculty and students to work towards vision of the Department.

MS 3: To develop association with industry, other Universities/Institute/Research Laboratories and work in collaboration with them.
MS 4: To use our expertise in all the relevant disciplines for helping society in solving its real life problem.

MS 5: To develop entrepreneurship skills in the students so that they can become problem solver and innovative developer and contribute to the society by providing employment to others.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Upon the completion of Academic Programme (B.Tech in CSE (Artificial Intelligence)

PEO1: Engineering Graduates will have the ability to adapt, contribute and innovate new technologies and systems in the key domains of Computer Science and Engineering.
PEO2: Engineering Graduates will have the ability to adapt, contribute and innovate new technologies and systems in the key domains of Computer Science and Engineering.
PEO3: Engineering Graduates will be able to perform in technical/managerial roles ranging from design, development, problem solving to production support in software industries and R&D sectors.
PEO4: Engineering Graduates will have the ability to explore research areas and produce outstanding contribution in various areas of Systems Engineering.
PEO5: Engineering Graduates will have sound knowledge of AI Concepts that can helps to invent novel solution for a particular problema in the multidisciplinary work environmnet.

Mapping Program Educational Objectives (PEOs)
with Mission Statements (MS)

	MS-1	MS-2	MS-3	MS-4	MS-5
PEO-1	3	2	2	1	1
PEO-2	2	1	3	3	3
PEO-3	1	2	2	3	3
PEO-4	2	3	2	2	2
PEO-5	2	2	3	3	3

Write ‘3’ in the box for ‘high-level’ mapping, 2 for ‘Medium-level’ mapping, 1 for ‘Low-level’ mapping.

Program Outcomes

On successful completion of the Program, the graduates of B. Tech. CSE (AI) Program will be able to

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **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.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:
On successful completion of the Program, the graduates of B.Tech. CSE (AI) Program will be able to:
PSO1: Apply adaptive algorithms and techniques to develop intelligent systems for solving problems from inter-disciplinary domains.

PSO2: Develop and apply Artificial Intelligence techniques to perform human intelligence tasks such as vision, language processing and speech recognition.

PSO3: Acquire Skills to model the AI assisted decision making systems and to analyse the data from these systems to arrive at appropriate decisions.

with Program Educational Objectives (PEOs)

	PEO-1	PEO-2	PEO-3	PEO-4	PEO-5
PO-1	3	3	2	2	1
PO-2	3	3	1	2	1
PO-3	3	2	2	2	3
PO-4	2	3	2	3	2
PO-5	3	2	2	3	2
PO-6	2	3	3	1	2
PO-7	2	3	3	2	2
PO-8	2	3	2	3	1
PO-9	1	2	3	2	3
PO-10	2	2	1	2	2
PO-11	2	2	3	2	1
PO-12	1	2	2	3	3
PSO-1	3	2	3	2	3
PSO-2	2	3	2	2	2
PSO-3	3	2	3	2	3

Mapping of Program Specific Outcomes (PSOs) where applicable.

Write ‘3’ in the box for ‘high-level’ mapping, 2 for ‘Medium-level’ mapping, 1 for ‘Low-level’ mapping.

Course Outcomes:

CO1: To develop an understanding of the basic concepts and techniques of linear algebra, calculus and basic probability theory needed for AI.
CO2: To provide an appreciation of the wide application of these disciplines within the scientific field.

CO3: To provide connection between the concepts of linear algebra, differential equation and probability theory.
CO4: To develop an insight into the applicability of linear algebra in business and scientific domains.
CO5: To equip the students to understand the role of probability theory in providing data sets for computational experiments in data science.

ADMISSION & EXAMINATION RULES

For
BACHELOR OF TECHNOLOGY COMPUTER SCIENCE AND ENGINEERING (EARTIFICIAL INTELLIGENCE)
B. TECH. CSE (AI)

2. THE PROGRAMME

Highlights of the course are described in the following table:

2.1 B.TECH CSE (AI)

a.	Name of the Programme	BACHELOR OF TECHNOLOGY CSE (Artificial Intelligence) B. TECH CSE(AI)
b.	Nature	Regular and Full Time
c.	Duration	Four Years (8 Semesters)
d.	Total number of credits	195
e.	Medium of Instruction and English Examinations	English
f.	Eligibility Criteria	A candidate seeking admission to this program must have passed Senior Secondary (12th / Intermediate) examination with Mathematics and Physics compulsory, and one subject out of the following: Computer Science, Chemistry, Electronics from CBSE or any other Board recognized by Jamia Hamdard as equivalent thereto, securing at least 50% marks or equivalent CGPA in aggregate.

	Selection procedure	Selection will be based on merit in Paper-1 (B.E. /B.Tech.) of JEE (Main) In case the seats remain unfilled, Jamia Hamdard may admit candidates on the basis of merit of qualifying examination or the merit of internal test and/or Interview conducted by Jamia Hamdard which will be announced separately, if situation arises.
h.	Total Seats	60, inclusive of seats reserved for NRI / sponsored candidates; additional seats are available for Foreign Nationals.
i.	Period of Completion	Not more than 07 years (14 Semesters)
j.	Commencement of the Programme	July of the every academic session

3. PROGRAMME STRUCTURE

Semester-wise course structure, guidelines for teaching, practical and associated assessment of the programme is described in the following tables:

Course Type	**Subject Area**	**Credits**	**Percentage (%)** *(Approx.)*
Foundation Core (FC)	Humanities and Social Sciences (HS), including Management	12	23
	Basic Sciences(BS) including Mathematics, Physics, Chemistry, Biology	31	
Professional Core (PC)	Engineering Science (ES) courses including Workshop, Drawing, Basics of Electrical/ Mechanical/ Computer etc	18	62
	Professional core courses	89	
	Project Work, Seminar and/or Internship in Industry or elsewhere.	15	

Departmental Electives (DE)	Professional Elective (DE) courses relevant to chosen specialization/branch	15	4.5
Open Electives (OE)	Open subjects – Electives (OE) from other technical and /or emerging subjects	6	6
Mandatory Courses (MC)	Mandatory Courses (MC)	0	Non-Credit
MOOCS	Online Courses	9	4.5
Total		195	**100**

Course Codes:

Course code	**Definitions**
BS	Basic Science Courses
ES	Engineering Science Courses
HS	Humanities and Social Sciences including Management courses
PC	Professional core courses
DE	Departmental Elective courses
OE	Open Elective courses
LC	Laboratory course
MC	Mandatory courses
PROJ	Project
DISS	Dissertation
MOOCs	Massive Open Online Courses

Mandatory Induction Program of 3 weeks duration (Non-Credit)

- Physical activity
- Creative Arts
- Universal Human Values
- Literary
- Proficiency Modules
- Lectures by Eminent People
- Visits to local Areas
- Familiarization to Dept./Branch & Innovations

Induction program for students will be offered right at the start of the first year.
L-T-P stands for number of contact hours as Lecture-Tutorial-Practical in a week.

A. **Definition of Credit:**

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

B. Range of credits:
A total credits 192 is required for a regular student and a total credit of 150 is required for a lateral entry student to be eligible to get Under Graduate degree in Engineering. A student will be eligible to get Under Graduate degree with Honors', if he/she completes an additional 20 credits. These could be acquired through MOOCs.

Semester – I

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 101	Applied Physics I	BS	25	75	100	3-1-0	4
BTCSEAI 102	Mathematics-I	BS	25	75	100	3-1-0	4
BTCSEAI 103	Basic Electrical Engineering	ES	25	75	100	3-1-0	4

BTCSEAI 104	Engineering Graphics & Design	ES	25	75	100	1-0-0	1
BTCSEAI 105	Applied Physics I Lab	BS	25	75	100	0-0-4	2
BTCSEAI 106	Basic Electrical Engineering Lab	ES	25	75	100	0-0-2	1
BTCSEAI 107	Engineering Graphics & Design Lab	ES	25	75	100	0-0-4	2
BTCSEAI 108	Essence of Indian Traditional knowledge	MC	25	75	100	2-0-0	0
					Total	**12-3-10**	**18**

Semester – II

Paper Code	**Title of the Paper**	**Course type**	**Marks**			**L-T-P**	**Credits**
			Internal Assessment	**Semester Exam**	**Total**		
BTCSEAI 201	Applied Physics II	BS	25	75	100	3-1-0	4
BTCSEAI 202	Probability and Statistics for AI	BS	25	75	100	3-1-0	4
BTCSEAI 203	Programming for Problem Solving	ES	25	75	100	3-0-0	3
BTCSEAI 204	Introduction to Artificial Intelligence	PC	25	75	100	3-0-0	3
BTCSEAI 205	English Language	HS	25	75	100	2-0-0	2
BTCSEAI 206	Applied Physics – II Lab	BS	25	75	100	0-0-4	2
BTCSEAI 207	Programming for Problem Solving Lab	ES	25	75	100	0-0-4	2

BTCSEAI 208	English Language Lab	HS	25	75	100	0-0-2	1
BTCSEAI 209	Environmental Sciences	MC	25	75	100	2-0-0	0
					Total	**16-2-10**	**21**

Semester – III

Paper Code	**Title of the Paper**	**Course Type**	**Marks**			**L-T-P**	**Credits**
			Internal Assessment	**Semester Exam**	**Total**		
BTCSEAI 301	Analog Electronic Circuits	ES	25	75	100	3-0-0	3
BTCSEAI 302	Chemistry	BS	25	75	100	3-1-0	4
BTCSEAI 303	Data structure & Algorithms	PC	25	75	100	3-0-0	3
BTCSEAI 304	Digital Electronics	PC	25	75	100	3-0-0	3
BTCSEAI 305	Programming with Python	PC	25	75	100	3-0-0	3
BTCSEAI 306	Effective Technical Communication	HS	25	75	100	3-0-0	3
BTCSEAI 307	Analog Electronic Circuits Lab	ES	25	75	100	0-0-4	2
BTCSEAI 308	Data structure & Algorithms Lab	PC	25	75	100	0-0-4	2
BTCSEAI 309	Digital Electronics Lab	ES	25	75	100	0-0-4	2
BTCSEAI 310	Programming with Python LAB	PC	25	75	100	0-0-4	2

BTCSEAI 311	Mathematics for Machine Learning & AI	BS	25	75	100	3-1-0	4
					Total	**21-2-16**	**31**

Semester – IV

Paper Code	**Title of the Paper**	**Course type**	**Marks**			**L-T-P**	**Credits**
			Internal Assessment	**Semester Exam**	**Total**		
BTCSEAI 401	Discrete Mathematics	PC	25	75	100	3-1-0	4
BTCSEAI 402	Computer Organization and Architecture	PC	25	75	100	3-1-0	4
BTCSEAI 403	Operating Systems	PC	25	75	100	3-1-0	4
BTCSEAI 404	Design and Analysis of Algorithms	PC	25	75	100	3-1-0	4
BTCSEAI 405	Object Oriented Programming	PC	25	75	100	3-0-0	3
BTCSEAI 406	Computer Organization and Architecture + Operating Systems Lab	PC	25	75	100	0-0-4	2
BTCSEAI 407	Design and Analysis of Algorithms Lab	PC	25	75	100	0-0-4	2
BTCSEAI 408	Object Oriented Programming Lab	PC	25	75	100	0-0-4	2

BTCSEAI 409	Disaster Management	PC	25	75	100	3-0-0	3
BTCSEAI 410	Data Mining & Prediction by Machines	PC	25	75	100	3-0-0	3
BTCSEAI 411	Data Mining & Prediction by Machines Lab	PC	25	75	100	0-0-4	2
					Total	**21-4-16**	**33**

Semester – V

Paper Code	**Title of the Paper**	**Course type**	**Marks**			**L-T-P**	**Credits**
			Internal Assessment	**Semester Exam**	**Total**		
BTCSEAI 501	Machine Learning	PC	25	75	100	3-0-0	3
BTCSEAI 502	Database Management Systems	PC	25	75	100	3-0-0	3
BTCSEAI 503	Formal Language & Automata Theory	PC	25	75	100	3-0-0	3
BTCSEAI 504	Java Programming	PC	25	75	100	3-0-0	3
BTCSEAI 505	Professional Practice, Law & Ethics	HS	25	75	100	3-0-0	3
BTCSEAI 506	Machine Learning Lab	PC	25	75	100	0-0-4	2
BTCSEAI 507	Database Management Systems Lab	PC	25	75	100	0-0-4	2
BTCSEAI 508	Java Programming Lab	PC	25	75	100	0-0-4	2
BTCSEAI 509	Constitution of India	MC	25	75	100	2-0-0	0
	Departmental Elective –I	DE	25	75	100	3-0-0	3

	Total	**20-0-12**	**24**

Semester – VI

Paper Code	**Title of the Paper**	**Course type**	**Marks**			**L-T-P**	**Credits**
			Internal Assessment	**Semester Exam**	**Total**		
BTCSEAI 601	Project – I	PROJ	25	75	100	0-0-6	3
BTCSEAI 602	Compiler Design	PC	25	75	100	3-0-0	3
BTCSEAI 603	Computer Networks	PC	25	75	100	3-0-0	3
BTCSEAI 604	Compiler Design Lab	PC	25	75	100	0-0-4	2
BTCSEAI 605	Computer Networks Lab	PC	25	75	100	0-0-4	2
BTCSEAI 606	Speech & Natural Language Processing	PC	25	75	100	3-0-0	3
BTCSEAI 607	Speech & Natural Language Processing Lab	PC	25	75	100	0-0-4	2
	Departmental Elective – II	DE	25	75	100	3-0-0	3
	Departmental Elective – III	DE	25	75	100	3-0-0	3
	Open Elective – I	OE	25	75	100	3-0-0	3
					Total	**18-0-18**	**27**

Semester – VII

Paper Code			**Marks**	**L-T-P**	**Credits**

	Title of the Paper	Course Type	Internal Assessment	Semester Exam	Total		
BTCSEAI 701	Project-II	PROJ	200	100	300	0-0-12	6
BTCSEAI 702	AI in Biology	BS	25	75	100	2-1-0	3
BTCSEAI 703	Cloud Computing	PC	25	75	100	3-0-0	3
BTCSEAI 704	Neural Network & Deep Learning	PC	25	75	100	3-0-0	3
BTCSEAI 705	Neural Network & Deep Learning Lab	PC	25	75	100	0-0-4	2
	Departmental Elective – IV	DE	25	75	100	3-0-0	3
	Departmental Elective – V	DE	25	75	100	3-0-0	3
	Open Elective – II	OE	25	75	100	3-0-0	3
					Total	**17-1-16**	**26**

Semester – VIII

Paper Code	Title of the Paper	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 801	Dissertation	DISS	300	200	500	0-0-12	6
	Department Elective-VI	DE	25	75	100	3-0-0	3

	Open Elective-III	OE	25	75	100	3-0-0	3
	Open Elective-IV	OE	25	75	100	3-0-0	3
					Total	**9-0-12**	**15**

Total Credits – 195

*** The list of online courses to be cleared through MOOCs shall be floated in the respective semester after approval from the Board of Studies with a provision for in house examination.**

Electives (Programme & Open Electives)

Professional Electives will be introduced in 4 threads besides the Open Elective. There are 6 slots for Professional Electives and 4 slots for Open Electives. The department may permit students to take 50% of these (Professional electives + open electives) from other disciplines, based on the choices of the students and consent of course advisors.

A. **Theory** B. **Systems** C. **Data Science** D. **Applications** and E. **Open Electives**

The students will have options of selecting the electives from the different threads depending on the specialization they wish to acquire. **There should be at least two electives from the open elective choices; the rest two can be taken from the other threads, if intended.**

Pls. see the Table.

The Electives are shown in different threads. The list is suggestive. The actual list of electives will depend on the availability of faculty and their research interests. However, there should be courses available in each thread.

On-line MOOC courses may contribute up to 20% of the credits, with in-house examination being conducted.

Programme Electives

Paper Code	**Title of the Paper**	**Marks**			**L-T-P**	**Credits**
		Internal Assessment	**Semester Exam**	**Total**		
Theory and Algorithms						
Departmental Elective –I						

BTCSEAI DE11	Pattern Recognition	25	75	100	3-0-0	3
BTCSEAI DE12	Soft Computing	25	75	100	3-0-0	3
BTCSEAI DE13	MOOCs1	25	75	100	3-0-0	3
Departmental Elective –II						
BTCSEAI DE21	Data Analytics	25	75	100	3-0-0	3
BTCSEAI DE22	Data Science	25	75	100	3-0-0	3
BTCSEAI DE23	MOOCs2	25	75	100	3-0-0	3
Departmental Elective –III						
BTCSEAI DE31	Multi-Agent Systems	25	75	100	3-0-0	3
BTCSEAI DE32	Robotic Process Automation	25	75	100	3-0-0	3
BTCSEAI DE33	MOOCs3	25	75	100	3-0-0	3
Departmental Elective –IV						
BTCSEAI DE41	Digital Image Processing	25	75	100	3-0-0	3
BTCSEAI DE42	Machine Learning for Medical Image Analysis	25	75	100	3-0-0	3

BTCSEAI DE43	Data Science Application of Vision	25	75	100	3-0-0	3
Departmental Elective –V						
BTCSEAI DE51	Web Programming for Artificial Intelligence	25	75	100	3-0-0	3
BTCSEAI DE52	Internet of Things	25	75	100	3-0-0	3
BTCSEAI DE53	Introduction to Blockchain Technology	25	75	100	3-0-0	3
Departmental Elective –VI						
BTCSEAI DE61	R Programming	25	75	100	3-0-0	3
BTCSEAI DE62	Business Analytics	25	75	100	3-0-0	3
BTCSEAI DE63	Social Network Analysis	25	75	100	3-0-0	3
Open Elective –I						
BTCSEAI OE11	ICT for Development	25	75	100	3-0-0	3

BTCSEAI OE12	Soft Skills & Inter Personal Communication	25	75	100	3-0-0	3
BTCSEAI OE13	Cyber Law and Ethics	25	75	100	3-0-0	3
Open Elective –II						
BTCSEAI OE21	History of Science & Engineering	25	75	100	3-0-0	3
BTCSEAI OE22	Sustainable Development	25	75	100	3-0-0	3
BTCSEAI OE23	Ethical Hacking	25	75	100	3-0-0	3
Open Elective –III						
BTCSEAI OE31	Data Mining	25	75	100	3-0-0	3
BTCSEAI OE32	Enterprise Resource and Planning	25	75	100	3-0-0	3
BTCSEAI OE33	Rural Technology & Community Development	25	75	100	3-0-0	3
Open Elective –IV						

BTCSEAI OE41	Green Computing	25	75	100	3-0-0	3
BTCSEAI OE42	Customer Relationship Management	25	75	100	3-0-0	3
BTCSEAI OE43	Infrastructure Systems Planning	25	75	100	3-0-0	3

4. MODE OF CURRICULUM DELIVERY

Mode of curriculum delivery includes classroom teaching, assignments, test, lab work, presentations, participation in relevant events and regularity.

5. THE GRADING SYSTEM

As per University Rule

6. CALCULATION OF SGPA AND CGPA OF A STUDENT IN A SEMESTER

As per University Rule

7. ADMISSION

A candidate, aspiring for admission to **B. Tech. CSE (AI) Programme**, shall have to apply in the prescribed application form that is complete in all respect, on or before the last date of submission.

NOTE:

a. Different procedure may be adapted for admission of foreign/NRI/Industry-sponsored candidates, who apply for admission in the prescribed form and fulfill the eligibility requirements.

a. The admission committee, duly constituted for purpose, would prepare a merit list on the basis of the selection criteria.

c. Admission committee shall display/publish the list of candidates that are declared eligible for admission, after the due approval of the competent authority.

d. Eligible candidates shall have to complete the prescribed formalities, for completion of admission, within the stipulated period of time; otherwise they will forfeit the right to admission.

8. ATTENDANCE

a. All students are supposed to attend every lecture and practical classes. However, the attendance requirement for appearing in the examination shall be a minimum of 75% of the classes held.

b. Each one-period teaching shall account for one attendance unit.

c. The concerned teacher will take a roll call in every scheduled class, maintains and consolidate the attendance record, which would be submitted to the Head of the Department at the conclusion of the semester.

d. Attendance on account of participation (with prior permission from the head of the department) in the co-curricular/extra-curricular activities can be granted by the Dean on receipt of certificates or recommendations of the respective activity issued by the Head of the Department.

e. Attendance records displayed on Notice Board from time to time, in respect of short attendance, shall be deemed to be a proper notification and no individual notice shall be sent to the students/local guardian.

f. In case a student is found to be continuously absent from the classes without information for a period of 30 days, the concerned teacher shall report it to the Head of the Department.

g. Head of the department may recommend for striking off the name of a student from rolls, after ensuring '**one month continuous absence**', from all the concerned teachers.

h. A student, whose name has been struck off on account of long absence, may apply to the Dean for readmission within 15 days of the notice of striking off the name. The readmission shall be effected on payments of prescribed readmission fees.

i. A student with less than 75% attendance, in aggregate shall not be allowed to appear in the semester examination. The Head of the Department shall recommend all such cases to the Dean of the faculty.

j. The Dean, on the recommendation of the Head of the Department, may consider the relaxation of attendance up to 10% on account of sickness and /or any other valid reason. No application for relaxation of attendance (duly certified by a Registered Medical Practitioner/Public hospital or a competent authority) will be entertained after 15 days from the recovery from illness etc.

k. A student detained on account of short attendance will start afresh in the same class in the next academic year on payment of current fees except enrollment fee, identity card fee and security deposits etc.

9. INTERNAL ASSESSMENT

a. Internal assessment, to be made by concerned teachers, will be based on unit tests, quizzes, presentation, programming test, demonstrations and assignments.

b. There will be three (3) Internal Assessment (Unit Tests) with a total of 20 marks ,and the best two (2) performances out of the three Unit tests of Internal Assessment will be counted. Other modes of assessment shall account for remaining 5 marks.

c. Dates for minor test will be announced at the beginning of the semester, by the examination coordinator.

d. The teacher concerned shall maintain a regular record of the marks obtained by students in minor tests and display the same in due course.

e. The concerned teachers shall submit the compiled internal assessment marks to the Head of the Department, on the conclusion of teaching of the current semester.

f. The Head shall display a copy of the compiled sheet, of internal assessment marks of all the papers, before forwarding it to the Controller of Examination, i.e. at the conclusion of the semester.

a. A promoted candidate, who has to reappear in the examination of a paper, will retain internal assessment marks.

b. In the case of re-admission, the candidates shall have to go through the internal assessment process afresh and shall retain nothing of the previous year.

10. SEMESTER EXAMINATIONS

Prescriptions for conducting semester examinations of theory and lab papers, those shall be conducted after the conclusion of each of the semesters, are presented in the following table:

S.N.	Classification	Theory	Lab

1.	Mode	Written Only	Written, Demo, Programming and viva- voce etc.
2.	Duration	03 Hours	04 Hours
3.	Total Marks	75 (Seventy Five Only)	75 (Seventy Five Only)

11. MAJOR PROJECT

a. Each student of the final semester will have to carry out a project under the guidance of one or two faculty members.

b. There shall be a mid-term evaluation of the progress and the internal supervisors.

c. All the candidates shall submit ***Two (02***) hard copies of the project report that are duly approved and signed by internal as well as external (if applicable) supervisors.

d. An external examiner, appointed for the purpose, shall evaluate the project report.

e. Head of the department shall forward the compiled total marks (awarded in internal assessment, project Report and Viva-voce Examination), in the project-semester of each of the candidate, to the Controller of Examination.

12. EXAMINATION

a. The performance of a student in a semester shall be evaluated through continuous class assessment and end semester examination. The continuous assessment shall be based on class tests, assignments/ tutorials, quizzes/ viva voce and attendance. The end semester examination shall be comprised of written papers, practical and viva voce, inspection of certified course work in classes and laboratories, project work, design reports or by means of any combination of these methods.

b. The marks obtained in a subject shall consist of marks allotted in end semester theory paper, practical examination and sessional work.

c. The minimum pass marks in each subject including sessional marks (Theory, Practical or Project etc.) shall be 40%.

13. PROMOTION SCHEME

a. A student will be required to clear minimum **40% of his/her papers** (including Labs; excluding non-credit papers) in a semester/annual examination to be eligible **for promotion to the next semester/year**. A student may appear in the supplementary examination after each semester/annual examination and can have a choice to appear in the backlog papers in the supplementary examination or in the subsequent regular semester/annual examination with a prescribed fee. A students detained due to shortage of attendance will repeat his/her paper in the subsequent semester concerned (even/odd).

b. A **detained** Student is not allowed to re-appear in the internal assessment (Unit test). His/her old internal assessment marks will remain same.

A student who cleared all the papers of a semester/annual examination of a programme/course will be eligible for improvement examination as per university rule.

After having passed all the EIGHT semesters, the students shall be eligible for the award of B. Tech. Computer Science & Engineering (Artificial Intelligence) degree of JAMIA HAMDARD.

14. CLASSIFICATION OF SUCCESSFUL CANDIDATES

The result of successful candidates, who fulfill the criteria for the award of **B. Tech. Computer Science & Engineering(Artificial Intelligence)**, shall be classified at the end of last semester, on the basis of his/her final CGPA (to be calculated as per university rule).

SEMESTER I

BTCSEAI 101-Applied Physics – I

Course Code: BTCSE (AI)-101 Title of the Course: Applied Physics – I
L-T-P: 3-1-0 Credits: 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 101	Applied Physics I	BS	25	75	100	3-1-0	4

Course Objective

- This is an established fact that a sound understanding of concepts of Physics is an essential part of the training of a prospective engineer.
- In the present era the spectacular progress of technology bears witness to the fact that the attractive edifice of technology can only be built on the solid foundation of Physics.
- In the past hundred years or so Physics has seen major upheavals where conventional frameworks have underwent revolutionary changes.
- From technological perspective these changes and development of new concepts are very crucial. This makes it incumbent that the students are equipped with proper skills and understanding of Physics.
- In this spirit, this course aims to train the student in logical and analytical thinking through understanding and applications of the principles of Physics to actual problems.
- The emphasis of this course is on the development of conceptual skills and their application to actual problems rather than rigorous theoretical treatments.

Course Outcome:

After studying this course the student is expected to:

CO-1 Develop good understanding of basic concepts related to semiconductors.
CO-2 Familiarize themselves with ideas related with LASER and develop an understanding of amazing properties of LASER heralding new pathways in technology.
CO-3 Get introduced to the working of optical fibers and their huge potential.
CO-4 Refresh and further develop their understanding of the two remarkable phenomena exhibited by light- interference and diffraction and related concepts.

CO-5 Get a feel of yet another mysterious phenomenon of nature-superconductivity and explore its technological potential.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	1	-	-	-	-	-	1	1	1	1	1
CO2	3	2	2	1	1	-	-	-	-	-	1	1	1	1	1
CO3	3	2	2	1	1	-	-	-	-	-	1	1	1	1	1
CO4	3	2	2	1	1	-	-	-	-	-	1	1	1	1	1
CO5	3	2	2	1	1	-	-	-	-	-	1	1	1	1	1

3-High Level, 2-Medium Level, 1-Low Level

UNIT 1: Semiconductor Physics **08 Hours**

Energy bands in solids, Fermi level and Fermi distribution function, Intrinsic and extrinsic semiconductors, P-N junction, Forward and reverse bias, V-I characteristics, Mobility of electrons and holes, Drift velocity, Electrical conductivity, resistivity, Zener diode.

UNIT 2: Lasers **10 Hours**

Einstein's theory of matter radiation interaction and A and B coefficients, amplification of light by population inversion, different types of lasers: He-Ne, Ruby, Properties of laser beams: monochromaticity, coherence, directionality and brightness, applications of lasers in science, engineering and medicine.

UNIT 3: Fiber Optics **08 Hours**

Numerical aperture, step index and graded index fibers, attenuation and dispersion mechanism in optical fibers (Qualitative only), applications of optical fibers, optical communication (Block diagram only).

UNIT 4: Wave Optics **08 Hours**

Huygens' Principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting, Young's double slit experiment, Newton's rings, Fraunhoffer diffraction from a single slit and N slit, Diffraction gratings, dispersive and resolving power of grating.

UNIT 5: Superconductivity **08 Hours**

Introduction, Variation of resistivity with temperature, Difference between a metal and a superconductor, Meissner effect, Type I and Type II superconductors, Examples of superconductors, BCS Theory (Qualitative only), London's equations, applications of superconductors.

Books Recommended:

- B.G. Streetman, "Solid State Electronic Devices", Prentice Hall of India, 1995.
- D.A. Neamen, "Semiconductor Physics and Devices," Times Mirror High Education Group, Chicago, 1997.
- O. Svelto, "Principles of Lasers", Springer Science & Business Media, 2010.
- Ghatak, "Optics", McGraw Hill Education, 2012.
- D. Neamen, D. Biswas, "Semiconductor Physics and Devices," McGraw Hill Education

BTCSEAI 102 MATHEMATICS-1

Course Code: BTCSE (AI)-102 Title of the Course: Mathematics-I
L-T-P: 3-1-0 Credits: 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 102	Mathematics-1	BS	25	75	100	3-1-0	4

Objective:

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

- To introduce the idea of applying differential and integral calculus to notions of curvature and to improper integrals. Apart from some applications it gives a basic introduction on Beta and Gamma functions.
- To introduce the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
- To develop the tool of power series and Fourier series for learning advanced Engineering Mathematics.
- To familiarize the student with functions of several variables that is essential in most branches of engineering.
- To develop the essential tool of matrices and linear algebra in a comprehensive manner.

COURSE OUTCOMES (COs)

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

CO-1 Apply the concept of curvature , evaluate the definite integral by using Beta and Gamma function and calculate the surface area and volume of solid revolutions by the help of definite integral.

CO-2 Verify Rolles Theorem and mean value theorem for the function defined in a closed interval, find an infinite expansion of a function and calculate the value of indeterminate forms.

CO-3 Discuss the nature of sequence and series and find the infinite series in terms of $\sin\theta$ and $\cos\theta$ of any continuous or discontinuous function in a bounded interval .

CO-4 Use the concept of function of several variables analyse the nature of the continuity and differentiability of function of two variable and find the maxima and minima of the function in R^2.

CO-5 Find the rank and inverse of the matrix, find the eigen value and the eigen-vector of a square matrix and solve system of homogenous and non-homogenous equations containing m equataions and n variables.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	-	-	-	-	-	-	-	2		2
CO2	3	2	3	-	2	-	-	-	-	-	-	-	2		2
CO3	3	2	3	2	2	-	-	-	-	-	-	-	2		2
CO4	3	3	2	-	2	-	-	-	-	-	-	-	1		2
CO5	3	3	3	2	2	-	-	-	-	-	-	-	2		2

Write '3' in the box for 'High-level'mapping, 2 for 'Medium-level'mapping, 1 for 'Low'-level 'mapping.

Detailed Syllabus:

Unit – I: **Calculus-I** **1o Hours**

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

Unit – II: Calculus-II **8 Hours**

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

Unit – III: **Sequences and series** **10 Hours**

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

Unit – IV: **Multivariable Calculus** **8 Hours**

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

Unit – V: **Matrices** **08 Hours**

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

Reference Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, 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. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
6. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
7. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
8. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

Teaching-Learning Strategies in brief

1. Build positive environment in the classroom.
2. Provide concrete basic and advanced knowledge of the subject.
3. Solve problems based on the basic & advanced concepts of the subject.
4. Encourage to the students to ask more & more questions.
5. Motivate to the students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.
5. **Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.**

BTCSEAI 103-Basic Electrical Engineering

Course Code: BTCSE (AI)-103 Title of the Course: Basic Electrical Engineering
L-T-P: 3-1-0 Credits: 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 103	Basic Electrical Engineering	ES	25	75	100	3-1-0	4

B. Tech (CSE AI) 1st Semester

COURSE OUTCOMES (COs):
After completing this Course, the students should be able to …….

CO1: Understand basic Laws in circuits, circuit elements and sources and their characteristics
CO2: Understand and analyse phasor diagram and waveforms for purely resistive, purely inductive and purely capacitive as well as series and parallel R-L, R-C & R-L-C circuits and also circuit Resonance.
CO3: Understand concepts of Real, Reactive & apparent power and Power factor. Understand 3-phase supply and star and delta connection and their relationships. Power measurement by wattmeter
CO4: Understand construction & working principle of 1- phase and 3- phase transformers. Understand Ideal and practical transformer and auto-transformer and its applications as well.
CO5: Understand generation of rotating magnetic fields. Understand construction and working of 3-phase induction motor, 1-phase induction motor, DC motors& synchronous generators.
CO6: Understand LT Switchgear such as Switch Fuse Unit (SFU), MCB, ELCB, MCCB. Understand about wires, cables, earthing & its importance. Understand about types of batteries & its important Characteristics. Understand basic calculations for energy consumption & power factor improvement.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	1	1	2	3	-	-	-	-	-	-	-	1	1	-
CO2	3		1	3	3	-	-	-	-	-	-	-	1	1	-
CO3	1	1	1	3	2	-	-	-	-	-	-	-	1	1	-
CO4	2	-		2	3	-	-	-	-	-	-	-	1	1	-
CO5	2	2	-	2	2	-	-	-	-	-	-	-	1	1	-

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level'mapping, 2 for 'Medium-level'mapping, 1 for 'Low'-level'mapping.

Detailed Syllabus:

UNIT 1: DC Circuits **8 Hours**

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

UNIT 2: AC Circuits **10 Hours**

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

UNIT 3: Transformers **06 Hours**

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

UNIT 4: Electrical Machines **8 Hours**

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

UNIT 5: Power Converters **8 Hours**

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation. **Electrical Installations :**Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Text / Reference Books

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

- V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

Teaching-Learning Strategies

- Learning by doing
- Learning through discussion among the peer group
- Open ended questions by teacher
- Open ended questions from students
- Reflective Learning

Assessment methods and weightages

Progress towards achievement of learning outcomes will be assessed using the following:

- time-constrained examinations
- closed-book tests
- problem based assignments
- practical assignments and
- viva voce interviews

BTCSEAI 104-Engineering Graphics & Design

Course Code: BTCSE AI 104 **Title of the Course: Engineering Graphics and Design**

L-T-P: - 1-0-2. **Credits**: - 3

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 104	Engineering Graphics & Design	ES	25	75	100	1-0-0	1

Course Objective

The Engineering Graphics course aims at the following educational objectives:

1. Comprehend general projection theory, with emphasis on orthographic projection to represent three-dimensional objects in two-dimensional views (principal, auxiliary, sections).

2. Dimension and annotate two-dimensional engineering drawings.

3. The application of industry standards and best practices applied in engineering graphics.

4. Emphasize freehand sketching to aid in the visualization process and to efficiently communicate ideas graphically.

5. Introduce CAD software for the creation of 3D models and 2D engineering drawings.

Course outcomes

CO-1 Acquire knowledge of basic principles of Engineering graphics, lettering, dimensioning, sketching, and use of drafting equipment.

CO-2 Need for scaling the dimension of an object, different types of scaling and scale (plain diagonal and vernier scales).

CO-3 Create geometric constructions; drawing parallel and perpendicular lines, and to construct engineering curves like ellipse, parabola, hyperbola, involute and cycloidal.

CO-4 Gain knowledge on types of projections and draw Orthographic projections of Lines, Planes, Solids, and Section of Solids.

CO-5 Construct isometric scale, isometric projections and views and Conversion of orthographic views to isometric views and vice versa.

CO-6 Create 2-D computer drawing: setting up working space (units, grids etc.), creating and editing 2-D geometries

CO-7 Create 3-D computer drawing: use industry-standard Computer Aided Design (CAD) software to model solid objects proceeding from basic sketching techniques to the creation of solid features through the use of extrusions, cuts, rotations, patterns and sweeps.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	1	2	-	-	-	-	2	-	2	1	1	-
CO2	2	2	3	2	2	-	-	-	-	2	-	2	1	1	1
CO3	2	2	3	2	3	-	-	-	-	3	-	2	1	1	-
CO4	1	3	2	2	2	-	-	-	-	2	-	2	1	1	-
CO5	2	2	3	2	2	-	-	-	-	3	-	2	1	1	1
CO6	2	2	3	2	2	-	-	-	-	3	-	2	1	1	-
CO7	2	2	3	3	3	-	-	-	-	3	-	2	1	1	-

Write '3' in the box for 'High-level'mapping, 2 for 'Medium-level'mapping, 1 for 'Low'-level'mapping.

Detailed Syllabus:

UNIT 1: 08 Hours

Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

UNIT 2: 08 Hours

Orthographic Projections covering, Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes; **Projections of Regular Solids** covering, those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

UNIT 3: **10 Hours**

Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT 4: **10 Hours**

Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions; **Overview of Computer Graphics** covering, listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids.

UNIT 5: **08 Hours**

Customization& CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

Reference Books:

- Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
- Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
- (iii)Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
- Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
- (Corresponding set of) CAD Software Theory and User Manuals

Teaching-Learning Strategies in brief (4 to 5 sentences)

Engineering graphics subject is full drawing-oriented subject. First fundamentals of different topics of engineering graphic are delivered and then explain the procedure of constructions step by steps. Later on, assignment issued to check the understanding. I explain the construction of drawing on both ways Manual drawing as well as on CAD software (Autocad and ProE) in lecturesI Provide study material, sample question and ppt. I always encourage students to raise their doubts and questions and create friendly environment for them.

Assessment methods and weightages in brief (4 to 5 sentences)

1. Theory Assessment is based on performance in two internal
2. Lab assessment is based on performance and number of sheets drawn.
3. Performance in Semester exam

Internal assessment (25 Marks) & Semester Examination (75 Marks)
Total Marks-100.

BTCSEAI 105-Semiconductor Physics Laboratory

Course Code: BTCSEAI 105 Title of the Course: Semiconductor Physics Laboratory

L-T-P: - 0-0-4. **Credits**: - 2

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 105	Applied Physics-I Lab	BS	25	75	100	0-0-4	2

Laboratory based upon Applied Physics -1 BTCSE 101

BTCSEAI 106-Basic Electrical Engineering Laboratory

Course Code: BTCSEAI 106 Title of the Course: Basic Electrical Engineering Laboratory

L-T-P: - 0-0-2. **Credits**: - 1

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 106	Basic Electrical Engineering Lab	ES	25	75	100	0-0-2	1

Laboratory based upon Basic Electrical Engineering BTCSE 103

BTCSEAI 107-Engineering Graphics & Design Laboratory

Course Code: BTCSEAI 107 Title of the Course: Engineering Graphics & Design Laboratory

L-T-P: - 0-0-4. **Credits**: - 2

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 107	Engineering Graphics & Design Lab	ES	25	75	100	0-0-4	2

Laboratory based upon Engineering Graphics & Design BTCSEAI 104

BTCSEAI 108-Essence of Indian Traditional knowledge

Course Code: BTCSEAI 108 Title of the Course: Essence of Indian Traditional knowledge

L-T-P: - 2-0-0. **Credits**: - 0

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 108	Essence of Indian Traditional Knowledge	MC	25	75	100	2-0-0	0

COURSE OBJECTIVE:

The objective of this course is to familiarize the prospective engineers with elements of Indian history and sociological concepts and theories by which they could understand contemporary issues and problems in Indian society. The course would enable them to analyze critically the social processes of globalization, modernization and social change. All of this is a part of the

quest to help the students imbibe such skills that will enhance them to be better citizens and human beings at their work place or in the family or in other social institutions.

Course Outcomes:

After studying this course the student is expected to:
CO-1: Understand and Learrn Indian socioal evolution.
CO-2: Analyse Social Structure and Social structure of Indian History
CO-3: Study and analyse Colonism concepts from British.
CO-4: Evaluatte and analyse Post-colonial issues.
CO-5: Evaluate and Demonstrate Modernization and Globalization Concepts.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) And Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	2	2	1	-	1	1	1	1	1
CO2	-	-	-	-	-	3	2	2	1	-	1	1	1	-	1
CO3	-	-	-	-	-	3	2	2	1	-	1	1	1	-	1
CO4	-	-	-	-	-	3	1	2	1	-	1	1	1	-	1
CO5	-	-	-	-	-	3	1	2	1	-	1	1	1	-	-

3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

UNIT 1: **08 Hours**

Introduction to Elements of Indian History: What is history? ; History Sources-Archaeology, Numismatics, Epigraphy & Archival research; Methods used in History; History & historiography; Introduction to sociological concepts-structure, system, organization, social institutions, Culture social stratification (caste, class, gender, power).State & civil society; (7 Lectures)

UNIT 2: **06 Hours**

Indian history & periodization; evolution of urbanization process: first, second &third phase of urbanization; Evolution of polity; early states to empires; Understanding social structures-feudalism debate; Understanding social structure and social processes: Perspectives of Marx, Weber & Durkheim;

UNIT 3 : **08 Hours**

From Feudalism to colonialism-the coming of British; Modernity & struggle for independence; Political economy of Indian society. Industrial, Urban, Agrarian and Tribal society; Caste, Class, Ethnicity and Gender; Ecology and Environment;

UNIT 4: **08 Hours**

Issues & concerns in post-colonial India (up to 1991); Issues & concerns in postcolonial India 2nd phase (LPG decade post 1991) ,

UNIT 5 : **06 Hour**

Social change in contemporary India: Modernization and globalization, Secularism and communalism, Nature of development, Processes of social exclusion and inclusion, Changing nature of work and organization

Reference Books:

- History
    - Desai, A.R. (2005), Social Background of Indian Nationalism, Popular Prakashan
    - Guha, Ramachandra (2007), India After Gandhi, Pan Macmillan
    - Thapar, Romila (2002), Early India, Penguin
    - Sharma R.S.(1965), Indian Feudalism, Macmillan
    - Deshpande, Satish (2002), Contemporary India: A Sociological View, Viking
    - Gadgil, Madhav & Ramachandra Guha(1993), This Fissured Land: An Ecological History of India, OU Press
- (b) Sociology:
    - Giddens, A (2009), Sociology, Polity, 6th edn.
    - Haralambos M, RM Heald, M Holborn (2000), Sociology, Collins
    - Xaxa, V (2008), State, Society and Tribes Pearson
    - Chandoke, Neera & Praveen Priyadarshi (2009), Contemporary India: Economy, Society and Politics, Pearson
    - Oommen,T.K.(ed.) (1997), Citizenship and National Identity: From Colonialism to Globalization, Sage.
    - Mohanty, M (ed.) (2004), Class, Caste & Gender- Volume 5, Sage
    - Dhanagare, D.N. , Themes and Perspectives in Indian Sociology, Rawat
    - Ramaswamy, E.A. and Ramaswamy,U.(1981), Industry and Labour, OU Press
    - Bhowmik, S (ed.) (2010), Street Vendors in the Global Urban Economy, Routledge
    - Rao, M.S.A. (ed.) (1974), Urban Sociology, Orient Longmans

Teaching-Learning Strategies in brief

- Build positive environment in the classroom.
- Provide concrete basic and advanced knowledge of the subject.

- Encourage to the students to ask more & more questions.

Assessment methods and weightages in brief

- By taking two sessional examinations.
- By taking presentation on real life issues.
- By taking semester examination.

Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100

SEMESTER II

BTCSEAI 201 Applied Physics – II

Course Code: BTCSEAI 201 **Title of the Course: Applied Physics – II**

L-T-P: - 3-1-0. **Credits**: - 4

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 201	Applied Physics-II	BS	25	75	100	3-1-0	4

COURSE OUTCOMES (COs)

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

CO 1: Apply basic physical principles to explain the functioning of some semiconductor devices. (Cognitive level: Apply)
CO 2: Apply Maxwell theory underlying the electric and magnetic processes to the propagation of electromagnetic waves. (Cognitive level: Apply)
CO 3: Analyze the inadequacy of classical mechanics and beauty of the quantum ideas. (Cognitive level: Analyze)
CO 4: Apply the Newtonian mechanics principles to a few mechanical oscillatory systems. (Cognitive level: Apply)
CO 5: Understand the Physics behind the working of X- rays. (Cognitive level: Understand)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO 1	PS O2	PS O3
CO1	3	2	3	2	3	-	-	-	-	-	-	-	1	1	1
CO2	3	2	2	3	3	-	-	-	-	-	-	-	1	1	-
CO3	2	3	1	3	2	-	-	-	-	-	-	-	1	1	1
CO4	3	2	2	2	3	-	-	-	-	-	-	-	1	1	-
CO5	2	2	2	2	2	-	-	-	-	-	-	-	1	1	-

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level'mapping, 2 for 'Medium-level'mapping, 1 for 'Low'-level'mapping.

Detailed Syllabus:

UNIT 1: Semiconductor Materials **08 Hours**

Semiconductors materials of interest for optoelectronic devices, LEDs: device structure, materials, characteristics and figures of merit, Semiconductor photodetectors- P-N junction, Avalanche and Zener breakdown: structures, materials, working principle and characteristics, Noise limits on performance, Solar cells.

UNIT 2: Electromagnetic Theory **10 Hours**

Motion of charged particles in crossed electric and magnetic fields, Velocity selector, Gauss law, continuity equation, Inconsistency in Ampere's law, Maxwell's equations (differential and integral forms), Poynting theorem and Poynting vector, Propagation of plane electromagnetic waves in conducting and non-conducting medium.

UNIT 3: Quantum Mechanics **10 Hours**

Introduction to Quantum mechanics, wave nature of particles, Time-dependent and time-independent Schrodinger equation for wave function, expectation values, Wave-packets, uncertainty Principle, Solution of stationary state Schrodinger equation for particle in a box problem, Single step barrier, tunnelling effect.

UNIT 4: Mechanical Systems **08 Hours**

Newton's laws, Conservative and non-conservative forces, Concept of potential energy, Work energy theorem, Periodic and oscillatory motion, Simple harmonic motion, Time period, Frequency, Phase and phase constant, Energy in simple harmonic motion, Damped and forced oscillations.

UNIT 5: X-Rays **06 Hours**

Crystalline and amorphous solids, Bragg's law, Historical background: Discovery of X-rays, Production of X-rays, Moseley's law, Properties of X-rays, Continuous and characteristic X-rays, Soft and hard X-rays, Applications.

Reference Books:

1. Arthur Beiser, "Concepts of Modern Physics".
2. B.G. Streetman, "Solid State Electronic Devices", Prentice Hall of India, 1995.
3. David Griffiths, "Introduction to Electrodynamics".
4. R. Robinett, "Quantum Mechanics," OUP Oxford, 2006.

Teaching-Learning Strategies in brief:

6. Encourage participation of students in learning.
7. Connect the subject matter with the student's everyday life.
8. Encourage the spirit of questioning by the students.

9. Arrange student friendly study material and other learning resources.
10. Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

6. Two sessional examinations.
7. Assignments.
8. Oral quizzes in the class.
9. End semester examination.
10. **Internal Assessment: 25 Marks, End Semester Examination :75 Marks &Total Marks: 100.**

BTCSEAI 202: Probability and Statistics for AI

Course Code: BTCSEAI 202 **Title of the Course: Applied Physics – II**

L-T-P: - 3-1-0. **Credits**: - 4

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 202	Probability and Statistics for AI	BS	25	75	100	3-1-0	4

Course Prerequisite: Set theory, Basic Probability & Statistics

Course Objective:

- To introduce the idea of basic Probability and probability distribution of discrete random variables.
- To introduce the idea of continuous Probability Distribution.
- Introduce the concept of Bivariate Distributions and distribution of some and quotients.
- To introduce the concept of Measures of central tendency and some others probabolitiy distributin like, Binomial and Normal Distributions.
- To indroduce the Application of Statistics like, Curve fitting and diffrent sample test of single prortions.

COURSE OUTCOMES (COs)

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

CO-1 Discuss the problems of basic Probability and probability distribution of discrete random variables.

CO-2 Discribe the probability distribution of continuous random vriables and apply to solve problems.
CO-3 Find Bivariate Distributions and distribution of some and quotients.
CO-4 Solve the problems on Measures of central tendency and some others probabolitiy distributin like, Binomial and Normal Distributions.
CO-5 Use the Application of Statistics like, Curve fitting and diffrent sample test of single prortions.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) And Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	-	-	-	-	-	1	1	1	-	2
CO2	3	3	3	2	2	-	-	-	-	-	1	1	2	-	2
CO3	3	2	3	2	1	-	-	-	-	-	1	1	1	-	2
CO4	3	3	3	2	1	-	-	-	-	-	1	1	2	-	2
CO5	3	3	2	2	2	-	-	-	-	-	1	1	2	-	2

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level'mapping, 2 for 'Medium-level'mapping, 1 for 'Low'-level'mapping.

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Detailed Syllabus:

Unit – I: Basic Probability 10 Hours

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

.Unit – II: Continuous Probability Distributions 06 Hours

Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

.Unit – III: Bivariate Distributions 08 Hours

Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

.Unit – IV: Basic Statistics 08 Hours

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation

Unit – V: Applied Statistics 08 Hours

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion,

difference of proportions, single mean, difference of means, and difference of standard deviations. Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Reference Books:

9. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
10. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
11. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
12. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
13. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
14. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
15. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

Teaching-Learning Strategies in brief

11. Build positive environment in the classroom.
12. Provide concrete basic and advanced knowledge of the subject.
13. Solve problems based on the basic & advanced concepts of the subject.
14. Encourage to the students to ask more & more questions.
15. Motivate to the students to develop critical & strategic thinking

Assessment methods and weightages in brief

11. By taking two sessional examinations.
12. By giving assignments.
13. By conducting class tests.
14. By taking semester examination.
15. Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

BTCSEAI 203-PROGRAMMING FOR PROBLEM SOLVING

Course Code: BTCSEAI 203 **Title of the Course: PROGRAMMING FOR PROBLEM SOLVING**

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

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		

BTCSEAI 203	Programming for Problem Solving	ES	25	75	100	3-0-0	3

Course Outcomes:

The student should learn to:

CO-1: formulate simple algorithms for arithmetic and logical problems. To translate the algorithms to programs (in C language).
To test and execute the programs and correct syntax and logical errors.
CO-2: Implement conditional branching, iteration and recursion.
CO-3: Decompose a problem into functions and synthesize a complete program using divide and conquer approach.
CO-4: Apply the Use of arrays, pointers and structures to formulate algorithms and programs.
CO-5: Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
CO-6: Apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	1	-	-	-	-	-	-	1	1	-	-
CO2	3	2	2	1	1	-	-	-	-	-	-	1	1	-	-
CO3	3	2	2	1	1	-	-	-	-	-	-	1	1	-	-
CO4	3	3	2	2	1	-	-	-	-	-	-	1	1	-	-
CO5	2	2	3	2	1	-	-	-	-	-	-	1	1	-	-

3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

Unit 1: **08 Hours**

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

Unit 2: **08 Hours**

Arithmetic expressions and precedence, Conditional Branching, Writing and evaluation of conditionals and consequent branching**,** Iteration and loops

Unit 3: **08 Hours**

Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required), Arrays: Arrays (1-D, 2-D), Character arrays and Strings

UNIT 4: **08 Hours**

Function: Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference, Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT 5: **08 Hours**

Structure: Structures, Defining structures and Array of Structures, Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation), File handling (only if time is available, otherwise should be done as part of the Laboratory)

Suggested Text Books:

- Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
- E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Suggested Reference Books:

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

BTCSEAI 204-Introduction to Artificial Intelligence

Course Code: BTCSEAI-204 Title of the Course: Introduction to Artificial Intelligence

L-T-P: 3-1-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 204	Introduction to Artificial Intelligence	PC	25	75	100	3-0-0	3

Course Objectives:

To impart knowledge about Artificial Intelligence.

To give understanding of the main abstractions and reasoning for intelligent systems.

To enable the students to understand the basic principles of Artificial Intelligence in various applications.

COURSE OUTCOMES:

After successful completion of the course, the learners would be able to

1. Understand concepts of Artificial Intelligence and different types of intelligent agents and their architecture.

2. Formulate problems as state space search problem & efficiently solve them.

3. Understand the working of various informed and uninformed searching algorithms and different heuristics

4. Understand concept of knowledge representation i.e. propositional logic, first order logic.

5. Reasoning with uncertainty.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	1	-	-	-	-	-	-	1	1	-	-
CO2	3	2	2	2	1	-	-	1	-	-	-	1	1	-	-
CO3	3	2	2	1	1	-	-	1	-	-	-	1	1	-	-
CO4	3	2	2	1	1	-	-	-	-	-	-	1	1	-	-
CO5	3	2	2	1	1	-	-	-	-	-	-	1	1	-	-

3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

UNIT-1: **08 Hours**

Introduction: Introduction to Artificial Intelligence, various definitions of AI, AI Applications and Techniques, Turing Test and Reasoning - forward & backward chaining.

Unit-2: **08 Hours**

Intelligent Agents: Introduction to Intelligent Agents, Rational Agent, their structure, reflex, model-based, goal-based, and utility-based agents, behavior and environment in which a particular agent operates.

Unit-3: **08 Hours**

Problem Solving and Search Techniques: Problem Characteristics, Production Systems, Control Strategies, Breadth First Search, Depth First Search, iterative deepening, uniform cost search, Hill climbing and its Variations, simulated annealing, genetic algorithm search; Heuristics Search Techniques: Best First Search, A* algorithm, AO* algorithm, Minmax & game trees, refining minmax, Alpha – Beta pruning, Constraint Satisfaction Problem, Means-End Analysis.

Unit-4: 10 Hours

Knowledge Representation: Introduction to First Order Predicate Calculus, Resolution Principle, Unification, Semantic Nets, Conceptual Dependencies, semantic networks, Frames system, Production Rules, Conceptual Graphs, Ontologies.

Planning: Basic representation for planning, symbolic-centralized vs. Reactive distributed, partial order planning algorithm, The Blocks World, Components Of a Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems.

Unit –5: 10 Hours

Different types of uncertainty - degree of belief and degree of truth, various probability constructs - prior probability, conditional probability, probability axioms, probability distributions, and joint probability distributions, Bayes' rule, other approaches to modeling uncertainty such as Dempster-Shafer theory and fuzzy sets/logic.

Text Books

1. Stuart Russell and Peter Norvig – Artificial Intelligence A Modern Approach, PEARSON Education.

2. Simon Haykin -Neural Networks PHI.

Reference Books

1. N. P. Padhy – Artificial Intelligence and Intelligence Systems, OXFORD publication. 2. B. YagnaNarayana - Artificial Neural Networks, PHI Video Reference: 1. NPTEL Lecture: Prof. SudeshnaSarkar, http://nptel.ac.in/courses/106105077/

2. NPTEL Lecture: Prof. P.Das Gupta, http://nptel.ac.in/courses/106105079/

3. NPTEL Lecture: Prof. Deepak Khemani, http://nptel.ac.in/courses/106106126/

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the student's everyday life.
- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.
- End semester examination.

Internal Assessment: 25 Marks, End Semester Examination: 75 Marks &Total Marks: 100.

BTCSEAI 205-English Language

Course Code: BTCSEAI-205 **Title of the Course: English Language**
L-T-P: 2-0-0 **Credits**: - 02
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 205	English Language	HS	25	75	100	2-0-0	2

Course Objectives

I. Understand the role of communication in personal & professional success.

II. Develop awareness of appropriate communication strategies.

III. Prepare and present messages with a specific intent.

IV. Analyze a variety of communication acts.

V. Ethically use, document and integrate sources.

Course Outcomes: After successful completion of this course, students will be able to:

CO-1: Effectively communicate through verbal/oral communication and improve the listening skills

CO-2: develop Industrial Communication writing skills

CO-3: Able to be self-confident with positive vibes.

CO-4: Actively participate in group discussion/meetings/interviews and prepare & deliver presentations Become a more effective individual through goal/target setting, self motivation, and practicing creative thinking.

CO-5: Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of teamwork, interpersonal relationships, conflict management, and leadership quality.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	1	1	-	3	-	1	1	-	-
CO2	-	-	-	-	-	1	1	1	-	3	-	1	1	-	-
CO3	-	-	-	-	-	1	1	1	-	3	-	1	1	-	-
CO4	-	-	-	-	-	1	1	2	-	2	-	1	1	-	-
CO5	-	-	-	-	-	1	1	1	-	3	-	1	1	-	-

3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

UNIT 1: Vocabulary Building 8 Hours

The concept of Word Formation

Root words from foreign languages and their use in English

Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.

Synonyms, antonyms, and standard abbreviations.

UNIT 2: Basic Writing Skills 8 Hours

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

UNIT 3: Identifying Common Errors in Writing 8 Hours

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

UNIT 4: Nature and Style of sensible Writing 8 Hours

Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion

UNIT 5: Writing Practices and Oral Communication 8 Hours

Comprehension, Précis Writing, Essay Writing,

Oral Communication **8 Hours**

(This UNIT involves interactive practice sessions in Language Laboratory)

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

Reference Books:

- Practical English Usage. Michael Swan. OUP. 1995.
- Remedial English Grammar. F.T. Wood. Macmillan.2007
- On Writing Well. William Zinsser. Harper Resource Book. 2001

- Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
- Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

BTCSEAI 206 Applied Physics – II Lab

Course Code: BTCSEAI-206 **Title of the Course: Applied Physics-II**
L-T-P: 0-0-4 **Credits**: - 02
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 206	Applied Physics-II Lab	BS	25	75	100	0-0-4	2

List of Experiments

(1) Calibration of Voltmeter using DC Potentiometer.
(2) Calibration of Ammeter using DC Potentiometer.
(3) Calibration of Voltmeter using Crompton DC Potentiometer.
(4) Calibration of Ammeter using Crompton DC Potentiometer.
(5) Determination of e/m of electron by Thomson method.
(6) Determination of Planck constant using LED.
(7) Determination of Planck constant using LED (by plotting V-I graph.)
(8) Determination of Planck constant using photocell.

BTCSEAI 207- Programming for Problem Solving Laboratory

Course Code: BTCSEAI-207 Title of the Course: Programming for Problem Solving Laboratory
L-T-P: 0-0-4 **Credits**: - 02
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 207	Programming for Problem Solving Laboratory	ES	25	75	100	0-0-4	2

Lab based on Programming for Problem Solving

BTCSEAI 208-English Language Laboratory

Course Code: BTCSEAI-208 Title of the Course: English Language Laboratory
L-T-P: 0-0-2 **Credits**: - 01
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 208	English Language Laboratory	HS	25	75	100	0-0-2	1

(This course involves interactive practice sessions in Language Laboratory)

Laboratory 1: Familiarization with the lab & purpose

Laboratory 2: Writing Practices-Comprehension

Laboratory 3: Writing Practices-Préci s Writing

Laboratory 4: Writing Practices-Essay Writing

Laboratory 5: Oral Communication-Listening Comprehension

Laboratory 6: Oral Communication-Pronunciation, Intonation, Stress and Rhythm

Laboratory7: Oral Communication-Common Everyday Situations: Conversations and **Laboratory 8: Oral Communication-**Dialogues Communication at Workplace

Laboratory 9: Oral Communication-Interviews

Laboratory 10: Oral Communication-Formal Presentations

If time permits, group discussions may be added.

BTCSEAI 209 Environmental Sciences

Course Code: BTCSEAI-209 Title of the Course: Environmental Sciences
L-T-P: 2-0-0 **Credits**: - 0
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 209	**Environmental Sciences**	MC	25	75	100	2-0-0	0

The syllabus of Environmental sciences provides an integrated, quantitative and interdisciplinary approach to the study of environmental systems. The students of Engineering undergoing this Course would develop a better understanding of human relationships, perceptions and policies towards the environment and focus on design and technology for improving environmental quality. Their exposure to subjects like understanding of earth processes, evaluating alternative energy systems, pollution control and mitigation, natural resource management and the effects of global climate change will help the students bring a systems approach to the analysis of environmental problems;

Course outcomes (COs)

CO-1: Understand the basic concepts of Environments and its components, through the study of Ecology, Biodiversity, Environmental Microbiology and Environmental Chemistry

CO-2: Understand the different types of Pollutions, through the study of Climatic conditions, as well as air Pollution Studies, along with different laws about pollution

CO-3: Analyze and determine pollution using Environmental Analytical Techniques, Biostatistics and Computational Techniques.

CO-4: Use of different tools and techniques for the management of Environment, Energy resources, solid wastes, Biodiversity conservation & Geographical Information Systems and different methodologies.

CO-5: Determine the environmental impact due to different developmental projects and find solution to eliminate these impacts.

CO-6: Understand the disaster management and its disastrous impact on the environment.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	2	1	1	-	-	1		1	1	-	-
CO2	-	-	-	-	2	1	1	-	-	-	1	1	1	-	-
CO3	-	-	-	-	2	1	1	-	-	1	1	1	1	-	-
CO4	-	-	-	-	2	1	1	-	-	-	1	1	1	-	-
CO5	-	-	-	-	2	1	1	-	-	-	1	1	1	-	-

3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

UNIT 1: 8 Hours

Concepts of Environmental Sciences covering, Environment, Levels of organizations in environment, Structure and functions in an ecosystem; Biosphere, its Origin and distribution on land, in water and in air, Broad nature of chemical composition of plants and animals;

UNIT 2: 8 Hours

Natural Resources covering Renewable and Non-renewable Resources, Forests, water, minerals, Food and land (with example of one case study); Energy, Growing energy needs, energy sources (conventional and alternative);

UNIT 3: 8 Hours

Biodiversity and its conservation covering, Biodiversity at global, national and local levels; India as a mega-diversity nation; Threats to biodiversity (biotic, abiotic stresses), and strategies for conservation; Environmental Pollution covering, Types of pollution- Air, water (including urban, rural, marine), soil, noise, thermal, nuclear; Pollution prevention; Management of pollution- Rural/Urban/Industrial waste management [with case study of any one type, e.g., Power (thermal/nuclear), fertilizer, tannin, leather, chemical, sugar], Solid/Liquid waste management, disaster management;

UNIT 4: **08 Hours**

Environmental Biotechnology covering, Biotechnology for environmental protection- Biological indicators, bio-sensors; Remedial measures- Bio-remediation, phyto remediation, bio-pesticides, bio-fertilizers; Bio-reactors- Design and application. Social Issues and Environment covering, Problems relating to urban environment- Population pressure, water scarcity, industrialization; remedial measures; Climate change- Reasons, effects (global warming, ozone layer depletion, acid rain) with one case study; Legal issues- Environmental legislation (Acts and issues involved),Environmental ethics;

UNIT 5 **08 Hours**

Environmental Monitoring covering, Monitoring- Identification of environmental problem, tools for monitoring (remote sensing, GIS); Sampling strategies- Air, water, soil sampling techniques, Laboratory Work including Practical and Field Work covering, Plotting of bio-geographical zones and expanse of territorial waters on the map of India; Identification of biological resources (plants, animals, birds) at a specific location; Determination of (i) pH value, (ii) water holding capacity and (iii) electrical conductivity of different types of soils; Determination of energy content of plants by bomb calorimeter; Measurement and classification of noise pollution; Determination of particulate matter from an industrial area by high volume sampler; Determination of ico-chemical parameters (pH, alkalinity, acidity, salinity, COD, BOD) of tap water, well water, rural water supply industrial effluent and seawater & potability issues; Demonstration of Remote Sensing and GIS methods; Industrial visit for environmental biotechnology processes (e.g., any one of the fermentation, tissue culture, pharmaceutical industries).

SEMESTER III

BTCSEAI 301: Analog Electronic Circuits

Course Code: BTCSEAI-301 Title of the Course: Analog Electronic Circuits
L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 301	**Analog Electronic Circuits**	ES	25	75	100	3-0-0	3

Course Objectives: At the end of this course, students will demonstrate the ability to

• Understand the characteristics of transistors.

• Design and analyze various rectifier and amplifier circuits.

• Design sinusoidal and non-sinusoidal oscillators.

• Understand the functioning of OP-AMP and design OP-AMP based circuits.

Course Outcomes:

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

CO-1: Understand the Concept and applications of Diodes on clipping and clamping
CO-2: Understand the characteristics of transistors.
CO-3: Design and analyze various rectifier and amplifier circuits.
CO-4: Design sinusoidal and non-sinusoidal oscillators.
CO-5: Design and analysis of negative feedback amplifiers and oscillators.
CO-6: Design and analysis of different types of power amplifiers and tuned amplifiers.
CO-7: Behaviour of noise in an amplifier.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	3	3	-	-	-	-	-	-		1	1	-	-
CO2	3	2	2	1	-	-	-	-	-	-	1	1	1	-	-
CO3	3	2	2	1	-	-	-	-	-	-	1	1	1	-	-
CO4	3	2	2	1	-	-	-	-	-	-	1	1	1	-	-
CO5	3	2	2	1	-	-	-	-	-	-	1	1	1	-	-

Detailed Syllabus:

UNIT 1: Diode circuits **08 Hours**

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

UNIT 2: BJT circuits **08 Hours**

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

UNIT 3: MOSFET circuits **08 Hours**

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

UNIT 4: Differential, multi-stage and operational amplifiers 08 Hours

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

UNIT 5: Linear and Nonlinear applications of op-amp 08 Hours

Idealized analysis of op-amp circuits, Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift), Analog to Digital Conversion. Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators, Precision rectifier, peak detector, Mono-shot.

Reference books:

- S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
- J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
- J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
- P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
- P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the student's everyday life.
- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.
- End semester examination.

Internal Assessment: 25 Marks, End Semester Examination:75 Marks &Total Marks: 100.

BTCSEAI 302: Chemistry

Course Code: BTCSEAI-302 **Title of the Course: Chemistry**

L-T-P: 3-1-0 **Credits:** 4

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 302	**Chemistry**	BS	25	75	100	3-1-0	4

COURSE OUTCOMES (COs)
(5 to 8 in case 3 or 4 credit courses)

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

CO-1 Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.(Analyse)

CO-2 Rationalize bulk properties and processes using thermodynamic considerations.(Evaluate)

CO-3 Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques (apply)

CO-4 Rationalize periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.(analyse and evaluate)

CO-5 List major chemical reactions that are used in the synthesis of molecules.(apply and create)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) And Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	3	-	2	-	-	-	-	2	2	-	-	-
CO2	-	-	-	3	-	2	-	-	-	-	2	2	-	-	-
CO3	-	-	-	3	-	2	-	-	-	-	2	2	-	-	-
CO4	-	-	-	3	-	2	-	-	-	-	2	2	-	-	-

CO5	-	-	-	3	-	2	-	-	-	-	2	2	-	-	-

Write '3' in the box for 'High-level 'mapping, 2 for 'Medium-level 'mapping, 1 for 'Low'-level 'mapping.

Detailed Syllabus:

Unit I: 10 Hours

Atomic and molecular structure

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

UNIT 2:

Spectroscopic techniques and applications 08 Hours

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

UNIT 3:

Intermolecular forces and potential energy surfaces 08 Hours

Ionic, dipolar and van Der Waals interactions, Equations of state of real gases and critical phenomena, Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces. Organic reactions and synthesis of a drug molecule: Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings, Synthesis of a commonly used drug molecule

UNIT 4: Use of free energy in chemical equilibria and Periodic properties 08 Hours

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

UNIT 5: **10 Hours**

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries Stereochemistry, Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds (Number of Units may be decided by the School/Department/Centre)

Reference Books:

- University chemistry, by B. H. Mahan
- Chemistry: Principles and Applications, byM. J. Sienko andR. A. Plane
- Fundamentals of Molecular Spectroscopy, by C. N. Banwell
- Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
- Physical Chemistry, by P. W. Atkins

- Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Teaching-Learning Strategies:

- Learning through discussion among the peer group
- Learning through Case Studies
- Group Projects One Minute Paper during the classroom interaction
- Open ended questions by teacher
- Open ended questions from student

Assessment methods and weightages

A variety of assessment methods that are appropriate to the subject area and a programme of study have been used to assess progress towards the course learning outcomes. Priority has been accorded to formative assessment. Progress towards achievement of learning outcomes have been assessed using the following:

Time-constrained examinations; problem based assignments; individual project report (case-study reports); oral presentations, including seminar presentation; viva voce interviews etc.

BTCSEAI 303: Data Structure & Algorithms

Course Code: BTCSEAI-303 Title of the Course: Data Structure & Algorithms
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 303	Data Structure & Algorithms	PC	25	75	100	3-0-0	3

COURSE OUTCOMES (COs)

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

CO-1: For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness. (Cognitive level: Analyse)

CO-2: For a given Search problem (Linear Search and Binary Search) student will able to implement it. (Cognitive level: Apply)

CO-3: For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity. (Cognitive level: Analyse)

CO-4: Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity (Cognitive level: Evaluate)

CO-5: Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity. (Cognitive level: Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) And Program Specific Outcomes (PSOs)

	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	PS O3
CO 1	2	3	3	2	3	1	-	-	-	-	-	2	2	2	-
CO 2	3	2	3	2	2	1	-	-	-	-	-	-	2	2	-
CO 3	3	2	2	2	2	1	-	-	-	-	-	-	2	2	-
CO 4	3	2	2	2	2	1	-	-	-	-	-	-	2	2	-
CO 5	3	2	3	2	3	1	-	-	-	-	-	2	2	2	-

Detailed contents:

UNIT 1: **8 Hours**

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.

Searching: Linear Search and Binary Search Techniques and their complexity analysis.

UNIT 2: **8 Hours**

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

UNIT 3: **10 Hours**

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked

representation of Stack and Queue, Header nodes, doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

UNIT 4: 8 Hours

Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

UNIT 5: 6 Hours

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Reference books:

- "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.
- Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
- "How to Solve it by Computer", 2nd Impression by R. G. Dromey, Pearson Education.

Teaching-Learning Strategies in brief:

- Learning by doing
- Learning through discussion among the peer group
- Open ended questions by teacher
- Open ended questions from students
- Reflective Learning
- Provide relevant study material

Assessment methods and weightages in brief:

- time-constrained examinations
- closed-book class tests
- problem based assignments
- sessional examinations
- semester examination
- practical assignments
- viva voce

[-**Total Marks-100**

- Internal assessment (25 Marks)
- Semester Examination (75 Marks)

BTCSEAI 304: Digital Electronics

Course Code: BTCSEAI-304 **Title of the Course: Digital Electronics**
L-T-P: 3-0-0 **Credits**: - 03

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 304	Digital Electronics	PC	25	75	100	3-0-0	3

Course Objectives:

- Became familiar with the digital signal, positive and negative logic, Boolean algebra, logic gates, logical variables, the truth table, number systems, codes, and their conversion from to others.
- Learn the minimization techniques to simply the hardware requirements of digital circuits, implement it, design, and apply for real time digital systems.
- Understand the working mechanism and design guidelines of different combinational, sequential circuits and their role in the digital system.
- Understand working of logic families, Error correction and detection techniques.
- Became able to know various types of components-ADC and DAC, memory elements and the timing circuits to generate different waveforms, involved in the digital system.

Course Outcomes:

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

CO-1: Understand working of logic families and logic gates.
CO-2: Design and implement Combinational logic circuits.
CO-3: Design and implement Sequential Logic Circuits.
CO-4: Understand and Apply the process of Analog to Digital conversion and Digital to Analog conversion.
CO-5: Be able to use PLDs to implement the given logical problem.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	3	3	1	-	-	-	-	-	-	1	1	1	1
CO2	3	2	2	1	1	-	-	-	-	-	1	1	1	1	1
CO3	3	2	2	1	1	-	-	-	-	-	1	1	1	1	1
CO4	3	2	2	1	1	-	-	-	-	-	1	1	1	1	1
CO5	3	2	2	1	1	-	-	-	-	-	1	1	1	1	1

Detailed Syllabus:

UNIT 1: Fundamentals of Digital Systems and logic families 8 Hours

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital ICs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic

UNIT 2: Combinational Digital Circuits 8 Hours

Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions, Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry lookahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

UNIT 3: Sequential circuits and systems 8 Hours

A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

UNIT 4: A/D and D/A Converter 8 Hours

Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/Dc converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs

UNIT 5: Semiconductor memories and Programmable logic devices. 8 Hours

Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory (RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

Reference books:

- R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
- M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
- A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

Learning Outcomes:
At the end of this course students will be able to learn:

1. Convert different type of codes and number systems which are used in digital communication and computer systems.
2. Employ the codes and number systems converting circuits and Compare different types of logic families which are the basic unit of different types of logic gates in the domain of economy, performance and efficiency.
3. Analyze different types of digital electronic circuit using various mapping and logical tools and know the techniques to prepare the most simplified circuit using various mapping and mathematical methods.
4. Design different types of with and without memory element digital electronic circuits for particular operation, within the realm of economic, performance, efficiency, user friendly and environmental constraints.
5. Apply the fundamental knowledge of analog and digital electronics to get different types analog to digitalized signal and vice-versa converters in real world with different changing circumstances.
6. Assess the nomenclature and technology in the area of memory devices and apply the memory devices in different types of digital circuits for real world application.

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the student's everyday life.
- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.

- Oral quizzes in the class.
- End semester examination.

Internal Assessment: 25 Marks, End Semester Examination:75 Marks &Total Marks: 100.

BTCSEAI 305: Programming with Python

Course Code: BTCSEAI-305 Title of the Course: Programming with Python
L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 305	Programming with Python	PC	25	75	100	3-0-0	3

Course objective

1. To acquire programming skills in core Python.
2. To acquire Object Oriented Skills in Python
3. To develop the skill for doing project based on machine learning and data science in Python
4. To develop the ability to write database applications in Python Pre-requisites : Computer Concepts and C Programming

Course outcomes

CO-1: Understanding the basics of Python programming
CO-2: Modelling some real world problems in Python and solve them.
CO-3: Building projects in Python
CO-4: Understanding all the foundations of Python and knowing how to apply them
CO-5: Understanding all the python based Data Structures, Objects, Functions and Modules

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO2	3	2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO3	3	2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO4	3	2	2	1	-	-	-	-		1	1	1	1	-	-
CO5	3	2	2	1	-	-	-	-	1	-	1	2	1	-	-

3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

Unit – 1: Basics of Python 8 Hours

Introduction to Python, Anaconda navigator, Jupyter, Spyder IDE, Pycharm, print Function, variables, Data structure in python: Tuple, Dictionary, operators, Python Arrays

Unit – 2: Loops and Strings 8 Hours

Conditional Loops: If, Else, elif, & switch cases; For and While loops: Enumerate, break, and continue statement, pass statement; OOPS: Class, Objects, inheritance and constructor with examples. Strings: Replace, Join, Split, Reverse, Uppercase & Lowercase; strip function, string count, string format, string len() and find() method

Unit – 3: Functions & File Handling 8 Hours

Main functions, Lambda Function, abs(), round(), range(), map(), timeit(), yield, Queue, counter in collections, Enumerate(); File: create, open, read, write; copy file, rename file, zip file, exception handling, readline()

Unit – 4: Tools and Modules 8 Hours

Pandas, Scikit-learn, matplotlib, scipy, Keras, Numpy, reading and writing CSV File, JSON File, Matrix, project based on Machine Learning

Unit – 5: Python with other technologies 8 Hours

PHP, Java Script, Ruby, C++, Django, PERL, project based on Data Science

Books Recommended:

- Deitel, "Python for programmers", Pearson, 2020
- Mark Summerfield, "Programming in Python 3: A Complete Introduction to the Python Language", Pearson, 2018
- Reema Thareja, "Python Programming: Using Problem Solving Approach" Oxford University Press, 2017
- R. Nageswara Rao, "Core Python Programming", Dreamtech press, 2018

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the student's everyday life.
- Encourage the spirit of questioning by the students.

- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.
- End semester examination.

Internal Assessment: 25 Marks, End Semester Examination:75 Marks &Total Marks: 100.

BTCSEAI 306: Effective Technical Communication

Course Code: BTCSEAI-306 Title of the Course: Effective Technical Communication
L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 306	Effective Technical Communication	HS	25	75	100	3-0-0	3

Course Objective:

1. To learn Design and Development of different kinds of technical documents.
2. To learn Technical Writing, Grammar and Editing.
3. To learn how to develop and assessment oneself
4. To learn about Communication and Technical Writing.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3

CO 1	3	2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO 2	3	2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO 3	3	2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO 4	3	2	2	1	-	-	-	-	-	1	1	1	1	-	-
CO 5	3	2	2	1	-	-	-	-	1	-	1	2	1	-	-

1. 3-High Level, 2-Medium Level, 1-Low Level

Unit – I: Information Design and Development 8 Hours

Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

Unit – II: Technical Writing, Grammar and Editing 8 Hours

Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization.

Unit – III: Self-Development and Assessment 8 Hours

Self-assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity

Unit – IV: Communication and Technical Writing 8 Hours

Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

Unit – V:: Ethics 8 Hours

Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.

Text/Reference Books:

7. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004

8. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
9. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
10. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
11. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
12. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

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

1. Design and Develop different kinds of technical documents.
2. Do Technical Writing, Grammar and Editing.
3. Self-assess themselves
4. Do Communication and Technical Writing.

BTCSEAI 307: Analog Electronic Circuits Laboratory

Course Code: BTCSEAI-307 **Title of the Course: Analog Electronic Circuits Laboratory**
L-T-P: 0-0-4 **Credits**: - 02
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 307	**Analog Electronic Circuits Laboratory**	ES	25	75	100	0-0-4	2

Lab based on Analog Electronic Circuits

BTCSEAI 308: Data Structure & Algorithms Laboratory

Course Code: BTCSEAI-308 Title of the Course: Data Structure & Algorithms Laboratory
L-T-P: 0-0-4 **Credits**: - 02
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 308	**Data Structure & Algorithms Laboratory**	PC	25	75	100	0-0-4	2

Description
The objective of the course is to teach programming corresponding to theory and introduce elementary data structures.

Learning Outcomes

After the successful completion of the lab course the student will be able to:

Write programs to solve problems.

Choose and implement efficient data structures and apply them to solve problems.

Syllabus:

Arrays:

1) Program to find the largest and smallest number in an array
2) Implement Sorting using mergesort algorithm.
3) Implement Sorting using quicksort algorithm.
4) Program to Multiply two matrices

Linked list:

1. Create a linked list and perform the following operations on it
    A. Add element at the beginning
    B. Add element at the end
    C. Add element in between
    D. Delete element from the beginning
    E. Delete element from the end
    F. Delete element from the middle
    G. Display the linked list

2. Implement the following using linked list
    A. Linear Search
    B. Bubble sort
    C. Merge sort

3. Create a double linked list and perform: Insertion(at start, end , middle), Deletion(at start, end , middle), Searching

4. Create a circular linked list and perform- Insertion, Deletion, Searching, Count no. of nodes in the CLL

Stack & Queue:

1) Implement stack using array and linked list and create the following functions- push, pop
2) Implement queue and circular queue. Perform addition, deletion, searching
3) Implement Stack using Queues

Trees:

1) Program to create a BST.Insert a new node in it.Delete a node
2) Program to perform tree traversals- In order, pre-order, post-order
3) Create AVL tree and perform insertion deletion
4) Program to create a B tree. Perform addition, deletion.
5) Program to create a B+ tree. Perform addition, deletion

Graphs:

1) Program to perform depth first search on a graph.
2) Program to perform breadth first search on a graph.
3) Program to implement Warshall's algorithm.
4) Program to implement Floyd's algorithm.
5) Program to implement Dijkstra's algorithm.
6) Program to implement Prim's Algorithm.
7) Program to implement Kruskal's Algorithm.

BTCSEAI 309 Digital Electronics Lab

Course Code: BTCSEAI-309 Title of the Course: Digital Electronics Lab
L-T-P: 0-0-4 **Credits**: - 02
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 309	**Digital Electronics Lab**	PC	25	75	100	0-0-4	2

Course Objective

Laboratory courses and hands-on experiments are integral parts of engineering education. This laboratory course enables students to:

- Learn and understand the Basics of digital electronics components.
- Get practical experience in Designing and realization of combinational and sequential circuits.
- The emphasis of this course is on the development of practical skills and their application.

Course Content

1. Realization of truth table for basic Gates, Exclusive gates and Universal gates.
2. Realization of logic functions with the help of Universal Gates.
3. Realization of half adder and full adder.
4. Verification of DE Morgan's theorem.
5. Verification of the truth table of 1-bit and 2- bit comparator.
6. Design and implementation of Multiplexer and De-multiplexer using logic gates.
7. Design and implementation of encoder and decoder using logic gates
8. Design and implementation of code converters using logic gates
    i. BCD to excess-3 code and vice versa
    ii. Binary to gray and vice-versa.
9. To study a BCD to 7 segment LED display decoder.
10. To study parallel binary adder.
11. To study 2-bit ripple counter.
12. To study 4-bit Ring counter.
13. Realize Johnson Counter.
14. Design a synchronous UP/DOWN counter.
15. Construction and verification of a NOR gate latch.
16. Verify the truth table of RS, JK, T and D flip-flop using universal gates.
17. To study the conversion of D and T flip-flop to JK FF.
18. Design and verify the 4-bit Synchronous/Asynchronous counter using JKFF.
19. Verification of 4-bit Asynchronous mod-10 (decade) counter
20. Design and verify truth table of shift registers :
    i. Serial-In-Serial-Out
    ii. Serial-In-Parallel-Out

iii. Parallel-In-Serial-Out
iv. Parallel-In-Parallel-Out

21. Design and Verify the 4-Bit Serial In - Parallel Out Shift Registers

Course Outcome:

On successful completion of the course, the student will be able to

- Develop good understanding of basic experiments related to digital circuits.
- Identify the various digital circuits and understand their operation.
- Familiarize themselves with designing simple logic circuits
- Apply Boolean laws to simplify the digital circuits.
- Understand the function of elementary digital circuits under real and simulated environment.
- Prepare a report on basics of digital electronics

Books Recommended:

- Digital Fundamentals, Thomas L. Floyd, Pearson Education, ISBN:9788131734483
- Digital Principles and Applications, Malvino and Leach, TMH
- Charles H Roth: Digital Systems Design using VHDL, Thomson Learning, 1998
- H. Taub and D. Schilling, Digital Integrated Electronics, McGraw Hill, 1977.
- D.A. Hodges and H.G. Jackson, Analysis and Design of Digital Integrated Circuits, International Student Edition, McGraw Hill, 1983.

BTCSEAI 310: Programming with Python Lab

Course Code: BTCSEAI-310 **Title of the Course: Programming with Python Lab**
L-T-P: 0-0-4 **Credits**: - 02
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 310	**Programming with Python Lab**	PC	25	75	100	0-0-4	2

BTCSEAI – 310: Programming with Python Lab

List of Experiments:

1. Write a Python Program to print the "Hello World"
2. Write a python Program to show functionality of different operators used in Python
3. Write a Python program to read and write a CSV file.
4. Write a Python program to show different list, string, & Dictionary operations
5. Write a Python Program to show the working of Pandas and Scikit-Learn
6. Write a Python Program to plot a graph using matplotlib and show its other functionalities
7. Binary Classification using Machine Learning
8. Multi Class Classification using Machine Learning models
9. Convolutional Neural Network for Classification
10. Write a program to simulate the rolling of a dice.

BTCSEAI 311 Mathematics for Machine Learning & AI

Course Code: BTCSEAI-311 **Title of the Course: Mathematics for Machine Learning & AI**
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 311	Mathematics for Machine Learning & AI	BS	25	75	100	3-1-0	4

Course Prerequisite: Calculus & Matrix Theory

COURSE OUTCOMES (COs)

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

CO-1 Discuss the concepts of vector spaces, linear algebra & vector calculus, & apply linear algebra in ML & AI

CO-2 Utilise eigen values and matrix factorisation techniques in practical problems

CO-3 Formulate LP (or optimization) problem & solve using different Optimization techniques

CO-4 Comprehend Gradient descent, Steepest descent & Newton`s Method

CO-5 Construct Error minimizing LPP & classify data & analyse the solution

Mapping of Course Outcomes (COs) with Program Outcomes (POs)
And Program Specific Outcomes (PSOs)

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	1	1	-	-	-	-	-	-	3		2
CO2	3	3	2	3	2	1	-	-	-	-	-	-	3		2
CO3	3	3	2	3	3	1	-	-	-	-	-	--	3		2
CO4	3	2	2	2	1	1	-	-	-	-	-		3		2
CO5	3	3	3	3	3	1	-	-	-	-	-		3		2

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level'mapping, 2 for 'Medium-level'mapping, 1 for 'Low'-level'mapping.

Detailed Syllabus:

UNIT-1: LINEAR ALGEBRA 8 Hours

Vector spaces and subspaces, basis and dimensions, linear transformation, four fundamental subspaces, Norms and spaces, Special Matrices and their properties, least squared and minimum normed solutions, minimal polynomial and Jordan canonical form.

UNIT-2: MATRIX DECOMPOSITION ALGORITHMS 8 Hours

SVD: Properties and applications, low rank approximations, Gram Schmidt process, polar decomposition.

UNIT-3: CALCULUS 8 Hours

Partial derivatives, Gradient, Directional derivatives, Jacobian, Hessian, Convex sets, Convex functions and its properties.

UNIT-4: OPTIMIZATION 8 Hours

Unconstrained and Constrained optimization, Constrained Optimization and Lagrange Multipliers, Convex Optimization, Numerical optimization techniques for constrained and unconstrained optimization: Newton's method, Steepest descent method, Penalty function method.

UNIT-5: SUPPORT VECTOR MACHINES 8 Hours

Introduction to SVM, Error minimizing LPP, Concepts of duality, Hard and soft margin classifiers.

Reference Books:

1. W. Cheney, Analysis for Applied Mathematics. New York: Springer Science+Business Medias, 2001.
2. S. Axler, Linear Algebra Done Right (Third Edition). Springer International Publishing, 2015.
3. J. Nocedal and S. J. Wright, Numerical Optimization. New York: Springer Science+Business Medias, 2006.
4. J. S. Rosenthal, A First Look at Rigorous Probability Theory (Second Edition). Singapore: World Scientific Publishing, 2006
5. M. P. Deisenroth, A. A. Faisal and C. S. Ong, Mathematics for Machine Learning. Cambridge University Press, 2020.

Teaching-Learning Strategies in brief

- Build positive environment in the classroom.
- Provide concrete basic and advanced knowledge of the subject.
- Solve problems based on the basic & advanced concepts of the subject.
- Encourage to the students to ask more & more questions.
- Motivate to the students to develop critical & strategic thinking

Assessment methods and weightages in brief

- By taking two sessional examinations.
- By giving assignments.
- By conducting class tests.
- By taking semester examination.

Internal assessment (25 Marks) & Semester Examination (75 Marks) &Total Marks-100.

SEMESTER IV

BTCSEAI 401: Discrete Mathematics

Course Code: BTCSEAI-401 **Title of the Course: Discrete Mathematics**
L-T-P: 3-1-0 **Credits**: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 401	Discrete Mathematics	PC	25	75	100	3-1-0	4

Objectives of the course

Throughout the course, students will be expected to demonstrate their understanding of Discrete Mathematics by being able to do each of the following:

- Use mathematically correct terminology and notation.
- Construct correct direct and indirect proofs.
- Use division into cases in a proof.
- Use counterexamples.
- Apply logical reasoning to solve a variety of problems.

Course Outcomes

CO-1: For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives
CO-2: For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference.
CO-3: For a given a mathematical problem, classify its algebraic structure
CO-4: Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.
CO-5: Develop the given problem as graph networks and solve with techniques of graph theory.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

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

3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

UNIT 1: **10 Hours**

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

Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

UNIT 2: **8 Hours**

Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination.

UNIT 3: **8 Hours**

Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers.

Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

UNIT 4: **8 Hours**

Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free And Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

UNIT 5: **8 Hours**

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Coloring, Coloring maps and Planar Graphs, Coloring Vertices, Coloring Edges, List Coloring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.

Suggested books:

- Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill
- Susanna S. Epp, Discrete Mathematics with Applications, 4th edition, Wadsworth Publishing Co. Inc.
- C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.

Reference books:

- J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and Its Application to Computer Science", TMG Edition, Tata McGraw-Hill
- Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press. Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson,
- Discrete Mathematics, Tata McGraw – Hill

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the student's everyday life.
- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.
- Oral quizzes in the class.
- End semester examination.

Internal Assessment: 25 Marks, End Semester Examination :75 Marks &Total Marks: 100.

BTCSEAI 402: Computer Organization &Architecture
Course Code: BTCSEAI-402 Title of the Course: Computer Organization & Architecture
L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 402	Computer Organization & Architecture	PC	25	75	100	3-0-0	3

Pre-requisites: Digital Electronics

Objectives of the course:

To expose the students to the following:

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

Course outcomes:

After completing this Course, the students should be able to:
CO-1: Draw the functional block diagram of single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.
CO-2: Apply assembly language program for specified microprocessor forcomputing16bit multiplication, division and I/O device interface ADC.
CO-3: Analyze a flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.
CO-4: Given a CPU organization and instruction, design a memory UNIT and analyze its operation by interfacing with the CPU.

CO-5: Given a CPU organization, assess its performance, and apply design techniques to enhance performance using pipelining, parallelism and RISC methodology

Mapping of Course Outcomes (COs) with Program Outcomes (POs) And Program Specific Outcomes (PSOs)

	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	PS O3
CO1	3	3	3	3	3	3	-	2	2	1	1	1	1	-	-
CO2	3	3	3	3	3	3	2	2	2	2	1	1	1	-	-
CO3	3	3	3	3	3	3	-	-	2	1	-	1	1	-	-
CO4	3	3	3	3	3	3	2	2	-	-	1	1	1	-	-
CO5	3	3	3	3	3	3	2	2	1	-	-	2	1	-	-

Detailed contents:

UNIT 1 **10 Hours**

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

Data representation: signed number representation, fixed and floating-point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

UNIT 2: **8 Hours**

Introduction to x86 architectures.

CPU control unit design: hardwired and micro-programmed design approaches Case Study– design of a simple hypothetical CPU.

Memory system design: semiconductor memory Technologies, memory organization.

UNIT 3: **8 Hours**

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes–role of interrupts in process state transitions, I/O device interfaces – SCII, USB

UNIT 4: **8 Hours**

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

UNIT 5: 8 Hours

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

Reference books:

- "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
- "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.
- "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill
- "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education.
- "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Learning Outcomes:

- Upon successful completion of this course, students will be able to:
- 1. Identify various components of computer and their interconnection
- 2. Identify basic components and design of the CPU: the ALU and control unit.
- 3. Compare and select various Memory devices as per requirement.
- 4. Compare various types of IO mapping techniques
- 5. Critique the performance issues of cache memory and virtual memory

Teaching-Learning Strategies in brief

TEACHING - LEARNING STRATEGIES
1. BLENDED LEARNING
2. BRAINSTORMING
3. CASE STUDY
4. COMPUTER AIDED PRESENTATION
5. COMPUTER LABS/LAPTOP INSTRUCTION
6. DEMONSTRATION
7. DIRECT INSTRUCTION
8. DISCOVERY LEARNING
9. DISCUSSION
10. DRILL AND PRACTICE
11. EXAMINATION
12. FLIPPED CLASS

13. FULLY ONLINE INSTRUCTION
14. GROUP ACTIVITIES
15. INQUIRY
16. LECTURE
17. MENTAL MODELING
18. MOOC ONLINE
19. PROJECT DEVELOPMENT
20. PROJECT PRESENTATION
21. QUESTION AND ANSWER
22. ROLE PLAY
23. SELF-LEARNING
24. SEMINAR
25. TUTORIAL
26. WEB-ENHANCED LEARNING

Assessment methods and weightages in brief

1. Internal Assessment: 25
2. Semester Exam: 75
   Assessments through Sessional, Assignments, Quizzes etc.

BTCSEAI 403: Operating Systems

Course Code: BTCSEAI-403
Title of the Course: Operating Systems
L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 403	Operating Systems	PC	25	75	100	3-0-0	3

Objectives of the course

To learn the fundamentals of Operating Systems.

- To learn the mechanisms of OS to handle processes and threads and their communication
- To learn the mechanisms involved in memory management in contemporary OS
- To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols

- To know the components and management aspects of concurrency management.

Course Outcomes (Revised Bloom's taxonomy of cognitive levels are:

CO-1: Create processes and threads.
CO-2: Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.
CO-3: For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.
CO-4: Design and implement file management system.
CO-5: For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	1	-	1	1	1	-	-
CO2	3	2	2	1	1	-	-	-	1	-	1	1	1	-	-
CO3	3	2	2	1	1	-	-	-	1	-	1	1	1	-	-
CO4	3	2	2	1	1	-	-	-	-	1	1	1	1	-	-
CO5	3	2	2	1	1	-	-	-	1	-	1	2	1	-	-

3-High Level, 2-Medium Level, 1-Low Level

Detailed Ssyllabus:

UNIT 1: 10 Hours

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

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

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

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling

Criteria: CPU utilization, Throughput, Turn-around Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

UNIT 2: 8 Hours

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

UNIT 3: 8 Hours

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

UNIT 4: 10 Hours

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation –Fixedandvariablepartition– InternalandExternalfragmentationandCompaction; Paging: Principle of operation – Page allocation–Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory–Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/ Dirty bit–Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO),Second Chance (SC), Not Recently used (NRU) and Least Recently used (LRU).

UNIT 5: 10 Hours

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

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

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

Reference books:

- Operating System Concepts Essentials, 9th Edition by Avi Silberschatz, 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.

Assessment methods and weightages in brief

1. Internal Assessment: 25
2. Semester Exam: 75
   Assessments through Sessional, Assignments, Quizzes etc.

BTCSEAI 404: Design and Analysis of Algorithm

Course Code: BTCSEAI-404 Title of the Course: Design and Analysis of Algorithm
L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 404	Design and Analysis of Algorithms	PC	25	75	100	3-0-0	3

Pre-requisites: Programming for Problem Solving

After completion of this course, the students should be able to:
CO-1: Demonstrate understanding of major algorithms and data structures.(Cognitive level: Understand)
CO-2: Apply important algorithmic design paradigms(Divide & Conquer, Greedy, Dynamic, Backtracking) and methods of analysis.(Cognitive level: Apply)
CO-3: Analyze the asymptotic performance of algorithms. (cognitive level: Analyse)
CO-4: Write rigorous correctness proofs for algorithms. (cognitive level: Apply)
CO-5: Design efficient algorithms without any error in common engineering design situations. (cognitive level: create).

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	2	3	2	1	-	-	-	-	1	1	3	-	-	-
CO2	2	2	3	3	2	-	-	-	-	1	1	3	-	-	-
CO3	2	2	2	3	2	-	-	-	-	1	1	2	-	-	-

CO4	1	1	1	3	1	-	-	-	-	1	1	2	-	-	-
CO5	3	2	3	3	1	-	-	-	-	1	1	3	-	-	-

'3' in the box for 'High-level'mapping,
2 for 'Medium-level'mapping,
1 for 'Low'-level'mapping.

Detailed Syllabus:

UNIT - 1: 8 Hours

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

UNIT - 2: 8 Hours

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

UNIT – 3: 8 Hours

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

UNIT - 4: 8 Hours

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

UNIT - 5: 8 Hours

Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P Space.

Reference books:

- Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
- Fundamentals of Algorithms – E. Horowitz et al.
- AlgorithmDesign,1STEdition,JonKleinbergand ÉvaTardos, Pearson.
- Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
- Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA.

Learning Outcomes

- Students must be able to design and analyze an algorithm, compute the best, worst, and average case complexities.
- Students must possess the ability to use the effective algorithm paradigm to solve any problem.
- To learn various graph traversal techniques and to prove its effectiveness.
- To understand the concept of tractable and intractable problem.
- Ability to write and implement an approximation or randomized algorithms.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.
- End semester examination.

Internal Assessment: 25 Marks, End Semester Examination :75 Marks &Total Marks: 100.

BTCSEAI 405 – Object Oriented Programming

Course Code: BTCSEAI-405 **Title of the Course: Object Oriented Programming**
L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 405	Object Oriented Programming	HS	25	75	100	3-0-0	3

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO2	3	2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO3	3	2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO4	3	2	2	1	-	-	-	-		1	1	1	1	-	-
CO5	3	2	2	1	-	-	-	-	1	-	1	2	1	-	-

3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

Unit-I **10 Hours**

Principles of Object Oriented Programming, Beginning with C++, Basic concepts of procedure-oriented and object oriented programming, Benefits and Applications of OOP, Structure of C++ program with simple C++ program, C++ data types, Symbolic constants and Reference by variables, Operators in C++ and Operator precedence, Control structures, Function in C++, main function, function prototyping, call by reference & return by reference, Inline function & default arguments, function overloading.

Unit-II **8 Hours**

Classes and Objects: specifying a class, defining member functions, Specifying a class-Defining member functions, Private member functions & Nesting of member functions, Arrays within a class, Memory allocation for objects, Static data members & Static member functions, Array of objects, Objects as function arguments, Friendly functions, Returning objects.

Unit-III **8 Hours**

Constructers and Destructors, Overloading: Constructors, Default constructor, Parameterized constructor & Copy constructor, Multiple constructors, Constructors with default arguments & Dynamic constructor

Destructors: Operator overloading, Unary and Binary operator overloading, R**ule** of overloading, types of conversion.

Unit-IV **8 Hours**

Inheritance: Inheritance, Defining derived classes & Visibility modes, Single, Multilevel, Multiple, Hierarchical and Hybrid inheritance, Virtual base classes & Abstract classes, Constructors in derived classes, Nesting of classes.

Unit-V **8 Hours**

Pointers, Virtual Functions and Polymorphism, Working with Files, pointers, ponters to objects & this pointer, Pointers to derived classes, Virtual functions & Pure virtual functions, File Stream classes, File pointers and their manipulations

Text Books for Reference

1. E. Balagurusamy – Object Oriented Programming with C++, Fifth edition, Tata McGraw Education Hill , 2011.

2. Ashok N. Kamthane, Object oriented Programming with ANSI & Turbo C++, First Edition, Pearson India

Text Books for Enrichment

1. Robert Lafore, Object Oriented Programming in Turbo C++, First Edition, Galgotia Publications.

2. D Ravichandran, Programming with C++, Second edition, Tata McGraw- Hil

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.
- End semester examination.
- **Internal Assessment: 25 Marks, End Semester Examination :75 Marks &Total Marks: 100.**

BTCSEAI 406-Computer Organization &Architecture Laboratory

Course Code: BTCSEAI-406 Title of the Course: Computer Organization &Architecture Laboratory
L-T-P: 0-0-4 **Credits**: - 02
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 406	Computer Organization & Architecture Laboratory	PC	25	75	100	0-0-4	2

Lab based on Computer Organization &Architecture

BTCSEAI 407-Operating Systems Laboratory

Course Code: BTCSEAI-407 Title of the Course: Operating Systems Laboratory
L-T-P: 0-0-4 **Credits**: - 02
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		

BTCSEAI 407	Operating System Laboratory	PC	25	75	100	0-0-4	2

Lab based on Operating Systems

BTCSEAI 408- Design and Analysis of Algorithms Lab
Course Code: BTCSEAI-408 **Title of the Course:** Design and Analysis of Algorithms Lab
L-T-P: 0-0-4 **Credits**: - 02
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 408	Design and Analysis of Algorithms Lab	PC	25	75	100	0-0-4	2

Lab based on Design and Analysis of Algorithms

BTCSEAI 409 Disaster Management

Course Code: BTCSEAI-409 **Title of the Course: Disaster Management**
L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 409	Disaster Management	PC	25	75	100	3-0-0	3

COURSE OBJECTIVES

1. To provide basic conceptual understanding of disasters and its relationships with development.

2. To gain understand approaches of Disaster Risk Reduction (DRR) and the relationship between vulnerability, disasters, disaster prevention and risk reduction.

3. To understand Medical and Psycho-Social Response to Disasters.

4. To prevent and control Public Health consequences of Disasters

5. To enhance awareness of Disaster Risk Management institutional processes in India

6. To build skills to respond to disasters.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO2	3	2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO3	3	2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO4	3	2	2	1	-	-	-	-	-	1	1	1	1	-	-
CO5	3	2	2	1	-	-	-	-	1	-	1	2	1	-	-

2. 3-High Level, 2-Medium Level, 1-Low Level

UNIT-1: Introduction to Disaster 10 Hours

Concepts of Hazard, Vulnerability, Risks, Natural Disasters (earthquake, Cyclone, Floods, Volcanoes), and Man Made Disaster (Armed conflicts and civil strip, Technological disasters, Human Settlement, Slow Disasters (famine, draught, epidemics) and Rapid Onset Disasters(Air Crash, tidal waves, Tsunami) Risks, Difference between Accidents and Disasters, Simple and Complex Disasters, Refugee problems, Political, Social, Economic impacts of Disasters, Gender and Social issues during disasters, principles of psychosocial issues and recovery during emergency situations, Equity issues in disasters, Relationship between Disasters and Development and vulnerabilities, different stake holders in Disaster Relief. Refugee operations during disasters, Human Resettlement and Rehabilitation issues during and after disasters, Inter-sectoral coordination during disasters, Models in Disasters.

UNIT-II: Approaches to Disaster Risk Reduction 10 Hours

Disaster Risk Reduction Strategies, Disaster Cycle, Phases of Disaster, Preparedness Plans, Action Plans and Procedures, Early warning Systems Models in disaster preparedness, Components of Disaster Relief-(Water, food, sanitation, shelter, Health and Waste Management), Community based DRR, Structural non structural measures in DRR, Factors affecting Vulnerabilities, , Mainstreaming disaster risk reduction in development, Undertaking risk and vulnerability assessments, Policies for Disaster Preparedness Programs, Preparedness Planning, Roles and Responsibilities, Public Awareness and Warnings, Conducting a participatory capacity and vulnerability analysis, , Sustainable Management, Survey of Activities Before Disasters Strike, Survey of Activities During Disasters, DRR Master

Planning for the Future, Capacity Building, Sphere Standards. Rehabilitation measures and long term reconstruction. Psychosocial care provision during the different phases of disaster.

UNIT- III: Prinicples of Disaster Medical Management 10 Hours

Introduction to disaster medicine, Various definitions in disaster medicine, Disaster life cycle, Disaster planning, Disaster preparation, Disaster recovery in relation to disaster medical management, Medical surge, Surge capacity, Medical triage, 275 National Assessing the nature of hazardous material - Types of injuries caused, Self protection contaminated area and decontaminated area – Pre hospital medical management of victims – Triaging medical & psychosocial identification of hospitals and other medical facilities to offer efficient disastrous medical service – Safe patient transportation –Identification of valuable groups (Pregnancy, pediatric and geriatric other people with associated medical co morbidities) (DM, Systemic Hypertension / Cardiac, Pulmonary, Cerebral and Renal) – knowledge about antidotes, - and Body decontaminations procedures (skin, GI tract, Respiratory tract and from blood) – Poly trauma Care - Specific treatment in emergency and Intensive Care Units – allocation of specialists in Local EMS System including equipments, safe use of equipments.

UNIT-IV: Public Health Response and International Cooperation 8 Hours

Principles of Disaster Epidemiology, Rapid Health Assessment, Rapid Health needs assessment. Outbreak Investigation Environment health hygiene and sanitation issues during disasters, Preventive and prophylactic measures including Measles immunization, ORS, water, supply, chemoprophylaxis, food fortification, food supplements, MISP-Reproductive Health Care, International cooperation in funding on public health during disaster, To identify existing and potential public health problems before, during and after disasters. (168 countries Framework Disaster Risk Reduction), International Health Regulation, United Nation International Strategy for Disaster Risk Reduction (UNISDR), United Nation Disaster Management Team, International Search and Rescue Advisory Group, (INSARAG, Global Facility for Disaster Risk Reduction (GFDRR), Asean Region Forum (ARF), Asian disaster Reduction Centre (ADRC), SAARC

UNIT-V: Disaster Risk Management in India 8 Hours

Hazard and Vulnerability Profile India, Disaster Management Indian scenario, India's vulnerability profile, Disaster Management Act 2005 and Policy guidelines, National Institute of Disaster Management, , National Disaster Response Force (NDRF)National Disaster Management Authority, States Disaster Management Authority, District Disaster Management Authority Cases Studies : Bhopal Gas Disaster, Gujarat Earth Quake, Orissa Super-cyclone, south India Tsunami, Bihar floods, Plague- Surat, Landslide in North East, Heat waves of AP& Orissa, Cold waves in UP. Bengal famine, best practices in disaster management, Local Knowledge Appropriate Technology and local Responses, Indigenous Knowledge, Development projects in India (dams, SEZ) and their impacts, Logistics management in specific emergency situation. Rajiv Gandhi Rehabilitation package, Integrated Coastal Zone Management, National Flood Risk Mitigation Project (NFRMP), Mines Safety in India, Indian

Meteorological Department, National Crisis Management Committee, Indian NATIONAL Centre for Oceanic Information System (INCOIS).

Course Outcome:

- Upon successful completion of the topics of discussion, students would be able to: 1. Explain disaster management theory.
- Compare hazards, disasters and associated natural phenomena and their interrelationships, causes and their effects.
- Compare anthropogenic hazards, disasters and associated activities and their interrelationships of the subsystems.
- Apply knowledge about existing global frameworks and existing agreements and role of community in successful Disaster Risk Reduction.
- Evaluate DM study including data search, analysis and presentation as a case study

Text/Reference books :

1. Disaster Management Guidelines. GOI-UNDP Disaster Risk Reduction Programme (2009-2012.

2. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State

of California, EMSA no.214, June 2003

3. Guerisse P. 2005 Basic Principles of Disaster Medical Management.

4. Aim and Scope of Disaster Management. Study Guide prepared by Sharman and Hansen. UW-DMC, University of Washington.

5. Sphere Project (2011). Humanitarian Charter and Minimum Standards in Disaster Response.

6. Geneva: Sphere Project. http://www.sphereproject.org/ handbook/

7. Satapathy S. (2009) Psychosocial care in Disaster management, A training of trainers manual (ToT), NIDM publication.

8. Prewitt Diaz, J.O (2004). The cycle of disasters: from Disaster Mental Health to Psychosocial Care. Disaster Mental Health in India, Eds: Prewitt Diaz, Murthy, Lakshmi Narayanan, Indian Red Cross Society Publication.

9. Sekar, K (2006). Psychosocial Support in Tsunami Disaster: NIMHANS responses. Disaster and Development, 1.1, pgs 141-154.

10. Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC.

11. Alexander David, 2000 Introduction in 'Confronting Catastrophe', Oxford University Press.

12. Andharia J. 2008 Vulnerability in Disaster Discourse, JTCDM, Tata Institute of Social Sciences Working Paper no. 8,

13. Blaikie, P, Cannon T, Davis I, Wisner B 1997. At Risk Natural Hazards, Peoples' Vulnerability and Disasters, Routledge.

14. Coppola P Damon, 2007. Introduction to International Disaster Management, Carter, Nick 1991. Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manil

BTCSEAI 410 Data Mining & Prediction by Machines

Course Code: BTCSEAI-410 **Title of the Course:** Data Mining & Prediction by Machines

L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 410	Data Mining & Prediction by Machines	PC	25	75	100	3-0-0	3

OBJECTIVES:

- Understand and apply the fundamental concepts of datamining and modern predictive modeling.
- Know how to preprocess and clean up data extracted from large databases – known as data wrangling by predictive modelers.
- Explore large datasets to find hidden but important relations among variables – this is sometimes called unsupervised learning.
- Build and validate predictive models (known as supervised learning) using such techniques as Decision Trees, Random Forests Boosted Trees, and Neural Network Models.
- Create ensembles of predictive models to create even more powerful predictions.

COURSE OUTCOMES:

The students will be able to:
CO-1: Understand the process of formulating business objectives, data selection/collection, preparation and process to successfully design, build, evaluate and implement predictive models for a various business application.
CO-2: Create a Model for Data mining.
CO-3: Evaluate predictive modelling to analyses time series
CO-4: Select appropriate predictive modeling approaches to identify cases to progress with.
CO-5: Apply predictive modeling approaches using a suitable package such as Python/Tableu

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO2	3	2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO3	3	2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO4	3	2	2	1	-	-	-	-	-	1	1	1	1	-	-
CO5	3	2	2	1	-	-	-	-	1	-	1	2	1	-	-

3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

Unit 1: 8 Hours

Introduction to Data Mining Introduction, what is Data Mining? Concepts of Data mining, Technologies Used, Data Mining Process, KDD Process Model, CRISP – DM, Mining on various kinds of data, Applications of Data Mining, Challenges of Data Mining.

Unit 2: 8 Hours

Data Understanding and Preparation Introduction, Reading data from various sources, Data visualization, Distributions and summary statistics, Relationships among variables, Extent of Missing Data. Segmentation, Outlier detection, Automated Data Preparation, Combining data files, Aggregate Data, Duplicate Removal, Sampling DATA, Data Caching, Partitioning data, Missing Values.

Unit 3: 8 Hours

Model development & techniques Data Partitioning, Model selection, Model Development Techniques, Neural networks, Decision trees, Logistic regression, Discriminant analysis, Support vector machine, Bayesian Networks, Linear Regression, Cox Regression, Association rules.

Unit 4: 8 Hours

Advanced techniques, Data Mining software and applications, Text mining: extracting attributes (keywords), structural approaches (parsing, soft parsing), Bayesian approach to classifying text , Web mining: classifying web pages, extracting knowledge from the web, Data Mining software and applications

Unit 5: **8 Hours**

Model Evaluation and Deployment Introduction, Model Validation, Rule Induction Using CHAID, Automating Models for Categorical and Continuous targets, Comparing and Combining Models, Evaluation Charts for Model Comparison, MetaLevel Modeling, Deploying Model, Assessing Model Performance, Updating a Model.

Reference books:

1. Data Mining for Business Intelligence: Concepts, Techniques and Applications with JMP Pro; Shmueli, Bruce, Stephens, Patel 2017,Wiley & Sons.
2. Predictive & Advanced Analytics (IBM ICE Publication).
3. Preparing Data for Analysis with JMP by Robert Carver.
4. Introduction to Statistical Learning, sixth printing, by Gareth, Tibshirani, Hastie, and Whitten.

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the Business Analytics.
- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.
- End semester examination.

Internal Assessment: 25 Marks, End Semester Examination:75 Marks &Total Marks: 100.

BTCSEAI 411 – Data Mining & Prediction Laboratory

Course Code: BTCSEAI-411 Title of the Course: Data Mining & Prediction Laboratory

L-T-P: 0-0-4 **Credits**: - 02

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Lab based on Data Mining & Prediction

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 411	Data Mining & Prediction Laboratory	PC	25	75	100	0-0-4	2

COURSE OBJECTIVES:

1. Learn how to build a data warehouse and query it (using open source tools like Pentaho Data Integration Tool, Pentaho Business Analytics).
2. Learn to perform data mining tasks using a data mining toolkit (such as open source WEKA).
3. Understand the data sets and data preprocessing.
4. Demonstrate the working of algorithms for data mining tasks such association rule mining, classification, clustering and regression.

5. Exercise the data mining techniques with varied input values for different parameters.
6. To obtain Practical Experience Working with all real data sets.
7. Emphasize hands-on experience working with all real data sets.

NAME OF THE EXPERIMENTS

1. Data Processing Techniques:

   (i) Data Cleaning
   (ii) Data Transformation-Normalization
   (iii) Data Integration

2. Data Warehouse Schemas: Star, Snowflake, Fact Constellation
3. Data Cube Construction-OLAP operations
4. Data Extraction, Transformations, Loading operations
5. Implementation of Apriori algorithm
6. Implementation of FP-Growth algorithm
7. Implementation of Decision Tree Induction
8. Calculating information gain measures
9. Classification of data using Bayesian approach
10. Classification of data using K-Nearest Neighbor approach
11. Implementation of K-Means algorithm

COURSE OUTCOMES:

1. Ability to understand the various kinds of tools.
2. Demonstrate the classification, clustering and etc. in large data sets.
3. Ability to add mining algorithms as a component to the exiting tools.
4. Ability to apply mining techniques for realistic data.

SEMESTER V

BTCSEAI 501-Machine Learning
Course Code: BTCSEAI-501 Title of the Course: Machine Learning
L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 501	Machine Learning	PC	25	75	100	3-0-0	3

COURSE OBJECTIVES:

1. To understand pattern classification algorithms to classify multivariate data

2. To understand the Implementation of genetic algorithms

3. To gain knowledge about Q-Learning

4. To create new machine learning techniques.

COURSE OUTCOMES: Upon completion of the course, the students will be able to:

CO-1. Create and apply pattern classification algorithms to classify multivariate data.

CO-2. Develop and apply regression algorithms for finding relationships between data variables.

CO-3. Develop and apply reinforcement learning algorithms for learning to control complex systems.

CO-4. Write and Analyze scientific reports on computational machine learning methods, results and conclusions.

CO-5. Learn and Apply advance Machine Learning Algorithm.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO2	3	2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO3	3	2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO4	3	2	2	1	-	-	-	-		1	1	1	1	-	-
CO5	3	2	2	1	-	-	-	-	1	-	1	2	1	-	-

3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

UNIT I **08 Hours**

BASICS Learning Problems Perspectives and Issues Concept Learning Version Spaces and Candidate eEliminations – Inductive bias – Decision Tree learning – Representation Algorithm – Heuristic Space Search

UNIT II **08 Hours**

NEURAL NETWORKS AND GENETIC ALGORITHMS: Neural Network Representation Problems Perceptions Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms Hypothesis Space Search– Genetic Programming – Models of Evolutions and Learning.

UNIT III **08 Hours**

BAYESIAN AND COMPUTATIONAL LEARNING: Bayes Theorem Concept Learning Maximum Likelihood Minimum Description Length Principle Bayes Optimal Classifier Gibbs Algorithm Naïve Bayes Classifier Bayesian Belief Network EM Algorithm Probability Learning Sample Complexity Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT IV **08 Hours**

INSTANT BASED LEARNING: K- Nearest Neighbor Learning Locally weighted Regression Radial Bases Functions – Case Based Learning.

UNIT V **08 Hours**

ADVANCED LEARNING: Learning Sets of Rules Sequential Covering Algorithm Learning Rule Set First Order Rules Sets of First Order Rules Induction on Inverted Deduction Inverting Resolution Analytical Learning Perfect Domain Theories Explanation Base Learning – FOCL Algorithm - Reinforcement Learning Task Learning Temporal Difference Learning.

TEXT BOOK:

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill, 2010

2. Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995

REFERENCES:

1. Ethem Alpaydin, (2004) “Introduction to Machine Learning (Adaptive Computation and Machine Learning)”, The MIT Press

2. T. astie, R. Tibshirani, J. H. Friedman, “The Elements of Statistical Learning”, Springer (2nd ed.), 2009

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the student’s everyday life.
- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.

- End semester examination.

Internal Assessment: 25 Marks, End Semester Examination:75 Marks &Total Marks: 100.

BTCSEAI 502-Database Management Systems
Course Code: BTCSEAI-502 Title of the Course: Database Management Systems
L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 502	Database Management Systems	PC	25	75	100	3-0-0	3

Course Objective:

1. To understand the different Issues involved in the Design and Implementation of a Database System.
2. To study the Physical and Logical Database Designs, Database Modeling, Relational, Hierarchical, and Network Models.
3. To understand and use Data Manipulation Language to Query, Update, and Manage a Database.
4. 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.
5. To design and build a simple Database System and demonstrate competence with the fundamental tasks involved with Modeling, Designing, and Implementing a DBMS.

Course Outcomes:
CO-1: For a given query write relational algebra expressions for that query and optimize the developed expressions.
CO-2: For a given specification of the requirement design the databases using E-R Method and Normalization.
CO-3: For a given specification construct the SQL queries for open source and Commercial DBMS -MYSQL, ORACLE, and DB2.
CO-4: For a given query optimize its execution using Query optimization algorithms.
CO-5: For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.
CO-6: Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	1	-	1	1	1	-	-
CO2	3	2	2	1	1	-	-	-	1	-	1	1	1	-	-
CO3	3	2	2	1	1	-	-	-	1	-	1	1	1	-	-
CO4	3	2	2	1	1	-	-	-		1	1	1	1	-	-
CO5	3	2	2	1	1	-	-	-	1	-	1	2	1	-	-

3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

Unit – I: Database System Architecture 8 Hours

Database System Architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML), Data Models: Entity-Relationship Model, Network Model, Relational and Object-Oriented Data Models, Integrity Constraints, Data Manipulation Operations.

Unit – II: Relational Query Languages 8 Hours

Relational Query Languages: Relational Algebra, Tuple and Domain Relational Calculus, SQL3: DDL and DML Constructs, Open Source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL Server, Relational Database Design: Domain and Data Dependency, Armstrong's Axioms, Normal Forms, Dependency Preservation, Lossless Design, Query Processing and Optimization: Evaluation of Relational Algebra Expressions, Query Equivalence, Join Strategies, Query Optimization Algorithms.

Unit – III: Transaction Processing 8 Hours

Transaction Processing: Concurrency Control, ACID Property, Serializability: Serializability of Scheduling, Locking and Timestamp Based Schedulers, Multi-version and Optimistic Concurrency Control schemes, Database Recovery.

Unit – IV: Storage and Security of Database 8 Hours

Storage Strategies: Indices, B-trees, Hashing. Database Security: Authentication, Authorization and Access Control, Security Models: DAC, MAC and RBAC Models, Intrusion detection: SQL injection.

Unit – V: Advanced Topics 8 Hours

Advanced Topics: Object Oriented and Object Relational Databases, Logical Databases, Web databases, Distributed databases, Data warehousing and Data Mining.

Text Books:

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.
2. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.

Reference Books:

1. "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education.
2. "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley.

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the student's everyday life.
- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.
- Oral quizzes in the class.
- End semester examination.

Internal Assessment: 25 Marks, End Semester Examination:75 Marks &Total Marks: 100.

BTCSEAI 503-Formal Language & Automata Theory

Course Code: BTCSEAI-503 Title of the Course: Formal Language & Automata Theory

L-T-P: 3-0-0 **Credits**: - 03

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 503	Formal Language & Automata Theory	PC	25	75	100	3-0-0	3

Course Objectives:

1. Develop a formal notation for strings, languages and machines.
2. Design finite automata to accept a set of strings of a language.
3. Prove that a given language is regular and apply the closure properties of languages.
4. Design context free grammars to generate strings from a context free language and convert them into normal forms.
5. Prove equivalence of languages accepted by Push down Automata and languages generated by context free grammars.
6. Identify the hierarchy of formal languages, grammars and machines.

7. Distinguish between computability and non-computability and Decidability and un-decidability.

COURSE OUTCOMES (COs)

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

CO-1: Understand the basic properties of formal languages and grammars.
CO-2: Differentiate regular, context-free and recursively enumerable languages.
CO-3: Make grammars to produce strings from a specific language.
CO-4: Describe the language accepted by an automata or generated by a regular expression or a context free grammar.
CO-5: Acquire concepts relating to the theory of computation and computational models including decidability and intractability.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

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

3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

Unit – I: Introduction to Regular Language and Grammar 8 Hours

Introduction: Alphabet, Languages and Grammars, Productions and Derivation: Chomsky Hierarchy of Languages, Regular Languages and Finite Automata: Regular Expressions and Languages: Deterministic Finite Automata (DFA) and Equivalence with Regular Expressions, Nondeterministic Finite Automata (NFA) and Equivalence with DFA, Regular Grammars and Equivalence with Finite Automata, Properties of Regular Languages: Pumping Lemma for Regular Languages, Minimization of Finite Automata.

Unit – II: Context-free Grammar and Languages 8 Hours

Context-free Languages and Pushdown Automata: Context-free grammars (CFG) and Languages (CFL), Chomsky and Greibach Normal Forms, Nondeterministic Pushdown Automata (PDA) and Equivalence with CFG, Parse Trees, Ambiguity in CFG, Pumping lemma for Context-free Languages, Deterministic Pushdown Automata, Closure Properties of CFLs.

Unit – III: Context-Sensitive Languages 8 Hours

Context-Sensitive Languages: Context-Sensitive Grammars (CSG) and languages, linear bounded automata and equivalence with CSG.

Unit – IV: Turing Machines 8 Hours

Turing Machines: The Basic Model for Turing Machines (TM), Turing-Recognizable (Recursively Enumerable) and Turing-Decidable (Recursive) Languages and their Closure Properties, Variants of Turing Machines, Nondeterministic TMs and Equivalence with

Deterministic TMs, Unrestricted Grammars and Equivalence with Turing Machines, TMs as Enumerators.

Unit – V: Un-Decidability ***8 Hours***

Un-Decidability: Church-Turing Thesis, Universal Turing Machine, Universal and Diagonalization Languages, Reduction between Languages and Rice s theorem, Un-decidable Problems about Languages.

Text Books:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.
2. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.

Reference Books

1. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
2. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
3. John Martin, Introduction to Languages and the Theory of Computation, Tata McGraw Hill.

Learning Outcomes:

1. Write a formal notation for strings, languages and machines.
2. Design finite automata to accept a set of strings of a language.
3. For a given language determine whether the given language is regular or not.
4. Design context free grammars to generate strings of context free language.
5. Determine equivalence of languages accepted by Push down Automata and languages generated by context free grammars.
6. Write the hierarchy of formal languages, grammars and machines.
7. Distinguish between computability and non-computability and Decidability and un-decidability.

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the student's everyday life.
- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.
- Oral quizzes in the class.
- End semester examination.

Internal Assessment: 25 Marks, End Semester Examination:75 Marks &Total Marks: 100.

BTCSEAI 504-Object Oriented Programming
Course Code: BTCSEAI-504 Title of the Course: Object Oriented Programming Theory
L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 504	Object Oriented Programming	PC	25	75	100	3-0-0	3

Course Objectives:

1. The course will introduce standard tools and techniques for software development, using object-oriented approach.
2. Use of a version control system, an automated build process, and an appropriate framework for automated unit and integration tests.

COURSE OUTCOMES (COs)
After completing this Course, the students should be able to:
CO-1: Understand the difference between the top-down and bottom-up approach.
CO-2: Describe the object-oriented programming approach in connection with C++
CO-3: Apply the concepts of object-oriented programming.
CO-4: Illustrate the process of data file manipulations using C++
CO-5: Apply virtual and pure virtual function & complex programming situations.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	1	-	1	1	1	1	-
CO2	3	2	2	1	-	-	-	-	1	-	1	1	1	1	-
CO3	3	2	2	1	-	-	-	-	1	-	1	1	1	1	-
CO4	3	2	2	1	-	-	-	-	-	1	1	1	1	1	-
CO5	3	2	2	1	-	-	-	-	1	-	1	2	1	1	-

3. 3-High Level, 2-Medium Level, 1-Low Level

Unit – I: Introduction 8 Hours

Introductory Concepts of ADT: Abstract Data Types and their Specifications.

Unit – II: Abstract Data Types 8 Hours

Implement an ADT: Concrete State Space, Concrete Invariant, Abstraction function, Implementing Operations, illustration by the Text examples.

Unit – III: Features of Object-Oriented Programming 8 Hours

Features of Object-Oriented Programming: Encapsulation, Object Identity, Polymorphism – but not inheritance.

Unit – IV: Object Oriented Design 8 Hours

Inheritance in OO design: Design Patterns, Introduction and Classification, The Iterator Pattern: Model-View-Controller Pattern, Commands as Methods and as Objects, Implementing OO Language Features, Memory Management.

Unit – V: Generic Types 8 Hours

Generic types and collections: GUIs, Graphical Programming with Scala and Swing, The Software Development Process.

Reference books

1. Barbara Liskov, Program Development in Java, Addison-Wesley, 2001.
2. Any book on Core Java.
3. Any book on C++

Learning Outcomes:

1. Specify simple abstract data types and design implementations, using abstraction functions to document them.
2. Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.
3. Name and apply some common object-oriented design patterns and give examples of their use.
4. Design applications with an event-driven graphical user interface.
5. Will be able to develop software.

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the student's everyday life.
- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.
- Oral quizzes in the class.
- End semester examination.

Internal Assessment: 25 Marks, End Semester Examination:75 Marks &Total Marks: 100.

BTCSEAI 505-Professional Practice, Law & Ethics
Course Code: BTCSEAI-505 Title of the Course: Professional Practice, Law & Ethics
L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 505	Professional Practice, Law & Ethics	HS	25	75	100	3-0-0	3

Course OBJECTIVES:

1. To enable the students to create an awareness on Engineering Ethics and Human Values

2. To instil Moral and Social Values and Loyalty and to appreciate the rights of others.

3. To provide knowledge on global development on governance

4. To instil knowledge on risk management, compliances, ethics and sustainability aspects

5. To explore best governance practices followed worldwide.

Course OUTCOMES:

Upon completion of the course, the student should be able to

CO-1: Understand the History of Legal Professionals in India.

CO-2: Discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

CO-3: To develop skills of high order so as to provide thorough knowledge and insight into the corporate governance framework, best governance practices.

CO-4: develop skills of high order so as to provide thorough knowledge and insight into the spectrum of risks faced by businesses.

CO-5: develop the ability to devise and implement adequate and effective systems to ensure compliance of all applicable laws and to acquire knowledge of ethics in business and framework for corporate sustainability reporting

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO2
CO1	3	2	2	1	-	-	-	-	1	-	1	1	1	1	--
CO2	3	2	2	1	-	-	-	-	1	-	1	1	1	1	-
CO3	3	2	2	1	-	-	-	-	1	-	1	1	1	1	-
CO4	3	2	2	1	-	-	-	-	-	1	1	1	1	1	-
CO5	3	2	2	1	-	-	-	-	1	-	1	2	1	1	-

4. 3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

UNIT I: History of Legal Profession in India: **10 Hours**

Ancient legal texts including Manusmriti, Arthashastra, Quran refers to the law, advocates, judges and courts. Law and lawyers existed and played an important role at all times, even in ancient period. The system underwent certain changes during medieval and the period of British rule. Our present legal system including the judicial is to a large extent based upon the British legal and judicial system. This UNIT contains the study of legal profession in India in ancient, medieval and especially the changes which the profession underwent during British rule and other related aspects essential to understand the history of legal profession in India.

Legal Education in India: The system of legal education, as existed in India during various periods, the changes it underwent during British rule, the introduction of three and five year courses making the system more qualitative, the impact of globalization upon the legal system, particularly upon the legal education, etc will be the issues covered under this UNIT. The role played by Bar Council, UGC and other bodies in regulating legal education in India, the suggestions made by Law Commission of India in its 184th Report will also be discussed.

UNIT II: Professional Ethics and Duties of Lawyers: **8 Hours**

"Ethics is basis of a civilized and organized society. Ethics is a system, a philosophy of conduct of principles practiced by a person or group of persons. Every profession has its code of conduct, pertaining to right and wrong in conduct based on the principles of morality." The need and necessity of ethics in the legal profession, relevant theories explaining its value and relevance in legal profession will be the core issue of discussion under this UNIT. In addition,

duties of lawyers towards his clients, court, public, his fellow attorneys, self, society, etc., will also be undertaken for discussion. Indian code of ethics will be discussed in comparison with that of American Code and other countries will be taken up for discussion. An advocate should practice law for the purpose of administering justice and making a living afterwards. The UNIT will also include role played by a lawyer in the administration of justice. The discussion will also cover issues like an advocate's duty towards legal reform, duty to provide legal aid, etc.

UNIT III: Rights & Interests and Limitations of Such Rights: 8 Hours

The rights to practice, right to argue his case, right over his professional fees, etc will be the core contents of this UNIT. Decisions of courts on, Advocate's right to strike" will be subject of deliberation. Conflicts of interests [lawyer –v- client's interests] and limitations of the rights of lawyers including restrictions on advertising, bar from carrying on other professions, etc will also be taken up for discussion.

UNIT IV: Regulation of Legal Profession: 8 Hours

"Nobody has a more sacred obligation to obey the law than those who make the law". A lawyer, being one involved with the process of law-making and interpretation is also bound by law. This UNIT will cover issues relating to regulation of legal profession in India, focusing more on topics like - the nature, composition, constitution, power, responsibilities and other related topics relating to the Bar Councils, etc. The enrolment of advocates, disciplining of advocates, etc will also be covered.

UNIT V: Liability for Deficiency in Service and other Wrongs Committed By Lawyers:

8 Hours

This UNIT includes the analysis of case laws and relevant laws like Consumer Protection Act, Contempt of Court proceedings, etc which imposes liability upon an advocate for the wrongs he commits in the course of his professional service.

Other Important Issues: The following topics of importance will be taken up for class discussion during the course: - Impact of Globalization on legal profession - Legal outsourcing in India. - Role of advocate in providing legal aid services. – Advocate's role in outside court / informal settlement of disputes. - Age bar and entry into practice

Suggested Readings:

1. Raju Ramachandran, Professional Ethics: Changing Profession and Changing Ethics (Lexis Nexis, Butterworths).

2. Dr. P. B. Mukharji, Professional Ethics of The Advocate(University of Burdwan)

3. P. RamanathaAiyer,Legal & Professional Ethics – Legal Ethics, Duties & Privileges of a Lawyer(Wadhwa Publications, Nagpur).

4. Justice V. R. Krishna Iyer,Law, Lawyers and Justice(b. R. Publishing Corpn, Delhi).

5. Stephen Gillers, Regulation of Lawyers: Problems of Law & Ethics(Little, Brown & Com Boston Toronto, London).

6. Ross Grauston (ed.), Legal Ethics & Professional Responsibility(Clarendon Press, Oxford).

7. Gary Bellow & Bea Moultan,The Lawyering Process: Ethics and Professional Responsibility, (The Foundation Press, Inc.).

8. D.V. SubbaRao, Sanjiva Row's The Advocates Act, 1961(LexisNexis, Butterworths).

9. Nicolson and Webb, Professional Legal Ethics(OUP).

10.S. C. Sarkar, Modern Advocacy and Professional Ethics.

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the student's everyday life.
- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.
- Oral quizzes in the class.
- End semester examination.

Internal Assessment: 25 Marks, End Semester Examination:75 Marks &Total Marks: 100.

BTCSEAI 506: Machine Learning LAB

Course Code: BTCSEAI-506 Title of the Course: Machine Learning LAB

L-T-P: 0-0-4 **Credits**: - 02
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 506	Machine Learning Lab	PC	25	75	100	0-0-4	2

Suggested List of Experiments:

1. Develop a cost function of linear regression using sample data.
2. Develop a Gradient descent of linear regression using sample data.
3. Implement linear regression algorithm using sample data.
4. Implement logistic regression algorithm using sample data. 0%
5. Develop regularization in already developed logistic regression algorithm.
6. Calculate bias and variance from already computed algorithm.
7. Calculate Error Matrix for already implemented algorithm.
8. Implement k-means algorithm using sample data.
9. Develop PCA based on sample data.
10. Develop and implement Neural-network based any algorithm using sample data.

BTCSEAI 507 Database Management Systems Lab

Course Code: BTCSEAI-507 Title of the Course: Database Management Systems Lab

L-T-P: 0-0-4 **Credits**: - 02
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 507	Database Management Systems Lab	PC	25	75	100	0-0-4	2

COURSE OUTCOMES
At the end of the course the students are able to:
1. Apply the basic concepts of Database Systems and Applications.
2. Use the basics of SQL and construct queries using SQL in database creation and interaction.

3. Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system.
4. Analyze and Select storage and recovery techniques of database system.

Experiment 1
Student should decide on a case study and formulate the problem statement.

Experiment 2
Conceptual Designing using ER Diagrams (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.)
Note: Student is required to submit a document by drawing ER Diagram to the Lab teacher.

Experiment 3
Converting ER Model to Relational Model (Represent entities and relationships in Tabular form, Represent attributes as columns, identifying keys)
Note: Student is required to submit a document showing the database tables created from ER Model.

Experiment 4
Normalization -To remove the redundancies and anomalies in the above relational tables, Normalize up to Third Normal Form

Experiment 5
Creation of Tables using SQL- Overview of using SQL tool, Data types in SQL, Creating Tables (along with Primary and Foreign keys), Altering Tables and Dropping Tables

Experiment 6
Practicing DML commands- Insert, Select, Update, Delete

Experiment 7
Practicing Queries using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, CONSTRAINTS etc.

Experiment 8
Practicing Sub queries (Nested, Correlated) and Joins (Inner, Outer and Equi).

Experiment 9
Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, VIEWS Creation and
Dropping.

Experiment 10
Practicing on Triggers - creation of trigger, Insertion using trigger, Deletion using trigger, Updating using trigger

Experiment 11
Procedures- Creation of Stored Procedures, Execution of Procedure, and Modification of Procedure.

Experiment 12
Cursors- Declaring Cursor, Opening Cursor, Fetching the data, closing the cursor.

BTCSEAI 508-Object Oriented Programming Laboratory
Course Code: BTCSEAI-508 Title of the Course: Object Oriented Programming Laboratory
L-T-P: 0-0-4 **Credits**: - 02
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper		Marks	L-T-P	Credits

		Course type	Internal Assessment	Semester Exam	Total		
BTCSEAI 508	Object Oriented Programming Laboratory	PC	25	75	100	0-0-4	2

Lab based on Object Oriented Programming

BTCSEAI 509: Constitution of India
Course Code: BTCSEAI-509 Title of the Course: Constitution of India Laboratory
L-T-P: 2-0-0 **Credits**: - 0
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 509	Constitution of India	MC	25	75	100	2-0-0	0

Course outcomes (CO)
After completing this Course, the students should be able to:

CO-1: Understand the emergence and evolution of Indian Constitution.
CO-2: Understand the structuctural framework and composition of Indian Constitution
CO-3: Understanding and analyzing federalism in the context of India.
CO-4: analyze the significance and benefit of Panchayathi Raj institutions as a medium of decentralization
CO-5: Understand and analyze the three organs of the state in the contemporary scenario.
CO-6: understand and evaluate the Indian Political scenario..

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3

CO1									1		1	1	1	-	-
CO2									1		1	1	1	-	-
CO3									1		1	1	1	-	-
CO4										1	1	1	1	-	-
CO5									1		1	2	1	-	-

5. 3-High Level, 2-Medium Level, 1-Low Level

Detaileed Syllabus:

UNIT 1: 8 Hours

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working), Philosophy of the Indian Constitution: Preamble, Salient Features

UNIT 2: 8 Hours

Contours of Constitutional Rights & Duties: Fundamental Rights: Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT 3: 8 Hours

Organs of Governance: Parliament: Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT 4: 8 Hours

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT 5: 8 Hours

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Suggested reading

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the student's everyday life.
- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.

- Oral quizzes in the class.
- End semester examination.

Internal Assessment: 25 Marks, End Semester Examination:75 Marks &Total Marks: 100.

Department Elective-I

SEMESTER VI

BTCSEAI 601 Project–I

Title of the Course: Project–I
L-T-P: 0-0-6 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 601	Project-I	PROJ	25	75	100	0-0-6	3

The object of Project Work I is to enable the student to take up investigative study in the broad field of Computer Science Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/ Modeling/ Simulation/ Experiment/ Design/ Feasibility;
4. Preparing a Written Report on the Study conducted for presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental committee.

BTCSEAI 602 Complier Design

Title of the Course: Complier Design

L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 602	Compiler Design	PC	25	75	100	3-0-0	3

Course Outcomes Upon successful comple.on of this course, students will be able to:

CO-1: Understand the basic concepts of formal languages and their application to Compiler Design.

CO-2: Get an understanding of the fundamental principles in compiler design.

CO-3: Understand the process of translating a high-level language to executable code

CO-4: Understand and analyze different parsing techniques and algorithms

CO-5: Generate intermediate code for statements in the high-level languages

CO-6: Understand techniques for code optimization.

CO-7: Implement a complete compiler for a small programming language.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	-	-	-	-	1	1	1	-	-
CO2	3	3	3	2	-	-	-	-	-	-	1	1	1	-	-
CO3	3	3	2	2	-	-	-	-	-	-	1	1	1	-	-
CO4	3	3	2	2	-	-	-	-	-	1	1	1	1	-	-
CO5	3	3	2	2	-	-	-	-	-	-	1	2	1	-	-
CO6	3	3	2	2	-	-	-	-	-	-	-	-	1	-	-
CO7	3	3	2	2	-	-	-	-	-	-	-	-	1	-	-

6. 3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

UNIT 1: 10 Hours

Introduction: Phases of compilation and overview, Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, from regular expressions to finite automata, scanner generator (lex, flex)

UNIT 2: 10 Hours

Syntax Analysis (Parser): Context-free languages and grammars, push-down automata, LL(1) gram-mars and top-down parsing, operator grammars, LR(O), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (YAAC, bison)

UNIT 3: 10 Hours

Semantic Analysis: Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree

UNIT 4: 10 Hours

Symbol Table: Its structure, symbol attributes and management, Run-time environment: Procedure activation, parameter passing, value return, memory allocation, and Scope, Intermediate Code Generation: Translation of different language features, different types of intermediate forms. Code Improvement(optimization): Analysis: control-flow, data-flow dependence etc.; Code improvement local optimization, global optimization, loop optimization, peep-hole optimization etc. Architecture dependent code improvement: instruction scheduling (for pipeline), loop optimization (for cache memory) etc. Register allocation and target code generation

UNIT 5: 6 Hours

Advanced topics: Type systems, data abstraction, compilation of Object-Oriented features and non-imperative programming languages.

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the student's everyday life.
- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.
- End semester examination.

- **Internal Assessment: 25 Marks, End Semester Examination :75 Marks &Total Marks: 100.**

BTCSEAI 603-Computer Networks

Title of the Course: Computer Networks

L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 603	Computer Networks	PC	25	75	100	3-0-0	3

COURSE OUTCOMES (COs)

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

CO-1: Understand and Analyse the functions of the different layer of the OSI Protocol.
CO-2: Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
CO-3: For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component
CO-4: For a given problem related TCP/IP protocol developed the network programming.
CO-5: Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

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

7. 3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

UNIT 1: **10 Hours**

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

UNIT 2: **10 Hours**

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

UNIT 3: **10 Hours**

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

UNIT 4: **10 Hours**

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

UNIT 5: **10 Hours**

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

Reference books

- Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
- Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.
- Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.
- Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
- TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.

- Connect the subject matter with the student's everyday life.
- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.
- End semester examination.
- **Internal Assessment: 25 Marks, End Semester Examination :75 Marks &Total Marks: 100.**

BTCSEAI 604-Complier Design Laboratory
Title of the Course: Complier Design Laboratory
L-T-P: 0-0-4 **Credits**: - 02

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Lab based on Complier Design

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 604	Compiler Design Laboratory	PC	25	75	100	0-0-4	2

BTCSEAI 605-Computer Networks Laboratory

Title of the Course: Computer Networks Laboratory
L-T-P: 0-0-4 **Credits**: - 02

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		

BTCSEAI 605	Computer Networks Laboratory	PC	25	75	100	0-0-4	2

Assignment 1: Understanding the basic network devices.
Assignment 2: Creating network topologies using the Network Simulator (NS2).
Assignment 3: Learning to use a packet sniffing software - Wireshark.
Assignment 4: Implementation of Link State Routing protocol.
Assignment 5: Implementation of Distance Vector Routing protocol.
Assignment 6: Implementation of Sliding Window protocol.
Assignment 7: Implementation of Address Resolution Protocol (ARP) in C.
Assignment 8: Implementation of Reverse Address Resolution Protocol (RARP) in C.
Assignment 9: Implementation of File Transfer Protocol (FTP) using C.
Assignment 10: Implementation of User Datagram Protocol (UDP) using C.
Assignment 11: Write a Traceroute program using C.
Assignment 12: Write an ICMP Ping program using C.

Department Elective-II

Department Elective-III

Open Elective-I

BTCSEAI 606 Speech & Natural Language Processing

Title of the Course: Speech & Natural Language Processing

L-T-P: 3 -0-0 **Credits**: - 03

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 606	Speech & Natural Language Processing	PC	25	75	100	3-0-0	3

Course Outcomes:

After taking this module students should be able to:

CO 1: Give an overview of the components of state-of-the art speech recognition and speech synthesis systems;
CO 2: Understand the main concepts and what each component does.
CO 3: Describe a simple version of each component.
CO 4: Analyze classifier Algorithm for speech recognition.
CO 5: Understand the Applications that are in speech recognition and synthesis.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO2		2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO3	3	2	2	1	-	-	-	-	1	-	1	1	1	-	-
CO4		2	2	1	-	-	-	-	-	1	1	1	1	-	-
CO5		2	2	1	-	-	-	-	1	-	1	2	1	-	-

3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

Unit-I **8 Hours**

Fundamentals of speech processing, familiarity with waveforms, spectra, spectrograms, resonance, formants, human speech production and perception., Speech Production Models, Hearing Physiology.

Unit-II **8 Hours**

Perceptually-motivated frequency scales, time vs. frequency representations; conversion between the two, the Fourier transform, source-filter model of speech, speech recognition, components of a typical recogniser, parameterisation of the speech signal.

Unit-III **8 Hours**

Introduction to NLP, Text classification, Language models, Types of Language Models: Unigram, ngram, exponential, Neural network. Information theory and the Shannon game.

Unit-IV **8 Hours**

Naive Bayes classification as language modeling, Classification as function learning, From generative to discriminative linear classifiers with the perceptron, Non-linear classification with multi-layer perceptrons.

Unit-V **8 Hours**

Syntactic parsing, Semantic Analysis, Information Extraction (IE), Machine Translation (MT), Applications of NLP.

Recommended Books:

1. Joseph Picone
   Signal Processing in Speech Recognition Publisher and ISBN: TBD.
   URL: http://www.isip.piconepress.com/publications/books/2013/sp_asr
2. D. Jurafsky and J.H. Martin
   SPEECH and LANGUAGE PROCESSING:An Introduction to Natural Language Processing,Computational Linguistics, and Speech Recognition, Prentice-Hall, ISBN: 0-13-095069-6, 2000.
3. L.R. Rabiner and B.W. Juang *Fundamentals of Speech Recognition* Prentice-Hall, ISBN: 0-13-015157-2, 1993.

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the student's everyday life.
- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.
- End semester examination.
- **Internal Assessment: 25 Marks, End Semester Examination :75 Marks &Total Marks: 100.**

BTCSEAI 607 Speech & Natural Language Processing Laboratory

Course Code: BTCSEAI-607 Title of the Course: Speech & Natural Language Processing Laboratory
L-T-P: 0-0-4 **Credits**: - 02
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 607	Speech & Natural Language Processing Laboratory	PC	25	75	100	0-0-4	2

Course Outcomes:

After taking this module students should be able to:

CO 1: Analyze words practically generate word forms from root and suffix information.
CO 2: know the importance of selecting proper features for training a model and size of training corpus in learning how to do chunking.
CO 3: Find POS tags of words in a sentence using Viterbi decoding.

Experiment No.1

Word Analysis; A word can be simple or complex

Experiment No.2

Word Generation; A word can be simple or complex

Experiment No.3

Ngram; Probability of a sentence can be calculated by the probability of sequence of words occurring in it.

Experiment No.4

POS Tagging - Hidden Markov Model

Experiment No.5

POS Tagging - Viterbi Decoding

Experiment No.6

Building POS Tagger

Experiment No.7

Chunking of text involves dividing a text into syntactically correlated words.

Experiment No.8

Chunking is an analysis of a sentence which identifies the constituents (noun groups, verbs, verb groups, etc.) which are correlated.

SEMESTER VII

BTCSEAI 701 Project–II

Course Code: BTCSEAI-701 **Title of the Course: Project-II**
L-T-P: 0-0-12 **Credits**: - 06
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper		Marks	L-T-P	Credits

		Course type	Internal Assessment	Semester Exam	Total		
BTCSEAI 701	Project-II	PROJ	200	100	300	0-0-12	6

The object of Project Work II is to enable the student to take up investigative study in the broad field of Computer Science Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/ Modeling/ Simulation/ Experiment/ Design/ Feasibility;
4. Preparing a Written Report on the Study conducted for presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental committee.

BTCSEAI 702-AI in BIOLOGY

Course Code: BTCSEAI-702 Title of the Course: AI in BIOLOGY

L-T-P: 2-1-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 702	AI in Biology	BS	25	75	100	2-1-0	3

COURSE OUTCOMES (COs)
After completing this Course, the students should be able to:

CO 1: Determine which problems in health care practice are appropriate to address, including ethical and safety positions, by using computerized methods for visualization and analysis.
CO 2: Understand the fundamental tools that are used to describe, analyze and process biomedical signals.
CO 3: Systematically apply methods to extract relevant information from biomedical signal measurements.

CO 4: Effectively and efficiently utilize the knowledge gained in one of the current research areas.

CO 5: Understand and have knowledge about significance and impact of mutations during evolution.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	2	2	1	-	-	-	-	-	-	1	1	1	-	-
CO2	-	2	2	1	-	-	-	-	-	-	1	1	1	-	-
CO3	-	2	2	1	-	-	-	-	-	-	1	1	1	-	-
CO4	-	2	2	1	-	-	-	-	-	-	1	1	1	-	-
CO5	-	2	2	1	-	-	-	-	-	-	1	2	1	-	-

8. 3-High Level, 2-Medium Level, 1-Low Level

UNIT 1:

Information transfer and Evolution **8 Hours**

Mendel's Laws of Inheritance, Gene Interaction, Multiple Alleles, Chromosomal Theory of Inheritance, Linkage, Recombination (Crossing Over), Chromosome Mapping, Genetic Disorders

Evolution: Origin of Universe, Origin of Life, Evolution of Life Forms, Evidences of Evolution, Adaptive Radiation, Theories of Evolution, Biological Evolution, Hardy–Weinberg Principle.

UNIT 2: **8 Hours**

Biomedical Signal processing : Introduction to Biomedical Signals: The nature of Biomedical Signals, Examples of Biomedical Signals, Objectives and difficulties in Bio-medical analysis.

Cardiological signal processing: Basic Electrocardiography, ECG data acquisition, ECG lead system, ECG signal characteristics.

Neurological signal processing: The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics

UNIT 3:

Medical Image Processing **8 Hours**

Introduction to medical imaging modalities and image analysis software: X-ray and Computed Tomography (CT) imaging, Magnetic Resonance Imaging (MRI), Ultrasonic Imaging, Molecular Imaging, SPECT and PET.

Application in vision: Background, requirements and issues, human vision, Image formation: geometry and photometry, Geometry, photometry (brightness and color), quantization, camera calibration. Image segmentation and Feature Extraction.

Application of neural networks in medical image processing

UNIT 4:

Telemedicine **8 Hours**

History and Evolution of telemedicine, Functional diagram of telemedicine system, Telemedicine, Telehealth. Sensors and wearable devices for measurement of telemetry data, Communication infrastructure for telemedicine – LAN and WAN technology, Internet technology and telemedicine using world wide web (www). Video and audio conferencing. Clinical data – local and centralized.

UNIT 5:

DNA and Protein Synthesis **8 Hours**

Structure of DNA. Replication, transcription and translation. Protein synthesis – Ribosomes, enzymes, Protein processing.

Books:

1. John G, Proakis and Dimitris Manolakis G. "Digital Signal Processing, Algorithms and Applications", PHI of India Ltd., New Delhi, fourth Edition, 2007.
2. B.D. Gupta, "Introducing Telemedicine (Applications, challenges, needs and benefits, components and infrastructure)"
3. A.C. Norris, "Essentials of Telemedicine and Telecare"
4. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S.Rajasekaran, G. A. Vijayalakshami, PHI.
5. Genetic Algorithms: Search and Optimization, E. Goldberg.
6. Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee, PHI.

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the student's everyday life.
- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.
- Oral quizzes in the class.
- End semester examination.
- **Internal Assessment: 25 Marks, End Semester Examination:75 Marks &Total Marks: 100.**

BTCSEAI 703 Cloud Computing

Course Code: BTCSEAI-703 **Title of the Course: Cloud Computing**
L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 703	Cloud Computing	PC	25	75	100	3-0-0	3

Course Outcomes: After completion of course, students would be able to:
CO 1: Understand the concept of Cloud computing with Analysis of online social media cloud.
CO 2: Identify security aspects of each cloud model.
CO 2: Develop a risk-management strategy for moving to the Cloud.
CO 3: Create and Implement a public cloud instance using a public cloud service provider.
CO 4: Apply trust-based security model to different layer.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

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

3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

UNIT– 1 **8 Hours**

Introduction to Cloud Computing: Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing

UNIT–2 **8 Hours**

Cloud Computing Architecture: Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model Cloud Deployment

Models: Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise

UNIT-3 **8 Hours**

Security Issues in Cloud Computing: Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security Identity and Access Management: Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management

UNIT-4 **8 Hours**

Security Management in the Cloud Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS.

Privacy Issues: Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations

Unit-5 **8 Hours**

Audit and Compliance Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud

Advanced Topics Recent developments in hybrid cloud and cloud security.

Reference Books:

1. Cloud Computing Explained: Implementation Handbook for Enterprises, John Rhoton, Publication Date: November 2, 2009.

2. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice), Tim Mather, ISBN-10: 0596802765, O'Reilly Media, September 2009.

Reference Books:

5. Arthur Beiser, “Concepts of Modern Physics”.
6. B.G. Streetman, “Solid State Electronic Devices”, Prentice Hall of India, 1995.
7. David Griffiths, “Introduction to Electrodynamics”.
8. R. Robinett, “Quantum Mechanics,” OUP Oxford, 2006.

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the student’s everyday life.

- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.
- Oral quizzes in the class.
- End semester examination.
- **Internal Assessment: 25 Marks, End Semester Examination :75 Marks &Total Marks: 100.**

BTCSEAI 704. Neural Network & Deep Learning

Course Code: BTCSEAI - 704 Title of the Course: Neural Network and Deep Learning

L-T-P: 3-0-0 Credits: **03**

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 704	Neural Network & Deep Learning	PC	25	75	100	3-0-0	3

COURSE OUTCOMES (COs)

After completing this Course, the students should be able to

CO1. Develop the concepts of Artificial Intelligence and Neural Networks.
CO2. Differentiate various machine learning strategies and how to apply them.
CO3. Design and formulate various Neural Network architectures.
CO4. Create the concepts of Deep Learning and compare it with machine learning.
CO5. Apply Deep Learning Algorithms Students over various applications.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	1	-	-	-	-	-	-	-	3	3	3	2
CO2	2	2	-	1	3	-	-	-	-	-	-	3	3	1	2
CO3	3	3	2	1	3	1	-	-	-	-	-	3	3	3	3
CO4	1	3	3	2	-	-	-	-	-	-	-	3	3	3	2
CO5	3	3	3	2	3	1	-	-	-	-	-	3	3	3	3

Detailed Syllabus:

UNIT - I: Introduction to Neural Network: 08 Hours

Introduction to Artificial Intelligence & Neural Network: Definition, Biological Neuron, Analogy of Biological Neural Network and Artificial Neural Network, Mathematical definition of Neural Network, Model of ANN, Advantages and Benefits of ANN, Features of ANN, Types of activation function, Learning Rate, Synaptic Weights.

Neural Network Architecture: Single Layer Feed Forward NN, Multiple layer Feed Forward NN, Recurrent Neural Network.

UNIT – II: Introduction to Machine Learning: 08 Hours

Machine Learning: Definition, types- supervised, unsupervised and reinforcement learning, and Learning process. Learning in ANN: Error Correction Learning, Hebbian Learning, Competitive Learning.

Introduction to Programming with R and python, Data preprocessing

Descending the Right Curve: Interpreting Learning as Optimization, Cost Functions.

Validating Machine Learning: Depicting Learning Curves, Training, testing and validation.

UNIT - III: Types of Neural Networks 08 Hours

Single layer perceptron: Least Mean Square Algorithm, Multilayer perceptron: Backpropagation Algorithm, Radial-basis function network, Support Vector Machine, Principal Components Analysis, Self-Organized Maps.

UNIT - IV: Introduction to Deep Learning: 08 Hours

Introducing Deep Learning, Machine learning principles, Basics of Deep Learning.

Moving towards Deep Learninsg: Benefits, Improving Processing Speed, Deep Learning vs other forms of AI, Find Smarter solutions, end to end learning.

Deep learning & Neural Network: Convolution Neural Networks, Recurrent Neural Networks

UNIT – V: Applications of Deep Learning 08 Hours

Applications and fields requiring Deep Learning, Deep Learning tools.

Interacting with Deep Learning: Image Classification, Advanced CNN, Language Processing, Playing with Reinforcement Learning.

Reference Books:

1. Simon Haykins, Neural Networks – A comprehensive foundation, Prentice Hall, Pearson Education, 1999.

2. Jaun Paul Mueller, Luca Massaron, Machine Learning for Dummies(With R and python), John Wiley & Sons, 2016.

3. Jaun Paul Mueller, Luca Massaron, Deep Learning for Dummies, John Wiley & Sons, 2019.

4. S. N. Deepa, S.N. Sivanandam, Principles of Soft Computing, John Wiley & Sons, 2007

Teaching-Learning Strategies in brief (4 to 5 sentences)

Apart from lectures, use of ICT for better visualization of the concepts and to demonstrate the working of various learning algorithms for model development.

Assessment methods and weightages in brief (4 to 5 sentences)

During the course, two sessional examinations will be conducted each of 10 marks for internal assessment. Apart from sessional examination, teacher assessment of 5 marks is carried out by attendance and the assignments.

BTCSEAI 705 Neural Network & Deep Learning Laboratory

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 705	Neural Network & Deep Learning Laboratory	PC	25	75	100	0-0-4	2

Neural Network and Deep Learning

List of practical to be done in Python / R:

1. To learn the basic operations of Python Programming.
2. To Implement Single layer perceptron
3. To implement ADALINE.
4. To implement Backpropagation Network.
5. To implement radial basis function.
6. To implement Support Vector Machine
7. To show the working of principal component analysis
8. To draw learning curves
9. To show the working of Convolutional Neural Network.
10. To show the working of Recurrent Neural Network.
11. To show the working of Advanced Convolution Neural Network.
12. To perform language processing.

Reference Books:

1. Jaun Paul Mueller, Luca Massaron, Machine Learning for Dummies(With R and python), John Wiley & Sons, 2016.
2. Jaun Paul Mueller, Luca Massaron, Deep Learning for Dummies, John Wiley & Sons, 2019.

Department Elective-IV

Department Elective-V

Open Elective-II

SEMESTER VIII

BTCSEAI 801 Dissertation

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI 801	Dissertation	DISS	300	200	500	0-0-12	6

The object of Dissertation is to enable the student to extend further the investigative study taken up under Project-I/ II, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned in the light of the Report prepared under Project-I/ II;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modeling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.

DEPARTMENTAL ELECTIVES
Department Elective-I

BTCSEAI DE11-Pattern Recognition

Course Code: BTCSEAI-DE11 **Title of the Course: Pattern Recognition**
L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI DE11	Pattern Recognition	PC	25	75	100	3-0-0	3

Course outcomes:

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

CO 1: Understand and Analyse pattern recognition principals

CO 2: Create algorithms for Pattern Recognition.

CO 3: Develop and analyze decision tress.

CO 4: Design the nearest neighbour classifier.

CO 5: Apply Decision tree and clustering techniques to various applications.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	1	-	1	1	1	2	1

CO2	3	2	2	1	-	-	-	-	1	-	1	1	1	2	1
CO3	3	2	2	1	-	-	-	-	1	-	1	1	1	2	1
CO4	3	2	2	1	-	-	-	-	-	1	1	1	1	2	1
CO5	3	2	2	1	-	-	-	-	1	-	1	2	1	2	1

3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

Unit-I **10 Hours**

Basics of Probability, Random Processes and Linear Algebra (recap): Probability: independence of events, conditional and joint probability, Bayes theorem Random Processes: Stationary and non-stationary processes, Expectation, Autocorrelation, Cross-Correlation, spectra.

Linear Algebra: Inner product, outer product, inverses, Eigen values, Eigen vectors, singular values, singular vectors.

Bayes Decision Theory: Minimum-error-rate classification. Classifiers, Discriminant functions, Decision surfaces. Normal density and discriminant functions. Discrete features.

Unit-II **8 Hours**

Parameter Estimation Methods: Maximum-Likelihood estimation: Gaussian case. Maximum a Posteriori estimation. Bayesian estimation: Gaussian case.

Unsupervised learning and clustering - Criterion functions for clustering.

Algorithms for clustering: K-Means, Hierarchical and other methods. Cluster validation. Gaussian mixture models, Expectation-Maximization method for parameter estimation. Maximum entropy estimation. Sequential Pattern Recognition.

Hidden Markov Models (HMMs). Discrete HMMs. Continuous HMMs. Nonparametric techniques for density estimation. Parzen-window method. K-Nearest Neighbour method.

Unit-III **8 Hours**

Dimensionality reduction: Principal component analysis - it relationship to eigen analysis. Fisher discriminant analysis - Generalized Eigen

analysis. Eigen vectors/Singular vectors as dictionaries. Factor Analysis, Total variability space - a dictionary learning methods. Non negative matrix factorization - a dictionary learning method.

Unit-IV **8 Hours**

Linear discriminant functions: Gradient descent procedures, Perceptron, Support vector machines - a brief introduction.

Unit-V **8 Hours**

Artificial neural networks: Multilayer perceptron – feed-forward neural network. A brief introduction to deep neural networks, convolutional neural networks, recurrent neural networks.

Non-metric methods for pattern classification: Non-numeric data or nominal data. Decision trees: Classification and Regression Trees (CART).

Text Books:

- R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001
- S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
- C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

BTCSEAI DE12 Soft Computing

Course Code: BTCSEAI-DE12 **Title of the Course: Soft Computing**
L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI DE12	Soft Computing	PC	25	75	100	3-0-0	3

The main objective of the course is to expose the students to soft computing, various types of soft computing techniques, and applications of soft computing. Upon completion of this course, the student should be able to get an idea on :

1. Artificial Intelligence, Various types of production systems, characteristics of production systems.
2. Neural Networks, architecture, functions and various algorithms involved.
3. Fuzzy Logic, Various fuzzy systems and their functions.
4. Genetic algorithms, its applications and advances.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1
CO2	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1
CO3	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1
CO4	3	2	2	1	-	-	-	-	-	1	1	1	2	2	1
CO5	3	2	2	1	-	-	-	-	1	-	1	2	2	2	-

9. 3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus:

Unit–I **10 Hours**

Soft Computing: Introduction to soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing. Artificial Intelligence: Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and various types of control strategies. Knowledge representation issues, Prepositional and predicate logic, monotonic and non-monotonic reasoning, forward Reasoning, backward reasoning, Weak & Strong Slot & filler structures.

Unit –II **8 Hours**

Neural Network: Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference b/w ANN and human brain, characteristic and applications of ANN, single layer network.

Unit–III **8 Hours**

Perceptron: Perceptron training algorithm, Linear separability, Widrow & Hebb's learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN. Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of BBPA, momentum, limitation, characteristics and application of EBPA. Counter propagation network: architecture, functioning & characteristics of counter Propagation network, Hop field/ Recurrent network, configuration, stability constraints, associative memory, and characteristics, limitations and applications. Hopfield v/s Boltzman machine. Adaptive Resonance Theory: Architecture, classifications, Implementation and training. Associative Memory.

Unit –IV **8 Hours**

Fuzzy Logic: Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions. Fuzzy rule base system : Fuzzy propositions, formation, decomposition & aggregation of fuzzy Rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic.

Unit–V **8 Hours**

Genetic algorithm: Fundamental, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator ,Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional methods.

Neuro-fuzzy hybrid systems – genetic neuro hybrid systems – genetic fuzzy hybrid and fuzzy genetic hybrid systems – simplified fuzzy ARTMAP – Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.

Course Outcomes: At the end of the course the student should be able to

1. Learn about soft computing techniques and their applications.
2. Analyze various neural network architectures.
3. Understand perceptron and counter propagation networks.
4. Define the fuzzy systems.
5. Analyze the genetic algorithms and their applications.

Text Books:

1. S.N. Sivanandam & S.N. Deepa, Principles of Soft Computing, Wiley Publications, 2nd Edition, 2011.

2. S, Rajasekaran & G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications, PHI Publication, 1st Edition, 2009.

References:

1. N.K.Bose, Ping Liang, Neural Network fundamental with Graph, Algorithms & Applications, TMH, 1st Edition, 1998.

2. Bart Kosko, Neural Network & Fuzzy System, PHI Publication, 1st Edition, 2009.

3. Rich E, Knight K, Artificial Intelligence, TMH, 3rd Edition, 2012.

4. George J Klir, Bo Yuan, Fuzzy sets & Fuzzy Logic, Theory & Applications, PHI Publication, 1st Edition, 2009.

5. Martin T Hagen, Neural Network Design, Nelson Candad, 2nd Edition, 2008.

Web references: www.myreaders.info/html/soft_computing.html 25

BTCSEAI DE13 Information Retrieval

Course Code: BTCSEAI-DE13 **Title of the Course: Information Retrieval**
L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI DE13	Information Retrieval	PC	25	75	100	3-0-0	3

Course Objective:

- The objective of the course is to introduce information retrieval models and query languages. Application of web search and information retrieval in social networks is also included.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1

CO2	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1
CO3	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1
CO4	3	2	2	1	-	-	-	-		1	1	1	2	2	1
CO5	3	2	2	1	-	-	-	-	1	-	1	2	2	2	1

10. 3-High Level, 2-Medium Level, 1-Low Level

Unit – I: Information Retrieval Model

Goals and history of IR. The impact of the web on IR, Information retrieval model, Information retrieval evaluation, searching the Web

Unit -II: Document Presentation and search

Document Representation, Query languages and query operation, Meta-data search, Indexing and searching, Scoring and ranking feature vectors

Unit III: Experimental Evaluation of IR

Performance metrics: recall, precision, and F-measure; Evaluations on benchmark text collections.

Unit -IV: Ontology

Ontology, domain specific search, parallel and distributed information retrieval

Unit -V: Recent Trends

Recent trends in Web search and Information retrieval techniques.

UNIT VI: Ethical Issues in IR

Privacy, Fairness, Fake news and disinformation, Filter bubble, Viewpoint diversity, Fostering extremism, Internet addiction.

Course Outcome:

After completion of course, students would be able to:

- To identify basic theories and analysis tools as they apply to information retrieval.
- To develop understanding of problems and potentials of current IR systems.
- To learn and appreciate different retrieval algorithms and systems.
- To apply various indexing, matching, organizing, and evaluating methods to IR problem.
- To become aware of current experimental and theoretical IR research.

Text/ Reference Books:

- C. D. Manning, P. Raghavan and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008 (available at http://nlp.stanford.edu/IR-book).
- Chakrabarti, S. (2002). Mining the web: Mining the Web: Discovering knowledge from hypertext data. Morgan-kaufman.

- B. Croft, D. Metzler, T. Strohman, Search Engines: Information Retrieval in Practice, AddisonWesley, 2009 (available at http://ciir.cs.umass.edu/irbook/).
- R. Baeza-Yates, B. Ribeiro-Neto, Modern Information Retrieval, Addison-Wesley, 2011.

BTCSEAI DE21 Data Analytics

Course Code: BTCSEAI-DE21 **Title of the Course: Data Analytics**
L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI DE21	Data Analytics	PC	25	75	100	3-0-0	3

Objectives and Learning Outcomes:

- To optimize business decisions and create competitive advantage with Big Data Analytics
- To explore the fundamental concepts of big data analytics.
- To learn to analyze the big data using intelligent techniques.
- To understand the various search methods and visualization techniques.
- To learn to use various techniques for mining data stream.
- To understand the applications using Map Reduce Concepts.
- To introduce programming tools PIG & HIVE in Hadoop echo system.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	1	-	1	1	2	2	2
CO2	3	2	2	1	-	-	-	-	1	-	1	1	2	2	2
CO3	3	2	2	1	-	-	-	-	1	-	1	1	2	2	2

CO4	3	2	2	1	-	-	-	-		1	1	1	2	2	2
CO5	3	2	2	1	-	-	-	-	1	-	1	2	2	2	2

11. 3-High Level, 2-Medium Level, 1-Low Level

Unit-I **10 Hours**

Introduction: What is Data Science? Big Data and Data Science hype – and getting past the hype, Why now? – Datafication, Current landscape of perspectives, Skill sets. NeededStatistical Inference: Populations and samples, Statistical modelling, probability distributions, fitting a model, - Introduction to R

Unit-II **10 Hours**

Mining data streams: Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform (RTAP) Applications – Case Studies - Real Time Sentiment Analysis- Stock Market Predictions.

Unit-III **10 Hours**

Hadoop: History of Hadoop- the Hadoop Distributed File System – Components of Hadoop Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics- Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features Hadoop environment.

Unit-IV **8 Hours**

Frameworks: Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphere Big Insights and Streams.

Unit-V **8 Hours**

Predictive Analytics- Simple linear regression- Multiple linear regression- Interpretation of regression coefficients. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications.

References:

1. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.

2. Tom White “Hadoop: The Definitive Guide” Third Edition, O’reilly Media, 2012.

3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.

4. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012.

5. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley& sons, 2012.

6. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007.

7. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", 2nd Edition, Elsevier, Reprinted 2008.

8. Da Ruan, Guoquing Chen, Etienne E.Kerre, Geert Wets, "Intelligent Data Mining", Springer, 2007.

9. Paul Zikopoulos, Dirkde Roos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, "Harness the Power of Big Data The IBM Big Data Platform", Tata McGraw Hill Publications, 2012.

10. Arshdeep Bahga, Vijay Madisetti, "Big Data Science & Analytics: A Hands On Approach ",VPT, 2016

11. Bart Baesens "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons,2014

Course Outcomes: Students will be able to:

- Work with big data platform and explore the big data analytics techniques business applications.
- Design efficient algorithms for mining the data from large volumes.
- Analyze the HADOOP and Map Reduce technologies associated with big data analytics.
- Explore on Big Data applications Using Pig and Hive.
- Understand the fundamentals of various big data analytics techniques.
- Build a complete business data analytics solution.

BTCSEAI DE22 MOOCs1

Paper Code	Title of the Paper		Marks	L-T-P	Credits

		Course type	Internal Assessment	Semester Exam	Total		
BTCSEAI DE22	MOOCs2	MOOC	25	75	100	3-0-0	3

Course opted from MOOCs

BTCSEAI DE23 Data Science
Course Code: BTCSEAI-DE23 **Title of the Course: Data Science**
L-T-P: 3-0-0 **Credits**: - 03
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI DE23	Data Science	PC	25	75	100	3-0-0	3

Course Objectives/Course Description

- To provide strong foundation for data science and application area related to it and understand the underlying core concepts and emerging technologies in data science.

Course Outcomes:

- CO1: Understand the fundamental concepts of data science
- CO2: Evaluate the data analysis techniques for applications handling large data
- CO3: Demonstrate the various machine learning algorithms used in data science process
- CO4: Understand the ethical practices of data science
- CO4:Visualize and present the inference using various tools
- CO5:Learn to think through the ethics surrounding privacy, data sharing and algorithmic decision-making.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1					1		1	1	2	2	1
CO2	3	2	2	1					1		1	1	2	2	1
CO3	3	2	2	1					1		1	1	2	2	1
CO4	3	2	2	1						1	1	1	2	2	1
CO5	3	2	2	1					1		1	2	2	2	1

12. 3-High Level, 2-Medium Level, 1-Low Level

Unit-1 **08 Hours**

Definition – Big Data and Data Science Hype – Why data science – Getting Past the Hype – The Current Landscape – Data Scientist - Data Science Process Overview – Defining goals – Retrieving data – Data preparation – Data exploration – Data modeling – Presentation.

Unit-2 **08 Hours**

Problems when handling large data – General techniques for handling large data through data analytics – Case study – Steps in big data – Distributing data storage and processing with Frameworks – Case study.

Unit-3 **08 Hours**

Machine learning – Modeling Process – Training model – Validating model – Predicting new observations –Supervised learning algorithms – Unsupervised learning algorithms. Filtering Spam, Why Linear Regression and k-NN are poor choices for Filtering Spam, Naive Bayes and why it works for Filtering Spam, Data Wrangling: APIs and other tools for scrapping the Web.

Unit-4 **08 Hours**

Feature Generation and Feature Selection (Extracting Meaning from Data): Motivating application: user (customer) retention. Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms. Filters; Wrappers; Decision Trees; Random Forests. Recommendation Systems: Building a User-Facing Data Product, Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system

Unit-5 **08 Hours**

Mining Social-Network Graphs: Social networks as graphs, clustering of graphs, direct discovery of communities in graphs, partitioning of graphs, Neighborhood properties in graphs, Data Visualization: Basic principles, ideas and tools for data visualization. Data Science and Ethical Issues, Discussions on privacy, security, ethics, Next-generation data scientists.

Text Books and Reference Books:

[1]. Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications Co., 1st edition, 2016

[2]. An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013

[3]. Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 1st edition, 2016
[4]. Ethics and Data Science, D J Patil, Hilary Mason, Mike Loukides, O' Reilly, 1st edition, 2018

Essential Reading / Recommended Reading

[1]. Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly, 1st edition, 2015
[2]. Doing Data Science, Straight Talk from the Frontline, Cathy O'Neil, Rachel Schutt, O' Reilly, 1st edition, 2013
[3]. Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Cambridge University Press, 2nd edition, 2014

Course Outcomes:

1. Define data science and its fundamentals.
2. Demonstrate the process in data science.
3. Explain machine learning algorithms necessary for data sciences.
4. Illustrate the process of feature selection and analysis of data analysis algorithms.
5. Visualize the data and follow of ethics.

DEPARTMENT ELECTIVE-III

BTCSEAI DE31 MULTI AGENT SYSTEM

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI DE31	Multi Agent System	PC	25	75	100	3-0-0	3

Course Objectives:

1. To understand Agent development
2. To gain Knowledge in Multi agent and Intelligent agents
3. To understand Agents and security
4. To gain Knowledge in Agent Applications
5. To study in detail about distributed computing.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	--	-	--	-	1	-	1	1	2	2	1
CO2	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1
CO3	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1
CO4	3	2	2	1	-	-	-	-		1	1	1	2	2	1
CO5	3	2	2	1	-	-	-	-	1	-	1	2	2	2	1

13. 3-High Level, 2-Medium Level, 1-Low Level

DETAILED SYLLABUS

Unit-I **08 Hours**

Agent Definition, Agent Programming Paradigms, Agent Vs. Object, Aglet, Mobile Agents, Agent Frameworks, Agent Reasoning, Interface Agents: Metaphors with Character, Processes, threads, daemons, Components, Java Beans, ActiveX, Sockets, RPCs, Distributed Computing.

Unit-II **08 Hours**

Agent–Oriented Programming, Jini Architecture, Actors and Agents, Typed and proactive messages, Interaction between agents, Reactive Agents, Cognitive Agents, Interaction protocols, Agent coordination, Agent negotiation, Software Agent for Cooperative Learning, Agent Organization, Self - interested agents in electronic commerce applications, Interface Agents, Agent Communication Languages, Agent Knowledge representation.

Unit-III **08 Hours**

Agent adaptability, Agent-Based Framework for Interoperability, Agents for Information Gathering, Belief Desire Intension, Mobile Agent Applications, Towards an Industrial-Strength Open Agent Architecture, Agent Security Issues, Mobile Agents Security, Protecting Agents against Malicious Hosts, Untrusted Agent, Black Box Security, Authentication for agents, Security issues for aglets.

Unit-IV **08 Hours**

Multi Agent system: Theoretical approaches and NASA applications – Agent based control for multi-UAV information collection- Agent based decision support system for Glider pilots – Multi agent system in E- Health Territorial Emergencies – Software Agents for computer network security- Multi-Agent Systems, Ontologies and Negotiation for Dynamic Service Composition in Multi- Organizational Environmental Management.

Unit-V **08 Hours**

Introduction to distributed intelligent systems. Communication. Standards. Coordination. Negotiation. Distributed planning. Voting. Auctions. Coalition formation. Application of multi-agent systems to industrial problems.

LEARNING OUTCOMES

After reading this subject, students will be able to:

1. Understand development of software agents
2. Gain Knowledge in Multi agent and Intelligent agents
3. Understand Agents and security
4. Gain knowledge on applications of agents.
5. Understand the main application areas of agent-based solutions and be able to develop a meaningful agent-based system using a contemporary agent development platform.

ESSENTIAL READING

1. Jeffrey M. Bradshaw, *Software Agents*, AAAI Press , 1997
2. Richard Murch, Tony Johnson, *Intelligent Software Agents*, Prentice Hall , 1999

SUPPLEMENTARY READING

1. Gerhard Weiss, *Multi Agent Systems – A Modern Approach to Distributed Artificial Intelligence*, MIT Press , 2016
2. Mohammad Essaaidi, Maria Ganzha, and Marcin Paprzycki, *Software Agents, Agent Systems and Their Applications*, IOS Press , 2012

BTCSEAI DE32 MOOCs2

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI DE32	MOOCs2	MOOC	25	75	100	3-0-0	3

BTCSEAI DE33: Robotic Process Automation

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI DE33	Robotic Process Automation	PC	25	75	100	3-0-0	3

Pre-requisites: Basic Programming Concepts

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1
CO2	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1
CO3	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1
CO4	3	2	2	1	-	-	-	-	-	1	1	1	2	2	1
CO5	3	2	2	1	-	-	-	-	1	-	1	2	2	2	1

14. 3-High Level, 2-Medium Level, 1-Low Level

Unit-I **8 Hours**

INTRODUCTION TO ROBOTIC PROCESS AUTOMATION: Scope and techniques of automation, Robotic process automation - What can RPA do?, Benefits of RPA, Components of RPA, RPA platforms, The future of automation. RPA BASICS: History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated - RPA Advanced Concepts - Standardization of processes - RPA Development methodologies - Difference from SDLC - Robotic control flow architecture - RPA business case - RPA Team - Process Design Document/Solution Design Document - Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem.

Unit-II **8 Hours**

Introduction to RPA Tool - The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Generic Value Variables - Text Variables - True or False Variables - Number Variables - Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices - The Arguments Panel - Using Arguments - About Imported Namespaces - Importing New Namespaces- Control Flow - Control Flow Introduction - If Else Statements - Loops - Advanced Control Flow - Sequences - Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity - The Delay Activity - The Do While Activity - The If Activity - The Switch Activity - The While Activity - The For Each Activity - The Break Activity - Data Manipulation - Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data

Unit-III **8 Hours**

ADVANCED AUTOMATION CONCEPTS & TECHNIQUES: Recording Introduction - Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel – Extracting

Unit-IV **8 Hours**

What are assistant bots? - Monitoring system event triggers - Hotkey trigger - Mouse trigger - System trigger - Monitoring image and element triggers - An example of monitoring email - Example of monitoring a copying event and blocking it - Launching an assistant bot on a keyboard event. Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors.

Unit-V **8 Hours**

DEPLOYING AND MAINTAINING THE BOT: Publishing using publish utility - Creation of Server - Using Server to control the bots - Creating a provision Robot from the Server - Connecting a Robot to Server - Deploy the Robot to Server - Publishing and managing updates - Managing packages - Uploading packages - Deleting packages.

Learning Outcomes:

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

- Model the workflow of different scrapping methodologies.
- Understand how the Citrix and the Image Recognition can be helpful.
- Understand Image, Text and Data Tables Automation.
- Interpret the events that can be used to trigger actions.
- Make use of exception handling techniques to handle the log errors.
- Experiment with workflow in a manner to get the optimized output from a Bot.

- Demonstrate the facility for scheduling bots and specifying the time intervals.
- Select the packages and to release them for the update of the bots.

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

- CO 1: Describe RPA, where it can be applied and how it's implemented.
- CO 2: Describe the different types of variables, Control Flow and data manipulation techniques.
- CO 3: Identify and understand Image, Text and Data Tables Automation.
- CO 4: Describe how to handle the User Events and various types of Exceptions and strategies.
- CO 5: Understand the Deployment of the Robot and to maintain the connection.

Text Books

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots with the leading RPA tool – UiPath Kindle Edition

2. Robotic Process Automation A Complete Guide - 2020 Edition Kindle Edition

DEPARTMENT ELECTIVE-IV

BTCSEAI DE41 (DIGITAL IMAGE PROCESSING)

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI DE41	DIGITAL IMAGE PROCESSING	PC	25	75	100	3-0-0	3

COURSE OBJECTIVES

6. To provide an overview of Digital Image Processing
7. To make student aware of Computer Vision
8. To enable the students to understand Object Recognition.
9. **Course Outcomes:**

10. CO1: understand the need for image transforms different types of image transforms and their properties.

11. CO2: develop any image processing application.

12. CO3: understand the rapid advances in Machine vision.

13. CO4: learn different techniques employed for the enhancement of images.

14. CO5: learn different causes for image degradation and overview of image restoration techniques.

15. CO6: understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.

16. CO7: learn different feature extraction techniques for image analysis and recognition

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	2	1	1	3	2	1	3	3	3	2
CO2	3	3	2	1	2	1	1	1	2	1	1	3	3	1	2
CO3	3	2	3	3	3	1	1	1	1	1	1	3	3	3	3
CO4	2	1	1	1	3	1	1	1	1	1	1	3	3	3	2
CO5	3	3	3	2	3	1	1	1	1	1	1	3	3	3	3

Unit – I **08 Hours**

Introduction and Fundamentals: Motivation and Perspective, Applications, Components of Image Processing System, Element of Visual Perception, A Simple Image Model, Sampling and Quantization.

Image Enhancement in Spatial Domain: Introduction; Basic Gray Level Functions – Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using Arithmetic/Logic Operations – Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter, Ordered Statistic Filter; Sharpening – The Laplacian.

Unit – II **08 Hours**

Image Enhancement in Frequency Domain: Fourier Transform and the Frequency Domain, Basis of Filtering in Frequency Domain, Filters – Low-pass, High-pass; Correspondence Between Filtering in Spatial and Frequency Domain; Smoothing Frequency Domain Filters –

Gaussian Lowpass Filters; Sharpening Frequency Domain Filters – Gaussian Highpass Filters; Homomorphic Filtering.

Unit – III 08 Hours

Color Image Processing: Color Fundamentals, Color Models, Converting Colors to different models, Color Transformation, Smoothing and Sharpening, Color Segmentation.

Morphological Image Processing: Introduction, Logic Operations involving Binary Images, Dilation and Erosion, Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening

Unit – IV 08 Hours

Segmentation: Introduction, Region Extraction, Pixel-Based Approach, Multi-level Thresholding, Local Thresholding, Region-based Approach, Edge and Line Detection: Edge Detection, Edge Operators, Pattern Fitting Approach, Edge Linking and Edge Following, Edge Elements Extraction by Thresholding, Edge Detector Performance, Line Detection, Corner Detection.

Unit – V 08 Hours

Feature Extraction: Representation, Topological Attributes, Geometric Attributes

Description: Boundary-based Description, Region-based Description, Relationship.

Object Recognition: Deterministic Methods, Clustering, Statistical Classification, Syntactic Recognition, Tree Search, Graph Matching.

Learning Outcomes:

1. Student will have a broad understanding of Image Processing.
2. Student will be capable of working with images over various software tools
3. The student will be able to work on the various image processing tools and programming platforms to meet the market and research trending demands.

REFERENCE BOOKS:

- Digital Image Processing 2nd Edition, Rafael C. Gonzales and Richard E. Woods. Published by: Pearson Education.
- Digital Image Processing and Computer Vision, R.J. Schalkoff. Published by: John Wiley and Sons, NY.
- Fundamentals of Digital Image Processing, A.K. Jain. Published by PrenticeHall, Upper Saddle River, NJ.

BTCSEAI DE42 Machine Learning for Medical Image Analysis

Pre-requisites: Multivariate Calculus, Linear Algebra, proficiency in MATLAB/Python including methods to display images on the screen of your laptop/desktop.

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI DE42	Machine Learning for Medical Image Analysis	PC	25	75	100	3-0-0	3

OBJECTIVES: Following this course students will be able to:

1. Describe fundamental machine learning problems in major biomedical application domains
2. Understand the unique challenges associated with biomedical data in different domains
3. Describe challenges in validating ML algorithms in healthcare and biomedical research.
4. Identify major public databases that can be used to develop and validate ML algorithms.

Course Outcomes:

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

1. Understand Imaging technology and it's applications in medical field
2. Can Analyze Imaging concepts and Algorithm
3. Will be able to design Medical Imaging concept.
4. Understand CT SCAN/ MRI SCAN
5. Implement Machine learning algorithm in diagnosing and treatment.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	1	1	1	1	2	1	1	3	2	1	3	2	2	1
CO2	3	3	2	1	2	1	1	1	2	1	1	3	2	2	1
CO3	3	2	3	3	3	1	1	1	1	1	1	3	2	2	1
CO4	2	1	1	1	3	1	1	1	1	1	1	3	2	2	1
CO5	3	3	3	2	3	1	1	1	1	1	1	3	2	2	1

Unit-I 08 Hours

Introduction to medical imaging technology, systems and modalities. Brief history; importance; applications; trends; challenges. Medical Image Storage, Archiving and Communication Systems and Formats, Picture archiving and communication system, (PACS); Formats: DICOM, Radiology Information Systems (RIS) and Hospital Information Systems (HIS).

Unit-II 08 Hours

Texture in Medical Images: Region Growing and Clustering, Random Walks for Segmentation Week, Active Contours for Segmentation, Systematic Evaluation and Validation.

Unit-III 08 Hours

Decision Trees for Segmentation and Classification, Random Forests for Segmentation and Classification, Neural Networks for Segmentation and Classification.

Unit-IV 08 Hours

Deep Learning for Medical Image Analysis: Retinal Vessel Segmentation, Vessel Segmentation in Lung CT Images, Lesion Segmentation in Brain MRI, Ultrasonic Tissue Characterization, Metastatic Region Segmentation in Lymph Node Histology.

Unit-V **08 Hours**

Case studies on some recent advances in analysis of retinal, CT, MRI, ultrasound and histology images.

Textbooks:

- Machine Vision, Wesley E. Snyder & Hairong Qi, ©2004, ISBN 978-0-521-16981-3 (paperback) or 978-0-521-83046-1 (hardback)
- Insight into Images: Principles and Practice for Segmentation, Registration and Image Analysis, Terry S. Yoo (Editor)

BTCSEAI DE43: Data Science Application of Vision

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI DE43	Data Science Application of Vision	PC	25	75	100	3-0-0	3

Prerequisites:

Mathematics: Knowledge of and ability to use calculus, analytical geometry, linear algebra and probability theory and Programming Ability to program in Python.

Learning outcomes: On successful completion of this course, students should have the skills and knowledge to develop computer vision applications using some common machine learning methods. Moreover, they will be able to analyze and make objective comparison between different approaches from the state of the art.

Course Outcomes:

After studying this subject, student will be able to:

1. Lear and Understand Image formation with human vision.
2. Can apply Image segmentation and feature extraction Algorithms.
3. Can recognize objects into the images.
4. Able to apply Neural network architecture for object recognition
5. Can analyze emotions, motion, activity of human

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	1	-	1	1	1	1	1
CO2	3	2	2	1	-	-	-	-	1	-	1	1	1	1	1
CO3	3	2	2	1	-	-	-	-	1	-	1	1	1	1	1
CO4	3	2	2	1	-	-	-	-	1	-	1	1	1	1	1
CO5	3	2	2	1	-	-	-	-	1	-	1	2	1	1	1

15. 3-High Level, 2-Medium Level, 1-Low Level

Unit-I

Introduction: Background, requirements and issues, human vision, Image formation: geometry and photometry, Geometry, photometry (brightness and color), quantization, camera calibration. Image segmentation and Feature Extraction

Unit-II

methods of image segmentation, edge detection, object proposals, SIFT features, Multi-view Geometry Shape from stereo and motion, feature matching, surface fitting, Active ranging

Unit-III

Object Recognition: Traditional Methods, HoG/SIFT features, Bayes classifiers, SVM classifiers Introduction to Neural Networks, Artificial neural networks, loss functions, backpropagation and SGD, Batch Normalization.

Unit-IV

Object Recognition Deep Learning Methods, Image classification, object detection and semantic segmentation, adversarial attacks. Various neural network architectures, visualization techniques.

Unit-V

Motion analysis and Activity Recognition, Motion detection and tracking, Inference of human activity from image sequences, Examples: Face recognition, Image grounding, Visual question answering.

Required Text:

The main book for the class is “Deep Learning” (2016) by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.

The print version of the book has not yet been released, but an online version is available here: http://www.deeplearningbook.org https://onlinecourses.nptel.ac.in/noc20_cs88/preview

DEPARTMENT ELECTIVE-V

BTCSE AIDE51 Web Programming for Artificial Intelligence

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI DE51	Web Programming for Artificial Intelligence	PC	25	75	100	3-0-0	3

Course Objective:

1. Understand Django Architecture and its take on MVC (Models, Views & Templates) Build and deploy robust Django web apps Integrate with RESTful web services Unit Testing and Debugging Django apps.

Learning Outcomes:

- Python is easy and quick to learn because it requires less time, less code and less concepts than other programming languages.
- Learn solid foundational skills that are easily transferable to other, more tedious languages.
- Gain an in-depth understanding of Python web programming.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1
CO2	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1
CO3	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1
CO4	3	2	2	1	-	-	-	-	-	1	1	1	2	2	1
CO5	3	2	2	1	-	-	-	-	1	-	1	2	2	2	1

3-High Level, 2-Medium Level, 1-Low Level

Syllabus

Unit-I **08 Hours**

Object Oriented Programming, An introduction to classes and objects, define a class, work with object composition, work with encapsulation, work with inheritance, override object methods, Methods Inheritance Abstract Classes Working with APIs RESTful architecture working with APIs Request library.

Unit-II **08 Hours**

Introduction to Developer Tools and SQL Assert statements Testing Git Intro to SQL CRUD. An introduction to relational databases, SQL statements for data manipulation, Using SQLite Manager to work with a database, Using Python to work with a database, Creating a GUI that handles an event, working with components.

Unit-III **08 Hours**

Introduction to Django, Introduction to Back-End Web Development using Django, HTTP protocol MVC model Virtual environment Django structure Generic Views HTML templates URL dispatcher.

Advanced Django for Web and Automation Custom Views GET and POST methods URL shortener User model Logic in templates Querying models Serving Static files Deployment of Django Automating tasks with Django.

Unit-IV **08 Hours**

Building Web APIs using Django REST Generic Views in Django Rest Serializers JSON Building RESTful APIs Filtering Models Working with Images Authentication with tokens Postman Related models Content types app Deploying Web APIs Using API endpoints Deployment of Django REST project

Unit-V **08 Hours**

Capstone Project, build a basic stock market web app, build a Chat-bot for real time applications.

Text Books:

- Programming Ruby: The Pragmatic Programmer's Guide, Dave Thomas, Chad Fowler and Andy Hunt, Pragmatic Programmers, 3rd Edition, 2008

Reference Books:

- Web Application Design and Implementation:Apache2, PHP5, MYSQL, Javascript, and LINUX/UNIX, Steven A. Gabarro, John Wiley and Sons, 2006.
- Programming the World Wide Web, R. W. Sebesta, Addison Wesley, 7th Edition, 2013

BTCSEAI DE52: INTERNET OF THINGS

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI DE52	Internet of Things	PC	25	75	100	3-0-0	3

Prerequisites:

1. Fundamentals of Computing
2. Introduction To Electronics
3. Basic knowledge of Digital Electronics and Microprocessors

OBJECTIVES

- The objective of this course is to impart necessary and practical knowledge of components of
- Internet of Things and develop skills required to build real-life IoT based projects.

LEARNING OUTCOMES

- After the completion of this course, the students will be able to:
- Understand internet of Things and its hardware and software components
- Interface I/O devices, sensors & communication modules
- Remotely monitor data and control devices
- Develop real life IoT based projects

Course Outcomes:

1. Understand the concepts of Internet of Things
2. Analyze basic protocols in wireless sensor network
3. Design IoT applications in different domain and be able to analyze their performance
4. Implement basic IoT applications on embedded platform.
5. Understand the Applications with case studies of IoT

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1
CO2	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1
CO3	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1
CO4	3	2	2	1	-	-	-	-	1	1	1	1	2	2	1
CO5	3	2	2	1	-	-	-	-	1	-	1	2	2	2	1

16. 3-High Level, 2-Medium Level, 1-Low Level

Unit-I: **08 Hours**

Introduction to IoT Defining IoT and Characteristics of IoT, Physical design of IoT: Things in IoT, protocols, Logical design of IoT: IoT Functional blocks, Communication models, and APIs, IoT Enabling Technology : Wireless sensor networks, cloud computing, Big data analytics, communication protocols, Embedded systems, IoT Levels and development templates: IoT Level 1 to Level 6.

Unit-II: **08 Hours**

IoT & M2M Need for IoT system management, simple network management protocols, Network Machine to Machine, Network operator requirements, Network Configuration Protocol (NETCONF), Yet Another Next Generation (YANG), IoT system management with NETCONF - YANG, Difference between IoT and M2M, Software define Network, IoT design methodology.

Unit-III: **08 Hours**

Network & Communication aspects Wireless medium access issues- Challenges and Constraints, MAC protocol survey- Contention-Free Medium Access, Contention-Based Medium Access, Characteristics of MAC Protocols in Sensor Networks, Contention-Free MAC Protocols, Contention-Based MAC Protocols, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

Unit-IV: n **08 Hours**

Challenges in IoT Design challenges, Development challenges, IoT Physical devices and end point, introduction to cloud storage model and communication APIS, Web application messaging protocol (WAMP) -Auto bahm for IoTs, Xively cloud for IoT, Connectivity, Power, Ecosystem, Standards, Integration, Multiple Connectivity and Data Management, IoT Security, Governance and Ethics.

Unit-V: **08 Hours**

Domain specific applications of IoT Home automation, Smart cities, Environment, Energy, Retail Management, Logistics, Agriculture, Industry applications, Oil and gas, Big data, Health and Lifestyle Surveillance applications, Green house. Developing IoT Introduction to Python, Introduction to different IoT tools, developing applications through IoT tools, developing sensor based application through embedded system platform, Implementing IoT concepts with

Textbook: 1. David Hanes et al., IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things, First edition, Pearson, 2017

Reference Book:

1. Jan Holler, Vlasiostsiatsis, Catherine Mulligan, Stefan Avesand, Stamatiskarnouskos, David Boyle, "From Machine-To-Machine To The Internet Of Things: Introduction To A New Age Of Intelligence", 1 St Edition, Academic Press, 2014.
2. Peter Waher, "Learning Internet Of Things", PACKT Publishing, BIRMINGHAM – MUMBAI
3. Bernd Scholz-Reiter, Florian Michahelles, "Architecting The Internet Of Things", ISBN 978-3-642-19156-5 E-ISBN 978-3-642-19157-2, Springer
4. Daniel Minoli, "Building The Internet Of Things With Ipv6 And Mipv6: The Evolving World Of M2M Communications", ISBN: 978-1-118- 47347-4, Willy Publications

Text Book:

Vijay Madisetti and Arshdeep Bahga, "Internet of Things: A Hands Published by Arshdeep Bahga publishers,2014On Approach" Waltenegus Dargie and Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice" Wiley and Sons publications,2010 . 114

BTCSEAI DE53: Introduction to Blockchain Technology

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		

BTCSEAI DE53	Introduction to Blockchain Technology	PC	25	75	100	3-0-0	3

Course objective:

To give students the understanding of emerging abstract models for Block chain Technology and to familiarize with the functional/operational aspects of cryptocurrency eco-system.

Course Outcomes (COs): At the end of this course students will be able to…

CO-1: Describe the basic concepts and technology used for block chain.

CO-2: Describe the primitives of the distributed computing and cryptography related to block chain.

CO-3: Illustrate the concepts of Bitcoin and their usage.

CO-4: Implement Ethereum block chain contract.

CO-5: Apply security features in block chain technologies.

CO-6: Use smart contract in real world applications.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1
CO2	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1
CO3	3	2	2	1	-	-	-	-	1	-	1	1	2	2	1
CO4	3	2	2	1	-	-	-	-		1	1	1	2	2	1
CO5	3	2	2	1	-	-	-	-	1	-	1	2	2	2	1

17. 3-High Level, 2-Medium Level, 1-Low Level

Unit-I **08 Hours**

Introduction: Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Nakamoto's concept with Blockchain based cryptocurrency, Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc.

Unit-II **08 Hours**

Basic Distributed Computing & Crypto primitives: Atomic Broadcast, Consensus, Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems.

Bitcoin basics: Bitcoin blockchain, Challenges and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use.

Unit-III **08 Hours**

Ethereum basics: Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts, Writing smart contracts using Solidity & JavaScript.

Unit-IV **08 Hours**

Privacy, Security issues in Blockchain: Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains: Sybil attacks, selfish mining, 51% attacks advent of algorand; Sharding based consensus algorithms to prevent these attacks.

Unit-V **08 Hours**

Case Studies: Block chain in Financial Service, Supply Chain Management and Government Services

List of References:

1. Narayanan, Bonneau, Felten, Miller and Goldfeder, "Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction", Princeton University Press.
2. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.
3. Imran Bashir, "Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained", Packt Publishing.
4. Merunas Grincalaitis, "Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols", Packt Publishing.
5. Prof. Sandip Chakraborty, Dr. Praveen Jayachandran, "Blockchain Architecture Design And Use Cases"[MOOC], NPTEL: https://nptel.ac.in/courses/106/105/106105184/

OPEN ELECTIVES

Open Electives-I

BTCSEAI OE11: ICT for Development

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI OE11	ICT for Development	PC	25	75	100	3-0-0	3

COURSE OBJECTIVES:

1. Knowledge of ICT including new and emerging technologies
2. Autonomous and discerning use of ICT

3. Skills to enhance work produced in a range of contexts
4. An understanding of the basic components, use and application of different ICT systems and networks.

Course Outcomes:

1. Skills to analyze, design, implement, test and evaluate ICT systems
2. The ability to recognize potential risks when using ICT, and use safe, secure and responsible practice.
3. Understand the Basics of Information and Communication technology.
4. Explore the Application of ICT for Development.
5. Analyze and exploits the merits of ICT to establish more effective Infrastructure.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

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

18. 3-High Level, 2-Medium Level, 1-Low Level

Unit I:

Types and components of computer systems:

Hardware consists of the physical components of a computer system Internal components including Central Processing Unit (CPU), processor, motherboard Internal memory including random access memory (RAM), read-only memory (ROM) Hardware components including graphics card, sound card, Network Interface Card (NIC), camera, internal/ external storage devices, System software provides the services that the computer requires to operate Examples of system software including compilers, linkers, device drivers, operating systems and utilities, Analogue and digital data Characteristics of analogue and digital data Differences between analogue and digital data The need to convert: analogue to digital data so it can be processed by a computer , digital data to analogue data so it can be used to control devices

Unit II:

Input and Output devices

Input and output devices Characteristics, uses, advantages and disadvantages of input devices including: keyboard, numeric keypad, pointing devices, remote control, joystick/driving wheel, touch screen (as an input device), scanners, camera, microphone, sensors, light pen, Direct data entry: Characteristics, uses, advantages and disadvantages of direct data entry devices including: magnetic stripe reader, chip and PIN reader, Radio Frequency Identification (RFID) reader, Optical Mark Recognition/Reader (OMR), Optical Character Recognition/Reader (OCR), bar code reader, QR scanner, Characteristics, uses, advantages and disadvantages of output devices including: monitors, touch screen (as an output device), multimedia projector, laser printer, inkjet printer, dot matrix printer, plotter, 3D printers, speaker, actuator

Unit III:
The effects of using IT
Microprocessor-controlled devices, Potential health problems related to the prolonged use of IT equipment, Including: repetitive strain injury (RSI), back problems, eye problems, headaches the causes of these health issues and strategies for preventing them

Unit IV:
ICT applications:
Communication media, Mobile communication, Computer modelling; Including: personal finance, bridge and building design, flood water management, traffic management, weather forecasting Advantages and disadvantages of using computer modelling rather than humans, Characteristics, uses, advantages and disadvantages of satellite systems including Global Positioning Systems (GPS), satellite navigation, Geographic Information Systems (GIS), media communication systems (satellite television, satellite phone)

Unit V:
The systems life cycle:

Characteristics, uses, advantages and disadvantages of the research methods of observation, interviews, questionnaires and examination of existing documents The need to identify the inputs, outputs and processing of the current system, problems with the current system, the user and information requirements for the new system, Identify and justify suitable hardware and software for the new system Design file/data structures, input formats, output formats and validation routines File/data structures including field length, field name, data type, coding of data for example M for male, F for female Validation routines including range check, character check, length check, type check, format check, presence check, check digit Input formats including data capture forms Output formats including screen layouts and report layouts

Text books:

Castells, Manuel Networks of Outrage and Hope: Social Movements in the Internet Age, 2nd Edition, John Wiley & Sons, 2015

BTCSEAI OE12: SOFT SKILLS AND INTERPERSONAL COMMUNICATION

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI OE12	SOFT SKILLS AND INTERPERSONAL COMMUNICATION	PC	25	75	100	3-0-0	3

COURSE OBJECTIVES:

- Learn fundamentals of Parts of Speech and using the Dictionary.
- Detailed study of Spellings, Silent letters and Articles.
- Learn Auxilary verbs, Subject and Object and how to make Questions and Question tags.
- Addressing the Greetings and giving directions.
- Detailed study of Homophones.

Course Outcomes:

- Students can gain potential knowledge towards Grammatical and Communicative competence through the useful inputs and task-based activities.
- This enables them to build their confidence in using English language.
- To be able to compete with the globalised world and become successful in all the challenges that they face.
- To develop Linguistic competence and Communicative competence which helps them to develop "thinking" skill in English.
- The students can hone their interpersonal and employability skills draw upon real-life situations and examples.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

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

19. 3-High Level, 2-Medium Level, 1-Low Level

UNIT I - Self Analysis:

SWOT Analysis, Who am I, Attributes, Importance of Self Confidence, Self Esteem.

UNIT II - Creativity:

Out of box thinking, Lateral Thinking, OBJECTIVE THINKING, perception.

UNIT III - Attitude:

Factors influencing Attitude, Challenges and lessons from Attitude, Etiquette.

UNIT IV – Motivation:
Factors of motivation, Self-talk, Intrinsic & Extrinsic Motivators.

UNIT V: Goal Setting : Wish List, SMART Goals, Blue print for success, Short Term, Long Term, Life Time Goals. Time Management Value of time, Diagnosing Time Management, Weekly Planner To do list, Prioritizing work. Extempore

TEXT BOOK:
SOFT SKILLS, 2015, Career Development Centre, Green Pearl Publications .
REFERENCE BOOK:
1. Covey Sean, Seven Habits of Highly Effective Teens, New York, Fireside Publishers, 1998.
2. Carnegie Dale, How to win Friends and Influence People, New York: Simon & Schuster, 1998.
3. Thomas A Harris, I am ok, You are ok , New York-Harper and Row, 1972 4. Daniel Coleman, Emotional Intelligence, Bantam Book, 2006

BTCSEAI OE13: Cyber Law and Ethics

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI OE13	Cyber Laws and Ethics	PC	25	75	100	3-0-0	3

COURSE OBJECTIVES

1. Students identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.

2. Students locate and apply case law and common law to current legal dilemmas in the technology field.

3. Students apply diverse viewpoints to ethical dilemmas in the information technology field and recommend appropriate actions.

4. Students distinguish enforceable contracts from non-enforceable contracts.

5. Students demonstrate leadership and teamwork.

Course Outcomes:
1. The students will understand the importance of professional practice, Law and Ethics in their personal lives and professional careers.

2. The students will learn the rights and responsibilities as an employee, team member and a global citizen.
3. Describe Information Technology act and Related Legislation.
4. Demonstrate Electronic business and legal issues.
5. Interpret Cyber Ethics.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

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

3-High Level, 2-Medium Level, 1-Low Level

UNIT I: Applied Ethics

What ethics is and is not, Explore differences between laws and ethics, Ethical viewpoints, Virtue, Natural Rights, Fairness (Justice), Ethical decision making process, Laws and ethics of employee monitoring, Review ethical codes of IT professional organizations

UNIT II: Cyber Law: Legal Issues and Challenges in India, USA and EU

A) Data Protection, Cyber Security,

B) Legal recognition of Digital Evidence

C) Recognition of liability in the digital world

D) Jurisdiction Issues in Transnational Crimes

UNIT III: HIPAA: Health Insurance Portability and Accountability Act

Basics of HIPAA, Implications of HIPAA for IT professionals, Administrative procedures, Physical safeguards, Technical security services, Technical security mechanisms

UNIT IV Cyberspace Intellectual Property Laws and Issues

Copyright law: Fair use, DRM (Digital Rights Management) and the DMCA (Digital Millennium Copyright Act), Copyright Web issues; Patent Law: Software patents issues, Trademarks; Cybersquatting, Using trademarks in meta-tags, Software License agreements

UNIT V: Cyber Crime and Related Laws

Review of cybercrime statistics and trends, Cybercrime categories, Computer fraud, Gray Hat Hacking, Crimes and penalties under the Computer Fraud and Abuse Act (CFAA)

Textbook/Reference Book:

1. Yatindra Singh: Cyber Laws.
2. Ajit Narayanan and Bennum (ed.): Law, Computer Science and Artificial Intelligence.
3. Linda Brennan and Victoria Johnson: Social, ethical and policy implication of Information Technology.
4. Kamath Nandan: Law relating to Computer, Internet and E-Commerce.
5. Arvind Singhal and Everett Rogers: India's Communication Revolution: From Bullock Carts to Cyber Marts.
6. Lawrence Lessing: Code and other Laws of cyberspace.
7. Mike Godwin: Cyber Rights Defencing free speech in the Digital Age.
8. Sunit Belapure and Nina Godbole, Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives, Wiley India Pvt. Ltd, 2011.
9. Mark F Grady, Fransesco Parisi, "The Law and Economics of Cyber Security", Cambridge University Press, 2006
10. Jonathan Rosenoer, "Cyber Law: The law of the Internet", Springer-Verlag, 1997.

BTCSEAI OE21: History of Science & Engineering.

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI OE21	History of Science & Engineering.	PC	25	75	100	3-0-0	3

Course Objective:

1. To make student understand different branches of Science in Ancient India.

2. General knowledge about Scientific and Technological Developments in Medieval India.

3. To study Early European Scientists in Colonial India

4. To be aware of Science and Technology in Modern India.

5. To know about Prominent scientist of India

Course Outcomes: Upon successful completion of this course, students will be able to

1. Understand Astronomy, Mathematics, Engineering and Medicine of ancient India.

2. Analyze Scientific and Technological Developments in Medieval India

3. Will be aware of Surveyors, Botanists, Doctors, under the EI Company's Service

4. Will be aware of various scientists of India,

5. Familiar with ISRO, DRDO, etc.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

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

3-High Level, 2-Medium Level, 1-Low Level

Unit-I:

Science and Technology-The beginning Development in different branches of Science in Ancient India: Astronomy, Mathematics, Engineering and Medicine. 2. Developments in metallurgy: Use of Copper, Bronze and Iron in Ancient India. 3. Development of Geography: Geography in Ancient Indian Literature.

Unit-II:

Developments in Science and Technology in Medieval India Scientific and Technological Developments in Medieval India; Influence of the Islamic world and Europe; The role of *maktabs, madrasas* and *karkhanas* set up. 2. Developments in the fields of Mathematics, Chemistry, Astronomy and Medicine. 3. Innovations in the field of agriculture - new crops introduced new techniques of irrigation etc.

Unit-III:

Developments in Science and Technology in Colonial India Early European Scientists in Colonial India- Surveyors, Botanists, Doctors, under the Company's Service. Indian Response to new Scientific Knowledge, Science and Technology in Modern India: Development of research organizations like CSIR and DRDO; Establishment of Atomic Energy Commission; Launching of the space satellites.

Unit-IV:

Prominent scientist of India since beginning and their achievement Mathematics and Astronomy: Baudhayan, Aryabhtatta, Brahmgupta, Bhaskaracharya, Varahamihira, Nagarjuna. Medical Science of Ancient India (Ayurveda & Yoga): Susruta, Charak, Yoga & Patanjali. Scientists

of Modern India: Srinivas Ramanujan, C.V. Raman, Jagdish Chandra Bose, Homi Jehangir Bhabha Dr. APJ Abul Kalam Azad and Dr. Vikram Sarabhai.

Textbook:

History of Science and Technology In India by Dr. Binod Bihari Satpathy.

BTCSEAI OE22: Sustainable Development

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI OE22	Sustainable Development	PC	25	75	100	3-0-0	3

Learning Objectives:

1. Understand the basic concept of Sustainable Development (SD), the environmental, social and economic dimensions.
2. Know the history of the SD idea.
3. Be able to discuss the conflicts which are involved in the SD concept on the national as well as on the global scale.
4. Be familiar with potential strategic options for SD (efficiency, sufficiency).
5. Be able to discuss the (dis-)advantages of instruments for SD.
6. Understand the SD challenge for companies, their responsibility and their potentials for action.

Course Outcomes: After completion of this course, students will be able to:

1. Understand the basic concept of Sustainable Development (SD), the environmental, social and economic dimensions.
2. Understand the embedment of sustainability issues in environmental, societal, and economic systems, and the relevance of the conditions, interrelations, and dynamics of these systems.
3. Demonstrate knowledge and understanding of the current sustainable development policies followed by selected countries.

4. To identify different stakeholders in a challenge to sustainability, and analyze the political and economic structures that connect them.
5. Assess the sustainable practices of any community based on metrics.
6. Demonstrate judging capability of the impact of any decision on the sustainable development metric of a community.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

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

3-High Level, 2-Medium Level, 1-Low Level

UNIT-I

Introduction to Sustainable Development: Glimpse into History and Current practices - Broad introduction to SD - its importance, need, impact and implications; definition coined; evolution of SD perspectives (MDGs AND SDGs) over the years; recent debates; 1987 Brundtland Commission and outcome; later UN summits (Rio summit, etc.) and outcome.

Unit-II

Dimensions to Sustainable Development - society, environment, culture and economy; current challenges - natural, political, socio-economic imbalance; sustainable development initiatives and policies of various countries : global, regional, national, local; needs of present and future generation - political, economic, environmental.

Unit-III

Frameworks of Sustainability - Analytical frameworks in sustainability studies, sustainability metrics: criteria and indicators; the significance of quantitative and qualitative assessments of sustainability; current metrics and limitations; metrics for mapping and measuring sustainable development; application of the metrics in real scenarios.

Unit-IV

Critical Perspectives on Sustainable Development: Resource management and implications on sustainable development - implications for valuation, risk assessment; integrated decision-making processes: requirements of information, information flow, data analytics, learning from historical data, multicriteria decisions, multi level decisions, participatory

decisions ; translating impact chains to information flows - impact of governance and policies

Unit-V

Case Studies & Projects on Rural Sustainable Development (Indian village perspectives) - Village resources (broad perspectives); current challenges and thematic areas; village social hierarchy; village economy; needs of present and future generation; conflicts - sustainability and rural culture & tradition; road to achieving sustainable development goals - bridging conflicts and way forward.

BTCSEAI OE23: Ethical Hacking

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI OE23	Ethical Hacking	PC	25	75	100	3-0-0	3

COURSE OBJECTIVES The objective of this Course is to help the students to master an ethical hacking practice.

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

- summarize the core concepts related to malware, hardware and software vulnerabilities and their causes.
- Understand Ethical Hacking skills and their applications.
- choose state-of-the-art tools to exploit the vulnerabilities related to computer system and networks hacking.
- Experiment with various tools to exploit web applications
- Solve the security issues in web applications.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

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

CO4	2	2	2	2	2						1	1
CO5	3	2	2	2	2						1	2

3-High Level, 2-Medium Level, 1-Low Level

UNIT I

Introduction to Ethical Hacking- Internet Crime Current Report-Essential Terminology-Elements of Information Security -Motives, Goals, and Objectives of Information Security Attacks- Internet Crime Current Report-Essential Terminology-Elements of Information Security -Motives, Goals, and Objectives of Information Security Attacks

UNIT II

Hacking Concepts- Why Ethical Hacking is Necessary -Scope and Limitations of Ethical Hacking -Skills of an Ethical Hacker -Why Ethical Hacking is Necessary -Scope and Limitations of Ethical Hacking -Skills of an Ethical Hacker

UNIT III

Footprinting Concepts- Footprinting Terminology -What is Footprinting?-Why Footprinting?-Objectives of Footprinting-Email Footprinting- System Hacking- Cracking Passwords -Password Cracking-Password Complexity-Password Cracking Techniques -Types of Password Attacks

UNIT IV

Trojan Concepts- What is a Trojan?-Purpose of Trojans -Indications of a Trojan Attack-Anti-Trojan Software - Anti-Trojan Software: Trojan Hunter - Anti-Trojan Software: Emsisoft Anti-Malware. UNIT V Types of Viruses -System or Boot Sector Viruses -File and Multipartite Viruses - Macro Viruses -Cluster Viruses -Stealth/Tunneling Viruses-Encryption Viruses.

UNIT V

An introduction to the particular legal, professional and ethical issues likely to face the domain of ethical hacking, ethical responsibilities, professional integrity and making appropriate use of the tools and techniques associated with ethical hacking – Social Engineering, Host Reconnaissance, Session Hijacking, Hacking - Web Server, Database, Password Cracking, Network and Wireless, Trojan, Backdoor, UNIX, LINUX, Microsoft, NOVEL Server, Buffer Overflow, Denial of Service Attack, Methodical Penetration Testing.

REFERENCE BOOKS:

1. Hacking for Dummies, Book by Kevin Beaver
2. The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration ... Book by Patrick Engebretson.

BTCSEAI OE31: Data Mining

Paper Code	**Title of the Paper**	**Course type**	**Marks**			**L-T-P**	**Credits**
			Internal Assessment	**Semester Exam**	**Total**		

BTCSEAI OE31	Data Mining	PC	25	75	100	3-0-0	3

Course Objectives: It is an introduction to the field of data mining (also known as knowledge discovery from data, or KDD for short). It focuses on fundamental data mining concepts and techniques for discovering interesting patterns from data in various applications It emphasizes techniques for developing effective, efficient, and scalable data mining tools.

Course Outcomes: After learning the course the students should be able to:

- Perform the preprocessing of data and apply mining techniques on it.
- Identify the association rules, classification, and clusters in large data sets.
- Solve real world problems in business and scientific information using data mining.
- Use data analysis tools for scientific applications.
- Implement various supervised machine learning algorithms.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

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

- 3-High Level, 2-Medium Level, 1-Low Level

Syllabus:

Unit-I

Introduction to data mining (DM): Motivation for Data Mining - Data Mining-Definition and Functionalities – Classification of DM Systems - DM task primitives - Integration of a Data Mining system with a Database or a Data Warehouse - Issues in DM – KDD Process

Unit-II

Data Pre-processing: Data summarization, data cleaning, data integration and transformation, data reduction, data discretization and concept hierarchy generation, feature extraction , feature transformation, feature selection, introduction to Dimensionality Reduction, CUR decomposition

Unit-III

Concept Description, Mining Frequent Patterns, Associations and Correlations:
What is concept description? - Data Generalization and summarization-based characterization - Attribute relevance - class comparisons, Basic concept, efficient and scalable frequent item-set mining methods, mining various kind of association rules, from association mining to correlation analysis, Advanced Association Rule Techniques, Measuring the Quality of Rules.

Unit-IV

Classification and Prediction
Classification vs. prediction, Issues regarding classification and prediction, Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree-Based Algorithms, Neural Network-Based Algorithms, Rule-Based Algorithms, Combining Techniques, accuracy and error measures, evaluation of the accuracy of a classifier or predictor. Neural Network Prediction methods: Linear and nonlinear regression, Logistic Regression Introduction of tools such as DB Miner / WEKA / DTREG DM Tools

Unit-5:

Cluster Analysis and Clustering: Problem Definition, Clustering Overview, Evaluation of Clustering Algorithms, Partitioning Clustering -K-Means Algorithm, K-Means Additional issues, PAM Algorithm; Hierarchical Clustering – Agglomerative Methods and divisive methods, Basic Agglomerative Hierarchical Clustering, Strengths and Weakness; Outlier Detection, Clustering high dimensional data, clustering Graph and Network data.

BTCSEAI OE32: Enterprise Resource and planning

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI OE32	Enterprise Resource and planning	PC	25	75	100	3-0-0	3

Course Objectives:

1. To understand the basic concept of ERP systems

2. To study the steps and activities in the ERP life cycle

3. To develop a process driven thinking towards business processes.

Course Outcomes: After studying this Paper, Students will be able to;

1. Demonstrate a good understanding of the basic issues in ERP systems.

2. Analyse the strategic options for ERP identification and adoption.

3. Design the ERP implementation strategies.

4. Understand the need of Business Systems and Processes through strategic analysis of ERP systems.

5. Develop and design the modules used in ERP systems, and can customize the existing modules of ERP systems.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

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

Syllabus

Unit-I

Introduction to ERP: ERP Overview, Benefits, Business process reengineering, ERP implementation life cycle, Options of various paradigms, Supply chain Management, Critical factors guiding selection and evaluation, Strategies for successful implementation, impediments and initiatives to achieve success, Critical success and failure factors, Integrating ERP into organizational culture.

Unit-II

SAP and ABAP: Architecture of SAP, Data types in ABAP, ABAP programming Language, ABAP User Dialogs, Function groups and function modules, Accessing Database Access, open SQL, Native SQL, ABAP Object Orientation, Classes and objects in ABAP, Inheritance,

Interfaces, Triggering and Handling Events, ABAP data dictionary, Declarations, selection screens, Formatting and Displaying Data, Program Events, , Dynpros, BSP applications.

Unit-III

SD: Basic functions and master data in SD, Sales orders, Deliveries, Pricing, Billing, Transportation, Credit Management. MM: Basic functions and master data, Consumption based planning, Purchasing, Inventory management, Evaluation of materials, Invoice verification, Balance sheet evaluation,Material ledger.

Unit-IV

Introduction, SAP AG, Baan Company, Oracle Corporation, People Soft, JD Edwards World Solutions Co, System Software Associates, Inc. (SSA); QAD; A Comparative Assessment and Selection of ERP Packages and Modules.

Unit-V

Issues in Implementing ERP Packages; Pre-evaluation Screening; Package Evaluatio; Project Planning Phase; Gap Analysis; Reengineering; Configuration; Implementation; Team Training; Testing; Going Live; End-User Training; Post Implementation (Maintenance Mode). Selection of ERPVendors, Future Direction in ERP.

Reference Books:

1. Manufacturing Resource Planning (MRP II) with Introduction to ERP; SCM; an CRM by Khalid Sheikh, Publisher: McGraw-Hill

2. The Impact of Enterprise Systems on Corporate Performance: A study of ERP, SCM, and CRM System Implementations [An article from: Journal of Operations Management] by K.B. Hendricks; V.R. Singhal; and J.K. Stratman, Publisher: Elsevier

3. ERP and Supply Chain Management by Christian N. Madu, Publisher: CHI

4. Implementing SAP ERP Sales & Distribution by Glynn C. Williams, Publisher McGraw-Hill

BTCSEAI OE33: Rural Technology & Community development

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI OE33	Rural Technology & Community development	PC	25	75	100	3-0-0	3

Course Objectives:

1. Understand theories and practices in the rural development model.

2. Learn and analyse rural life and rural economy.

3. Understand different measures in rural development.

4. Learn different technologies used in upliftment of rural life.

5. To participate in visits and case studies for better understanding for rural development and its impact on overall economy.

Course Outcomes: By the end of the course, students should be able to

1. Understand rural development model.

2. Learn different measures in rural development and its impact on overall economy.

3. Understand and learn importance of technologies in rural and community development.

4. Understand challenges and opportunities in rural development.

5. Analyze the cases of model villages.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

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

- 3-High Level, 2-Medium Level, 1-Low Level

Unit-I

RURAL DEVELOPMENT - Concepts and connotations, Basic Elements, Growth Vs. Development, Why rural development, Rising expectations and development, Development and Change, Human beings as cause and consequences of development. RURAL ECONOMY OF INDIA - Introduction, size and structure, The characteristics of rural sector, The role of agricultural sub-sector, The role of non-agricultural sub-sector, Challenges and opportunities.

Unit-II

MEASURES OF DEVELOPMENT - Introduction, Measures of level of rural development, Measures of income distribution, Measures of development simplified, Concepts and measures of rural poverty.

PARADIGMS OF RURAL DEVELOPMENT - Introduction, The modernization theory, The dependency theory of Marxist School, Rosenstein- Rodan's theory of 'Big Push', Lewis' model of economic development, The human capital model of development, The Gandhian Concept of Rural Development theories from other social sciences.

Unit-III

Using Water Resources - The water cycle, Drinking Water, Water quality testing, Water filtering ,Extraction from Groundwater ,Pumps Rope and washer pump ,Manuel pumps, Treadle pump, Irrigation for agriculture, Channel systems, Sprinkler systems, Drip systems Water diversion ,Water storage Building Infrastructures and Creating Energy - Basic energy uses , Energy Sources - Firewood, Solar Energy, Hydroelectricity, Hydromechanical, Wind Energy, Energy Storage, Connecting to the Electrical Network, Environmental Considerations.

Use of ICT in Rural and agricultural development - Education, Healthcare, Agriculture, Business, Resource Mapping, Digital and Social Media Marketing Decision Support Systems for soil conservation and farm management Waste Management and Sanitation.

Unit-IV

DEVELOPING COMMUNITIES - Introduction, Service Learning and community development, Theory and practice of community development, Community development issues. The diverse meaning of community development, The knowledge base of community development, International community development.

Different forms of Rural Entrepreneurship, Significance , Business planning for a new venture: the concept of planning paradigm, Forms of business enterprises-Sole proprietorship, partnership and corporations, Product and Process development, Marketing analysis and competitive analysis, strategies; Financial resources; debt financing, banks and financial institutions and other non-bank financial sources; Government programmes : direct loan assistance and subsidies; Industrial and legal issues for rural enterprises.

Unit-V

Role of Micro-Finance institutions in rural development, Use of ICT in Rural development, Watershed Management - Water-Cup Competition by Paani Foundation, Community Safe Water Solutions, Visit to a 'Woman Self help group' nearby and study of its functioning and its role in development. Visit to model villages in nearby region - Ralegan-Siddhi, Dist - Ahemadnagar, Hiware Bazar Dist - Ahemadnagar, Tikekarwadi - Dist. - Pune, Buchekarwadi Dist- Pune etc.

Text Books:

1. “Rural Development: Principles, Policies and Management” - Katar Singh , Sage Publications.

2. “Introduction to Community Development - Theory, Practice and Service Learning”, Edited by J W Robinson, Sage Publications.

3. G. N. Tiwari, Solar Energy: Fundamentals, Design, Modeling and Applications, Narosa, 2002.

4. “Fundamentals of Entrepreneurship”, H. Nandan, Third Edition, PHL Learning Pvt. Ltd.,

5. “Monetary Economics-Institutions, Theory and Policy”, First Edition, S B Gupta, S Chand Publications, ISBN – 9788121904346.

BTCSEAI OE41: Green Computing

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI OE41	Green Computing	PC	25	75	100	3-0-0	3

Course Objectives: Upon completion of the course, students should be able to:

1. Give an account of the concept green IT, - give an account of environmental perspectives on IT use,
2. Give an account of standards and certifications related to sustainable IT products,
3. Describe green IT in relation to technology,
4. Relate green IT to sustainable development,
5. Evaluate IT use in relation to environmental perspectives,
6. Discuss how the choice of hardware and software can facilitate a more sustainable operation,
7. Use methods and tools to measure energy consumption

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

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

- 3-High Level, 2-Medium Level, 1-Low Level

Unit-I

Green IT Fundamentals: Business, IT, and the Environment –Green computing: carbon foot print, scoop on power –Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

Unit-II

Green Assets: Buildings, Data Centers, Networks, and Devices - Green Business Process Management: Modeling, Optimization, and Collaboration –Green Enterprise Architecture – Environmental Intelligence Green Supply Chains –Green Information Systems: Design and Development Models.

Unit-III

Virtualizing of IT systems –Role of electric utilities, Telecommuting, teleconferencing and teleporting –Materials recycling –Best ways for Green PC –Green Data center –Green Grid framework.

Unit-IV

Socio-cultural aspects of Green IT –Green Enterprise Transformation Roadmap –Green Compliance: Protocols, Standards, and Audits –Emergent Carbon Issues: Technologies and Future.

Unit-V

The Environmentally Responsible Business Strategies (ERBS) –Case Study Scenarios for Trial Runs – calculating the carbon footprint – greening mobile devices - CASE STUDIES –Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

Course Outcomes:

1. To understand the concepts of technologies that conform to low-power computation.

2. To understand green (power-efficient) technologies for components of one single computer, such as CPU, memory and disk, and appreciate cutting edge designs for these components.

3. To have a basic understanding of a variety of technologies applied in building a green system and to identify the various key sustainability and green IT trends.

4. To discuss the various laws, standards and protocols for regulating green IT.

5. Be able to use a range of tools to help monitor and design green systems.

Text Books

1. Bhuvan Unhelkar, Green IT Strategies andApplications-Using Environmental Intelligence, CRC Press, June 2011

2. Woody Leonhard, Katherrine Murray, Green Home computing for dummies, August 2009.

Reference Books:

1. Alin Gales, Michael Schaefer, Mike Ebbers, Green Data Center: steps for the Journey, Shoff/IBM rebook, 2011.

2. John Lamb, The Greening of IT, Pearson Education, 2009.

3. Jason Harris, Green Computing and Green IT-Best Practices on regulations & industry, Lulu.com, 2008.

4. Carl Speshocky, Empowering Green Initiatives with IT, John Wiley & Sons, 2010.

5. Wu Chun Feng (editor), Green computing: Large Scale energy efficiency, CRC Press, 2012

BTCSEAI OE42: Customer Relationship Management

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI OE42	Customer Relationship Management	PC	25	75	100	3-0-0	3

COURSE OUTCOMES: After completion of this course, the student will be able to

1. Apply the concept of CRM, the benefits delivered by CRM, the contexts in which it is used, the technologies that are deployed and how it can be implemented.

2. Implement how CRM practices and technologies enhance the achievement of marketing, sales and service objectives throughout the customer life-cycle stages of customer acquisition, retention and development whilst simultaneously supporting broader organizational goals.

3. Implement various technological tools for data mining and also successful implementation of CRM in the Organizations

4. design customer relationship management strategies by understanding customers' preferences for the long-term sustainability of the Organizations.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

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

- 3-High Level, 2-Medium Level, 1-Low Level

Unit-I:

CRM Concepts: Acquiring Customers, Customer Loyalty, and Optimizing Customer Relationships. CRM Defined: Success Factors, the Three Levels of Service/ Sales Profiling, Service Level Agreements (SLAs), Creating and Managing Effective SLAs.

Unit-II:

CRM in Marketing: One-to-one Relationship Marketing, Cross Selling & Up Selling, Customer Retention, Behavior Prediction, Customer Profitability & Value Modeling, Channel Optimization, Event-Based marketing. CRM and Customer Service: The Call Centre, Call Scripting, Customer Satisfaction Measurement.

Unit-III:

Sales Force Automation: Sales Process, Activity, Contact, Lead and Knowledge Management. Field Force Automation. CRM Links in E-Business: E-Commerce and Customer Relationships on the Internet, Enterprise Resource Planning (ERP), Supply Chain Management (SCM), Supplier Relationship Management (SRM), Partner Relationship Management (PRM).

Unit-IV:

Analytical CRM: Managing and Sharing Customer Data - Customer Information Databases, Ethics and Legalities of Data Use. Data Warehousing and Data Mining Concepts. Data Analysis: Market Basket Analysis (MBA), Click Stream Analysis, Personalization and Collaborative Filtering.

Unit-V:

CRM Implementation: Defining Success Factors, Preparing a Business Plan - Requirements, Justification, Processes. Choosing CRM Tools: Defining Functionalities, Homegrown Versus Outsourced Approaches. Managing Customer Relationships: Conflict, Complacency, Resetting the CRM Strategy. Selling CRM, Internally: CRM Development Team, Scoping and Prioritizing, Development and Delivery, Measurement.

Suggested Books:

1. Stanley A. Brown, Customer relationship Management, John Wiley & Sons, Canada, Ltd.

2. Jagdish Seth, et al: Customer Relationship Management

3. Kristin L. Anderson & Carol J Kerr: Customer Relationship Management

4. H. Schmitt, Customer Experience Management: A revolutionary approach to connecting with your customers.

5. Ken Bernett, 2005, The Hand Book of Key Customer Relationship Management, Pearson Education

Learning Outcomes: By the end of the course, you should be able to:

1. Analyse relationship theory and relationship economics from the point of view of the customer and the organisation.
2. Critically analyse an organisation's relational strategies with stakeholder groups that affect how well it meets customer needs.
3. Evaluate CRM implementation strategies.
4. Formulate and assess strategic, operational and tactical CRM decisions.
5. Plan and conduct an investigation on an aspect of CRM, and communicate findings in an appropriate format

RECOMMENDED TEXT BOOK

Jagdish N Sheth, Parvatiyar Atul, G Shainesh, Customer Relationship Management: Emerging Concepts, Tools and Applications, 1st Edition, Tata McGraw Hill, June 2008
REFERENCE BOOKS

1. Judith W .Kincaid , Customer Relationship Management Getting it Right, Pearson Education

2. H. Peeru Mohamed , A Sagadevan, Custmer Relationship Management, A Step by Step Approach, Vikas Publishing House

3. Customer Centricity –Focus on right customer for strategic advantage, by Peter Fader, Wharton Digital Press, 2012

BTCSEAI OE43: Infrastructure systems planning

Paper Code	Title of the Paper	Course type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
BTCSEAI OE43	Infrastructure Systems planning	PC	25	75	100	3-0-0	3

OBJECTIVES:

To understand and explain concepts of infrastructure, private involvement in infrastructure, challenges to successful infrastructure planning and implementation, strategies for successful infrastructure project implementation, sustainable development of infrastructure.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

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

- 3-High Level, 2-Medium Level, 1-Low Level

Unit-I

AN OVERVIEW OF BASIC CONCEPTS RELATED TO INFRASTRUCTURE: Introduction to Infrastructure, an overview of the Power Sector in India., An Overview of the Water Supply and Sanitation Sector in India., an overview of the Road, Rail, Air and Port Transportation Sectors in India. , an overview of the Telecommunications Sector in India., an overview of the Urban Infrastructure in India, an over view of the Rural Infrastructure in India, an Introduction to Special Economic Zones, Organizations and layers in the field of Infrastructure, The Stages of an Infrastructure Project Lifecycle., an overview of Infrastructure Project Finance.

Unit-II

PRIVATE INVOLVEMENT IN INFRASTRUCTURE: A Historical Overview of Infrastructure Privatization. The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization, Challenges in Privatization of Water Supply: A Case Study, Challenges in Privatization of Power: Case Study, Privatization of Infrastructure in India: Case Study, Privatization of Road Transportation Infrastructure in India.

Unit-III

CHALLENGES TO SUCCESSFUL IMPLEMENTATION: INFRASTRUCTURE PLANNING AND Mapping and Facing the Landscape of Risks in Infrastructure Projects, Economic and Demand Risks: The Case study for Political Risks, Socio d Maintenance of Infrastructure. Environmental Risks, Cultural Risks in International Infrastructure Projects, Legal and Contractual Issues in Infrastructure, Challenges in Construction and Maintenance of Infrastructure.

Unit-IV

STRATEGIES FOR SUCCESSFUL INFRASTRUCTURE PROJECT IMPLEMENTATION: Risk Management Framework for Infrastructure Projects, Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Introduction to Fair Process and Negotiation, Negotiating with multiple Stakeholders on Infrastructure Projects.

Unit-V

SUSTAINABLE DEVELOPMENT OF INFRASTRUCTURE: Information Technology and Systems for Successful Infrastructure Management, and Maintenance of Infrastructure Facilities, Infrastructure Innovative Design Modeling and Life Cycle Analysis Techniques, Capacity Building and Improving the Governments Role in Infrastructure Implementation, An Integrated Framework for Successful Infrastructure Planning and Management Infrastructure Management Systems and Future Directions.

Course Outcomes:

1. Explain the basic concepts related to Infrastructure Projects.
2. Explain the role of private sector in infrastructure growth.
3. Describe the strategies for successful Infrastructure Project implementation.

4. Develop Infrastructure modeling and Life Cycle Analysis Techniques.
5. Explain Sustainable development of Infrastructure.