Learning Outcomes based Curriculum Framework (LOCF)

for

Bachelor of Technology
(Computer Science)
B.Tech. (Computer science)
(Duration 4 Years)

(w.e.f. 2026-27)

Department of Computer Science and Information Technology

School of Technology

MAULANA AZAD NATIONAL URDU UNIVERSITY

1. Vision and Mission

1.1 Vision

To meet the requirements of the society by imparting knowledge, ethics and moral values with a holistic approach.

1.2 Mission

To impart quality education and to undertake research and extension with emphasis on application and innovation that cater to the emerging societal needs through all-round development of students of all sections enabling them to be globally competitive and socially responsible citizens embedded with ethical values.

1.3 Strategies for Attaining the Vision and Fulfilling the Mission

Following strategies will be used to ensure the accomplishment of the stated vision and mission:

1. To create an ambiance for healthy teaching-learning process and attract the motivated students to the Department of Computer Science and Information Technology
2. Ensure that the curriculum followed is comparable to the relevance of local, national, regional and global development
3. To motivate the potential faculty members/ educators who are constantly upgrading their pedagogical approaches to motivate students and to enhance learning among them
4. Provide opportunities to students for global exposure, industrial internships, project based and research-based learning

2. Program Educational Objectives (PEOs)

Program Educational Objectives (PEOs) are broad statements that describe the career and professional accomplishments that CS&IT Department is preparing its graduates to achieve during the graduation. Following four PEOs are defined as:

PEO 1. Graduates using their acquired knowledge, competence and skill sets will develop into globally competent and locally relevant professionals through training and experiential learning enhancing their professional competence throughout their professional career.

PEO 2. Graduates will pursue knowledge and innovation-based development process to find solutions to problems in real life situation that satisfy technical performance specification.

PEO 3. Graduates will play adaptive leadership role in industry, government, education and R&D sectors to boost productivity and contribute economic development.

PEO 4. Graduates will be active members ready to serve the society locally and internationally apart from cultural needs, social awareness and responsibility.

3. Program Outcomes (POs)

Program outcomes are the narrower statements that describe what students are expected to know and be able to do upon graduation. POs represent the knowledge, skills and attitudes the students should have at the end of a program. Following are the statements for POs for CSE program. At the time of completing their degree requirements, students will be able to:

PO_1: Apply the knowledge of Mathematics, Science, and Engineering fundamentals, and an engineering specialization to solution of complex engineering problems **(Engineering Knowledge)**.

PO_2: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences (**Problem analysis**).

PO_3: Design of solutions for complex engineering problems and design of system components or processes that meet the specified needs with appropriate considerations of public health and safety, and cultural, societal, and environmental considerations (**Design/development of solutions)**.

PO_4: Use research-based methods including design of experiments, analysis and interpretation of data and synthesis of information leading to logical conclusions **(Conduct investigations of complex problems**).

PO_5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling complex engineering activities with an understanding of limitations (**Modern tool usage**).

PO_6: Apply reasoning within the contextual knowledge to access societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice **(The engineer and society)**.

PO_7: Understand the impact of the professional engineering solutions in the societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable developments (**Environment and sustainability**).

PO_8: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice (**Ethics**).

PO_9: Function effectively as an individual independently and as a member or leader in diverse teams, and in multidisciplinary settings (**Individual and team work**).

PO_{10}: 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 oral presentations, and give and receive clear instructions (**Communication**).

PO_{11}: Demonstrate knowledge and understanding of engineering management principles and apply those to one's own work as a member and leader of a team to manage projects in multidisciplinary environments (**Project management and finance**).

PO_{12}: 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 (**Life-long Learning**).

4. Program Specific Outcomes (PSOs)

Program Specific Outcomes (PSOs) are the statements that define outcomes of a program which make students realize the fact that knowledge and techniques learnt in a specific course has direct implication for the betterment of society and its sustainability.

PSO 1: The ability to design and develop computing systems using the knowledge of Mathematics, Science and Engineering fundamentals.

PSO 2: Ability to test and analyze the quality of developed applications and to integrate them in order to evolve a larger computing system.

PSO 3: Apply appropriate techniques, resources, and modern engineering and IT tools to address societal, health, safety, legal, and cultural issues.

PSO 4: To analyze and assess various functional and technical security challenges as per local needs and global standards.

PSOs have to be attained by the students in due course of the four years program either as part of their Core, Basic Sciences, Engineering Sciences or as part of their various levels of projects, compulsory courses of Humanities & Social Sciences areas.

5. Mapping between PEOs, POs and PSOs

The following Table lists the relationships between the PEOs, POs. and PSOs. The attainment of POs can be viewed as a strategy for attaining the PEOs. Each PEO is supported by multiple POs to ensure strength in compliance. Also, the relationship between individual PO and PEOs can vary between **Reasonable (1)** and **Strong (3)**.

PEOs	POs												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
PEO1	2	2	1	2	3	2	2	2	2	2	1	2	2	1	2	2
PEO2	2	1	2	1	2	1	1	3	1	1	2	1	2	2	3	2
PEO3	1	2	2	3	3	2	2	1	2	3	1	2	1	3	1	1
PEO4	3	3	1	2	1	1	1	2	1	2	3	2	3	2	2	2

1 – Reasonable

2 – Significant

3 – Strong

6. Course Outcomes (COs)

Course Outcomes are narrower statements that describe what students are expected to know and be able to do at the end of the course. Course outcomes are defined for all courses as part of the syllabus for the course and are measured through performance on assignments, written and oral presentation reports related to individual and team projects and through the mid-term and semester end examinations. Detailed syllabi for each course associated with Course Objectives and Course Outcomes has been for specific outcomes associated with the course. Attaining the COs is at the heart of the educational activity. If COs of individual courses are successfully attained and the curriculum has been designed to achieve the Program Outcomes, then attainment of the POs is also ensured. An effective Assessment Plan has been devised to meet the objective, quantitative and independent measures to demonstrate that all POs and PEOs are being attained by the program.

7. Continuous Quality Improvement and Assessment Plan

The purpose of the Assessment Plan is to ensure attainment of all Program Outcomes (POs) and also the attainment of the Program Educational Objectives (PEOs) and to independently confirm that the POs and PEOs are being attained. Periodic monitoring of progress allows faculty members and the leadership to take corrective actions where the POs and PEOs are not meeting established targets. The process consists of assessing and evaluating the extent to which the student outcomes are being attained. The results of these assessments and evaluations are subsequently used as the primary inputs for making improvements to the program.

GENERAL COURSE STRUCTURE & THEME

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
2 Hours Practical (P) per week	1 Credit

B. Range of Credits: In the light of the fact that a typical Model Four-year Under Graduate degree program in Engineering has about 164 credits, the total number of credits proposed for the four-year B.Tech/B.E. in Computer Science and Engineering (Engineering & Technology) is kept as 164 as per AICTE Norms. For B.Tech Lateral Entry students, the total credit requirement for the completion of the program shall be 122 credits, Additionally, the students who will earn an additional **20 credits** through NPTEL, SWAYAM, or other approved online courses they shall be awarded **B.Tech (Honours) degree**.

C. Structure of UG Program in CSE: The structure of UG program in Computer Science and Engineering shall have essentially the following categories of courses with the breakup of credits as given:

S. No.	Category	Credit Breakup for CSE students
1.	Humanities and Social Sciences including Management courses	09
2.	Basic Science courses	17
3.	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	22
4.	Professional core courses	42
5.	Professional Elective courses relevant to chosen specialization/branch	12
6.	Open Electives from other technical and /or emerging subjects	6
7.	Project work, seminar and internship in industry or elsewhere	19
8.	Laboratory Courses	33
9.	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition]	(non-credit)
10.	Internship(s)	04
	Total	**164**

D. Course code and definition:

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
C	Credits
HSMC	Humanities and Social Sciences including Management courses
BSC	Basic Science Courses
ESC	Engineering Science Courses

PCC-CS	Professional Core Courses
PEC-CS	Professional Elective Courses
OEC-CS	Open Elective Courses
LC	Laboratory Course
MC	Mandatory Courses
INT	Internship
PRP	Project

- **Course level coding scheme:** Three-digit number (odd numbers are for the odd semester courses and even numbers are for even semester courses) used as suffix with the Course Code for identifying the level of the course. Digit at hundred's place signifies the semester in which course is offered. e.g.

  101, 102 … Etc. for first semester.
  201, 202 …. Etc. for second semester.
  301, 302 … Etc. for third semester.

- **Category-wise Courses**

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES [HSMC]

Sl. No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	HST-141	Universal Human Values-II: Understanding Harmony And Ethical Human Conduct	I	2	0	0	2
2.	HST-241	English Communication	II	2	0	0	2
3.	HST-441	Humanities – 1 (Technology & Soceity)	IV	1	0	0	1
4.	HST-541	Management-I (Organizational Behavior)/ Finance & Accounting	V	2	0	0	2
5.	HST-542	Humanities – II (History of Science and Technology)	V	2	0	0	2
Total Credits							**09**

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BASIC SCIENCE COURSES [BSC]

Sl. No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	BST-141	Linear Algebra and Calculus	I	3	1	0	4
2.	BST-142	Physics-I (Semi-conductor Physics)	I	3	0	0	3
3	BST-241	Probability and Statistics	II	3	1	0	4
4	BST-242	Chemistry-I	II	2	0	0	2
5	BST-341	Differential Calculus and Numerical Analysis	III	3	1	0	4
Total Credits							**17**

ENGINEERING SCIENCE COURSES [ESC]

Sl. No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	EST-141	Basic Electrical Engineering	I	3	0	0	3
2.	EST-142	Engineering Graphics & Design	I	1	1	4	4
3.	EST-241	Programming for Problem Solving	II	3	0	0	3
4.	EST-242	Engineering Mechanics	II	3	0	0	3
5.	EST-341	Analog Electronic Circuits	III	3	0	0	3
6.	EST-342	Digital Electronics	III	3	0	0	3
7.	EST-641	Software Engineering	VI	3	0	0	3
Total Credits							**22**

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PROFESSIONAL CORE COURSES [PCC]

S No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	PCT-341	Data Structure and Algorithms	III	3	0	0	3
2.	PCT-441	Database Management Systems	IV	3	0	0	3
3.	PCT-443	Discrete Mathematics	IV	3	1	0	4
4.	PCT-444	Object Oriented Programming using Java	IV	2	1	0	3
5.	PCT-445	Quantitative Skill	IV	1	1	0	2
6.	PCT-442	Computer Organization and Architecture	IV	3	0	0	3
7.	PCT-541	Operating Systems	V	3	0	0	3
8.	PCT-542	Design and Analysis of Algorithms	V	3	0	0	3
9.	PCT-543	Theory of Computation	V	3	0	0	3
10.	PCT-641	Compiler Design	VI	3	0	0	3
11.	PCT-642	Computer Networks	VI	3	0	0	3
12.	PCT-742	Machine Learning	VII	3	0	0	3
13.	PCT-743	Introduction to cyber security(CNS)	VII	3	0	0	3
14.	PCT-741	Artificial Intelligence	VII	3	0	0	3
Total Credits							**42**

PROFESSIONAL ELECTIVE COURSES [PEC]

S.No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	BTCS54XPET	Elective-I	V	3	0	0	3
2.	BTCS64XPET	Elective-II	VI	3	0	0	3
3.	BTCS74XPET	Elective-III	VII	3	0	0	3
4.	BTCS84XPET	Elective-IV	VIII	3	0	0	3
Total Credits							**12**

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OPEN ELECTIVE COURSES [OEC]

S.No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	BTCS64XOET	Open Elective – I	VI	3	0	0	3
2.	BTCS84XOET	Open-Elective-II	VIII	3	0	0	3
Total Credits							**6**

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MANDATORY COURSES (MC)

NON-CREDIT THEORY (NCT)

S.No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	BTCS341NCT	Environmental Sciences	III	2	0	0	-
2.	BTCS441NCT	Essence of Indian Knowledge Tradition	IV	2	0	0	-
3.	BTCS541NCT	Constitution of India	V	2	0	0	-
Total Credits							-

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PROJECT WORK AND SEMINAR

S.No	Course Code	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	BTCS641PRP	Project-I	VI	0	0	6	3
2.	BTCS741PRP	Project-II	VII	0	0	12	6
3.	BTCS841PRP	Project-III	VIII	0	0	20	10
Total Credits							**19**

LABORATORY COURSES (LC)

S.No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1.	HSP-241	English Communication Lab	II	0	0	2	1
2.	BSP-142	Physics-I Lab	I	0	0	4	2
3.	BSP-242	Chemistry-I Lab	II	0	0	4	2
4.	ESP-141	Basic Electrical Engineering Lab	I	0	0	4	2
5.	ESP-241	Programming for Problem Solving Lab	II	0	0	4	2
6.	ESP-242	Workshop/Manufacturing Practices	II	0	0	6	3
7.	ESP-342	Digital Electronics Lab	III	0	0	4	2
8.	PCP-341	Data Structure and Algorithm Lab	III	0	0	4	2
9.	PCP-342	Python Lab	III	1	0	4	3
10.	PCP-441	Database Management System Lab	IV	0	0	4	2
11.	PCP-541	Operating Systems Lab	V	0	0	4	2
12.	PCP-440	Java Programming Lab	IV	0	0	4	2
13.	PCP-542	Design and Analysis of Algorithms Lab	V	0	0	4	2
14.	PCP-641	Compiler Design Lab	VI	0	0	4	2
15.	PCP-642	Computer Networks Lab	VI	0	0	4	2
16.	PCP-742	Machine Learning Lab	VII	0	0	4	2
Total Credits							**33**

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INTERNSHIP (INT)

S.No	Course Code	Course Title	Semester	Hours per week			Total Credits
				Lecture	**Tutorial**	**Practical**	
1.	BTCS541INT	Internship-I	V				2
2.	BTCS741INT	Internship-II	VII				2
Total Credits							**4**

INDUCTION PROGRAM

The Essence and Details of Induction program can also be understood from the 'Detailed Guide on Student Induction program', as available on AICTE Portal Link For more, Refer **Appendix II.**

Induction program (mandatory)	Three-week duration
Induction program for students to be offered right at the start of the first year.	• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations

E. Mandatory Visits/ Workshop/Expert Lectures:

a. It is mandatory to arrange one industrial visit every semester for the students of each branch.

b. It is mandatory to conduct a One-week workshop during the winter break after fifth semester on professional/ industry/ entrepreneurial orientation.

c. It is mandatory to organize at least one expert lecture per semester for each branch by inviting resource persons from domain specific industry.

F. Evaluation Scheme (Suggestive only):

a. For Theory Courses:

(The weightage of Internal assessment is 30% and for End Semester Exam is 70%) The student has to obtain at least 40% marks individually both in internal assessment and end semester exams to pass.

b. For Practical Courses:

(The weightage of Internal assessment is 50% and for End Semester Exam is 40%) The student has to obtain at least 50% marks individually both in internal assessment and end semester exams to pass.

c. For Summer Internship / Projects / Seminar etc.

Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

Note: The internal assessment is based on the student's performance in mid semester tests (two best out of three), quizzes, assignments, class performance, attendance, viva-voce in practical, lab record etc.

G. Mapping of Marks to Grades

Each course (Theory/Practical) is to be considered as 100% of marks, irrespective of the number of credits, and the mapping of marks to grades may be done as per the following table:

Range of % of Marks	**Assigned Grade**
91-100	AA/A^+
81-90	AB/A
71-80	BB/B^+
61-70	BC/B
51-60	CC/C^+
46-50	CD/C
40-45	DD/D
< 40	FF/F (Fail due to less marks)
-	F^R (Fail due to shortage of attendance and therefore, to repeat the course)

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II. SEMESTER WISE STRUCTURE OF CURRICULM
[L=Lecture, T=Tutorials, P=Practical, C=Credits]

PROGRAM		**YEAR**				**SEMESTER**			
B.Tech. (CS)		I				I			
Course Code	**Description**	**Course Title**	**Hours/Week**			Credits	**Score**		**End Exam Duration**
			L	T	P		Internal	External	
BTCS141BST	Basic Science	Linear Algebra and Calculus	3	1	0	4	30	70	3 Hrs
BTCS142BST	Basic Science	Engineering Physics	3	0	0	3	30	70	3 Hrs
BTCS141EST	Engineering Science	Basic Electrical Engineering	3	0	0	3	30	70	3 Hrs
BTCS142EST	Engineering Science	Engineering Graphics & Design	1	1	4	4	30	70	3 Hrs
BTCS142BSP	Basic Science	Engineering Physics Lab	0	0	4	2	50	50	3 Hrs
BTCS141ESP	Engineering Science	Basic Electrical Engineering Lab	0	0	4	2	50	50	3 Hrs
BTCS141HST	HSMC	Universal Human Value	2	0	0	2	15	35	2 Hrs
		Total				**20**	**650**		
Mandatory Induction Program- 3 Weeks Duration Note: End Semester Examinations of the subject(s) weighted more than 2 credits will be for three Hrs. duration with maximum 100 marks score (30+70)									
***HSMC** - Humanities & Social Sciences including Management									

PROGRAM		**YEAR**				**SEMESTER**			
B.Tech. (CS)		I				II			
Course Code	**Description**	**Course Title**	**Hours/Week**			Credits	**Score**		**End Exam Duration**
			L	T	P		Internal	External	
BTCS241BST	Basic Science	Probability and Statistics	3	1	0	4	30	70	3 Hrs
BTCS242BST	Basic Science	Engineering Chemistry	2	0	0	2	15	35	2 Hrs
BTCS241EST	Engineering Science	Programming for Problem Solving	3	0	0	3	30	70	3 Hrs
BTCS241HST	HSMC	English Communication	2	0	0	2	15	35	2 Hrs
BTCS242EST	Engineering Science	Engineering Mechanics	3	0	0	3	30	70	3 Hrs
BTCS242BSP	Basic Science	Engineering Chemistry Lab	0	0	4	2	50	50	3 Hrs
BTCS241ESP	Engineering Science	Programming for Problem Solving Lab	0	0	4	2	50	50	3 Hrs
BTCS242ESP	Engineering Science	Engineering Workshop	0	0	6	3	50	50	3 Hrs
BTCS241HSP	HSMC	English Communication Lab	0	0	2	1	50	50	2 Hrs
		Total				**22**	**800**		
***HSMC** - Humanities & Social Sciences including Management									

PROGRAM		YEAR				SEMESTER			
B.Tech. (CS)		II				III			
Course Code	Description	Course Title	Hours/Week			Credits	Score		End Exam Duration
			L	T	P		Internal	External	
BTCS341EST	Engineering Science Course	Analog Electronic Circuits	3	0	0	3	30	70	3 Hrs
BTCS341PCT	Professional Core Courses	Data structure & Algorithms	3	0	0	3	30	70	3 Hrs
BTCS342EST	Engineering Science Course	Digital Electronics	3	0	0	3	30	70	3 Hrs
BTCS341BST	Basic Science course	Differential Calculus and Numerical Analysis	3	1	0	4	30	70	3 Hrs
BTCS341PCP	Professional Core Courses	Data structure & Algorithms LAB	0	0	4	2	50	50	3 Hrs
BTCS342ESP	Engineering Science Course	Digital Electronics LAB	0	0	4	2	50	50	3 Hrs
BTCS342PCP	Professional Core Courses	Python Lab	1	0	4	3	50	50	3 Hrs
BTCS341NCT	Mandatory Courses	Environmental Sciences	2	0	0	-	15	35	2 Hrs
		Total				**20**	**750**		

PROGRAM		YEAR				SEMESTER			
B.Tech. (CS)		II				IV			
Course Code	Description	Course Title	Hours/Week			Credits	Score		End Exam Duration
			L	T	P		Internal	External	
BTCS441PCT	Professional Core Courses	Database Management Systems	3	0	0	3	30	70	3 Hrs
BTCS442PCT	Professional Core Courses	Computer Organization and Architecture	3	0	0	3	30	70	3 Hrs
BTCS443PCT	Professional Core Courses	Discrete Mathematics	3	1	0	4	30	70	3 Hrs
BTCS444PCT	Professional Core Courses	Object Oriented Programing Using Java	2	1	0	3	30	70	3 Hrs
BTCS440PCT	Professional Core Courses	Java Programming LAB	0	0	4	2	50	50	3 Hrs
BTCS441PCP	Professional Core Courses	Database Management Systems LAB	0	0	4	2	50	50	3 Hrs
BTCS441HST	HSMC	Technology & Society	1	0	0	1	15	35	2 Hrs
BTCS445PCT	Professional Core Courses	Quantitative Skill	1	1	0	2	15	35	2 Hrs
BTCS441NCT	Mandatory Courses	Essence of Indian Knowledge Tradition	2	0	0	-	15	35	2 Hrs
*** Every Student has to complete Mandatory 6-8 Week Internship during the summer vacations which shall be assess in the beginning of Next Semester/V Semester.**									
		Total				**20**	**750**		

PROGRAM		YEAR				SEMESTER			
B.Tech. (CS)		III				V			
Course Code	Description	Course Title	Hours/Week			Credits	Score		End Exam Duration
			L	T	P		Internal	External	
BTCS541PCT	Professional Core Courses	Operating Systems	3	0	0	3	30	70	3 Hrs
BTCS542PCT	Professional Core Courses	Design & Analysis of Algorithms	3	0	0	3	30	70	3 Hrs
BTCS541HST	HSMC	Organizational Behavior	2	0	0	2	15	35	2 Hrs
BTCS542HST	HSMC	History of Sciences & Technology in India	2	0	0	2	15	35	2 Hrs
BTCS543PCT	Professional Core Courses	Theory of Computation	3	0	0	3	30	70	3 Hrs
BTCS54XPET	Professional Elective Courses	Elective-I	3	0	0	3	30	70	3 Hrs
BTCS542PCP	Professional Core Courses	Design & Analysis of Algorithms LAB	0	0	4	2	50	50	3 Hrs
BTCS541PCP	Professional Core Courses	Operating Systems LAB	0	0	4	2	50	50	3 Hrs
BTCS541NCT	Mandatory Courses	Constitution of India	2	0	0	-	15	35	2 Hrs
BTCS541INT	Internship	Internship-I	-	-	-	2	50	50	-
Total						**22**	**850**		

PROGRAM		YEAR				SEMESTER			
B.Tech. (CS)		III				VI			
Course Code	Description	Course Title	Hours/Week			Credits	Score		End Exam Duration
			L	T	P		Internal	External	
BTCS641PCT	Professional Core Courses	Compiler Design	3	0	0	3	30	70	3 Hrs
BTCS642PCT	Professional Core Courses	Computer Networks	3	0	0	3	30	70	3 Hrs
BTCS641EST	Engineering Science	Software Engineering	3	0	0	3	30	70	3 Hrs
BTCS64XPET	Professional Elective Courses	Elective-II	3	0	0	3	30	70	3 Hrs
BTCS64XOET	Open Elective Courses	Open Elective-I	3	0	0	3	30	70	3 Hrs
BTCS641PCP	Professional Core Courses	Compiler Design LAB	0	0	4	2	50	50	3 Hrs
BTCS642PCP	Professional Core Courses	Computer Networks LAB	0	0	4	2	50	50	3 Hrs
BTCS641PRP	Project	Project-1	0	0	6	3	50	50	Viva-voce
*** Every Student has to complete Mandatory 6-8 Week Internship during the summer vacations which shall be assess in the beginning of Next Semester/VII Semester.**									
Total						**22**	**800**		

PROGRAM		YEAR				SEMESTER			
B.Tech. (CS)		IV				VII			
Course Code	Description	Course Title	Hours/Week			Credits	Score		End Exam Duration
			L	T	P		Internal	External	
BTCS741PCT	Professional core course	Artificial Intelligence	3	0	0	3	30	70	3 Hrs
BTCS742PCT	Professional core course	Machine Leaning	3	0	0	3	30	70	3 Hrs
BTCS743PCT	Professional core course	Introduction to cyber security(CNS)	3	0	0	3	30	70	3 Hrs
BTCS74XPET	Professional Elective Courses	Elective- III	3	0	0	3	30	70	3 Hrs
BTCS742PCP	Professional core course	Machine Leaning Lab	0	0	4	2	50	50	3 Hrs
BTCS741PRP	Project	Project-II	0	0	12	6	100	100	Viva-voce & Demonstration
BTCS741INT	Internship	Internship-II	-	-	-	2	50	50	-
Total						**22**	**800**		

PROGRAM		YEAR				SEMESTER			
B.Tech. (CS)		IV				VIII			
Course Code	Description	Course Title	Hours/Week			Credits	Score		End Exam Duration
			L	T	P		Internal	External	
BTCS84XPET	Professional Elective Courses	Elective-IV	3	0	0	3	30	70	3 Hrs
BTCS84XOET	Open Elective Courses	Open Elective- II	3	0	0	3	30	70	3 Hrs
BTCS841PRP	Project	Project-III	0	0	20	10	100	100	Viva-voce & Demonstration
Total						**16**	**400**		

PROFESSIONAL COURSES –ELECTIVE-I								
Course Code	**Course Title**	**Hours/Week**			Credits	**Score**		**End Exam Duration**
		L	T	P		Internal	External	
BTCS540PET	Computer Graphics	3	0	0	3	30	70	3 Hrs
BTCS541PET	Data Mining and Data Warehousing	3	0	0	3	30	70	3 Hrs
BTCS542PET	Signal and Systems	3	0	0	3	30	70	3 Hrs
BTCS543PET	Behavioral Economics	3	0	0	3	30	70	3 Hrs
BTCS544PET	Ad-Hoc and Sensor Network	3	0	0	3	30	70	3 Hrs

PROFESSIONAL COURSES – ELECTIVE-II								
Course Code	**Course Title**	**Hours/Week**			Credits	**Score**		**End Exam Duration**
		L	T	P		Internal	External	
BTCS642PET	Advance Python Programming	3	0	0	3	30	70	3 Hrs
BTCS644PET	Distributed Systems	3	0	0	3	30	70	3 Hrs
BTCS640PET	Data Science	3	0	0	3	30	70	3 Hrs
BTCS641PET	Big Data Analytics	3	0	0	3	30	70	3 Hrs
BTCS642PET	Image Processing	3	0	0	3	30	70	3 Hrs

PROFESSIONAL COURSES – ELECTIVE-III								
Course Code	**Course Title**	**Hours/Week**			Credits	**Score**		**End Exam Duration**
		L	T	P		Internal	External	
BTCS741PET	Soft Computing	3	0	0	3	30	70	3 Hrs
BTCS742PET	Wireless Sensor Network	3	0	0	3	30	70	3 Hrs
BTCS743PET	Internet of Things	3	0	0	3	30	70	3 Hrs

PROFESSIONAL COURSES – ELECTIVE- IV								
Course Code	**Course Title**	**Hours/Week**			Credits	**Score**		**End Exam Duration**
		L	T	P		Internal	External	
BTCS840PET	Deep Learning	3	0	0	3	30	70	3 Hrs
BTCS841PET	Cloud computing	3	0	0	3	30	70	3 Hrs
BTCS842PET	Blockchain Technology	3	0	0	3	30	70	3 Hrs
BTCS843PET	Human Computer Interaction	3	0	0	3	30	70	3 Hrs
BTCS844PET	Natural Language Processing	3	0	0	3	30	70	3 Hrs

OPEN ELECTIVE-I:

A Student need to opt any one subject from the following open electives to be offered by the other Departments

Course Code	Course Title	Hours/Week			Credits	Score		End Exam Duration
		L	T	P		Internal	External	
BTCS641OET	Soft Skill and Interpersonal Communication	3	0	0	3	30	70	3 Hrs
BTCS642OET	Human Resource Development and Organizational Behavior	3	0	0	3	30	70	3 Hrs
BTCS643OET	Cyber Law and Cyber Security	3	0	0	3	30	70	3 Hrs
BTCS644OET	Comparative Study of Modern Indian Languages	3	0	0	3	30	70	3 Hrs
BTCS645OET	Biology (Basic Science Course)	3	0	0	3	30	70	3 Hrs
BTCS646OET	Managerial Economics and Financial Analysis	3	0	0	3	30	70	3 Hrs

OPEN ELECTIVE-II:

A Student need to opt any one subject from the following open electives to be offered by the other Departments

Course Code	Course Title	Hours/Week			Credits	Score		End Exam Duration
		L	T	P		Internal	External	
BTCS841OET	Intellectual Property Rights	3	0	0	3	30	70	3 Hrs
BTCS842OET	Computational Finance	3	0	0	3	30	70	3 Hrs
BTCS843OET	Values & Ethics	3	0	0	3	30	70	3 Hrs
BTCS844OET	Economic Policies in India	3	0	0	3	30	70	3 Hrs

Course Code	Course Title	Lecture			Semester: I
BTCS141BST	Linear Algebra and Calculus	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	1	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic knowledge of Mathematics

Course Objectives:

1. To understand the concept of the matrix and applying to various engineering problems.
2. To provide the concept of Eigen values and Eigen vectors.
3. To acquire the concept of mean value theorems and successive differentiation.
4. To impart the concept of partial derivatives of first and higher orders in the field of engineering and Technology.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Apply differential and integral calculus to notions of curvature to improper integrals and various engineering problems.	PO_1, PO_2
CO_2	Find the rank of matrices and linear algebra including linear transformations, eigenvalues, diagonalization and orthogonalization.	PO_3, PO_5
CO_3	Evaluate the partial derivatives of first and higher orders.	PO_4
CO_4	Demonstrate various applications with basic understanding of Beta and Gamma functions.	PO_3, PO_{12}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	3										
CO_2			2		2							
CO_3				2								
CO_4			2									2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Matrices and Linear Systems:** Matrices, vectors addition and scalar multiplication, matrix multiplication, Linear systems of equations, linear Independence, rank of a matrix, determinants ,Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan, Cayley-Hamilton's theorem (without proof)and its applications.
Unit: 2	**Vector spaces and Transformation:** Vector Space, linear dependence of vectors, basis, dimension, Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank-nullity theorem, composition of linear maps, Matrix associated with a linear map.
Unit: 3	**Eigenvalues and Inner Product Spaces:** Eigenvalues, eigenvectors, symmetric, skew-symmetric and orthogonal Matrices, eigen bases, Diagonalization, Inner product spaces, Gram-Schmidt Orthogonalization.
Unit: 4	**Calculus-I (Foundations of Differential Calculus):** Rolle's mean value theorem, Lagrange's mean value theorem and Cauchy's mean value theorem (All Theorems without proof), Successive differentiation(standard results), Leibnitz's theorem, Expansions of functions, Taylor's and Maclaurin's series with remainders (All Theorems without proof), Maxima and minima for function of one variable.
Unit: 5	**Calculus – II (Multivariable Functions and Integral Applications):** Partial Differentiation**,** Partial derivatives of first and higher orders, Homogeneous Functions, Euler's Theorem; Total derivative, Change of variables. 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, Double integrals and their evaluation, Change of order for integration, Double integrals in polar coordinates, Triple integrals and Application of multiple integrals to find area, volume, surface area.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1 G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

2	Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3	D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
4	Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
5	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.
Reference Books:	
1	H. Anton, C. Rorres, Elementary Linear Algebra with Supplemental Applications, 11th Edition, Wiley Student Edition, New Delhi (2011)
2	N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
3	M. D. Weir, J. Hass, Thomas' Calculus,12th Edition, Pearson India Education Services Pvt Ltd., New Delhi (2016).
4	V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.

Course Code	Course Title	Lecture			Semester: I
BTCS142BST	Engineering Physics	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic knowledge of Physics

Course Objectives:

1. To acquire competency in the field of engineering with adaptability to new development in science and technology.
2. To demonstrate various scientific principles, engineering methods and technological development.
3. To learning basic properties and characteristics of light, double slit and triple slit interference, Newton's rings, interference in thin films.
4. To understand the concept of elementary particles and conservation laws.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the Bragg's Law and the principles of lasers, types of lasers and applications.	PO_1
CO_2	Apply various terms related to properties of materials such as, permeability, polarization, etc.	PO_1, PO_2
CO_3	Analyze some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.	PO_2, PO_3, PO_4
CO_4	Analyze and evaluate and simple quantum mechanics calculations.	PO_2, PO_3

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3											
CO_2	2	1										
CO_3		1	2	2								
CO_4		2	2									

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Diffraction: Introduction to interference and example; concept of diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits; diffraction grating, characteristics of diffraction grating and its applications. Polarisation: Introduction, polarisation by reflection, polarisation by double refraction, scattering of light, circular and elliptical polarisation, optical activity.
Unit: 2	Fibre Optics: Introduction, optical fibre as a dielectric wave guide: total internal reflection, numerical aperture and various fibre parameters, losses associated with optical fibres, step and graded index fibres, application of optical fibres. Lasers: Introduction to interaction of radiation with matter, principles and working of laser: population inversion, pumping, various modes, threshold population inversion, types of laser: solid state, semiconductor, gas; application of lasers.
Unit: 3	Electromagnetism : Laws of electrostatics, electric current and the continuity equation, laws of magnetism. Ampere's Faraday's laws. Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielectrics, internal fields in a solid, Clausius-Mossotti equation, applications of dielectrics.
Unit: 4	Magnetic Properties of Materials :Magnetisation, permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications. Introduction to quantum physics, black body radiation, explanation using the photon concept, photoelectric effect, Compton effect.
Unit: 5	Quantum Mechanics: de Broglie hypothesis, wave-particle duality, Born's interpretation of the wave function, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Beiser : Modern Physics

2	Mani and Damask : Modern Physics
Reference Books:	
1	Resnick and Halliday : Physics
2	M. Ratner & D. Ratner (Pearson Ed.): Nanotechnology
3	A.J. Decker (Macmillan): Solid State Physics

Course Code	Course Title	Lecture			Semester: I
BTCS141EST	Basic Electrical Engineering	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic knowledge of Mathematics and Physics

Course Objectives:

1. To introduce fundamental concepts and analysis techniques in electrical engineering.
2. To provide knowledge about the basic DC and AC electric circuits and magnetic circuits.
3. To impart the concepts of generators, motors, transformers and their applications.
4. To gain knowledge about the fundamentals of wiring and earthling.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understanding of the basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global.	PO_1, PO_2, PO_3
CO_2	Illustrate an understanding of basic concepts of analysis of simple DC and AC circuits used in electrical and electronic devices	PO_2, PO_3, PO_6
CO_3	Demonstrate an understanding of selection skill to identify the type of motors required for particular application.	PO_2, PO_3
CO_4	Analyze and evaluate the effects of electric shock and precautionary measures.	PO_1, PO_4, PO_7

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	2	1									
CO_2		2	2			1						
CO_3		2	2									
CO_4	3			1			2					

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**DC Circuits:** Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.
Unit: 2	**AC Circuits:** Representation of sinusoidal waveforms, peak and rms values, phasor , 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). Three-phase balanced circuits, voltage and current relations in star and delta connections.
Unit: 3	**Transformers:** Magnetic materials, ideal and practical transformer, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.
Unit: 4	**Electrical Machines:** Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, . Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, and speed control of separately excited dc motor. Construction and working of synchronous generators.
Unit: 5	**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.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2	D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.

Reference Books:

1	L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
2	E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
3	V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

Course Code	Course Title	Lecture			Semester: I
BTCS142EST	Engineering Graphics & Design	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	1	1	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	6	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Theory & Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic knowledge of Mathematics and Physics

Course Objectives:

1. To understand the concept of imagination skills.
2. To acquire the knowledge of developing basic graphic skills.
3. To develop skills in reading and interpretation of engineering Drawings.
4. To impart the knowledge of principles of Isometric Projection, Isometric scale, Isometric Views-Conventions Plane Figures, Simple and Compound Solids.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Get acquainted with the knowledge of various lines, geometrical constructions and construction of various kinds of scales, and Ellipse.	PO_1, PO_3, PO_9
CO_2	Improve their imagination skills by gaining knowledge about points, lines and planes.	PO_2, PO_3, PO_5, PO_9
CO_3	Become proficient in drawing the projections of various solids	PO_2, PO_5, PO_6, PO_9
CO_4	Gain knowledge about orthographic and isometric projections.	PO_2, PO_4, PO_5, PO_9

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2		2						1			
CO_2		1	1		2				1			
CO_3		2			2	3			1			
CO_4		2		1	2				1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**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	**Projections of Points and Straight Line**: Point placed in different quadrants. Projections of straight lines - Parallel, perpendicular, inclined to one plan and inclined to planes. True lengths and true angle of a line. Traces of a line. **Projections of Planes:** Projections of regular planes parallel, perpendicular and inclined to one reference plane. Plane inclined to both the reference plane.
Unit: 3	**Projections of Solids**: Projections of regular solids, cube, prism, pyramids, cylinder and cone, axis inclined to one and both the references plane
Unit: 4	**Sections and Sectional Views:** True shape of section, Right Regular Solids- Prism, Cylinder, Pyramid, Cone.
Unit: 5	**Isometric Projections**: Principles of Isometric Projection, Isometric scale, Isometric views-Conventions Plane Figures, Simple and Compound Solids. **Customisation & 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.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House.
2	Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.

Reference Books:

1	Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
2	Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

3	(Corresponding set of) CAD Software Theory and User Manuals

Course Code	Course Title	Lecture			Semester: I
BTCS142BSP	Engineering Physics Lab.	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Engineering Physics

Course Objectives:

1. To acquire competency in the field of engineering.
2. To demonstrate to new development in physics laboratory by successfully completing the experiments.
3. To understand and learn basic theory and principles of science.
4. To experiment Thermo electric effect – Seebeck effect and Peltier effect.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Learn basic properties and characteristics of light, Double slit and triple slit interference, Newton's rings, interference in thin films.	PO_1, PO_6
CO_2	Apply the working principle of LASER, laser action, population inversion, Einstein coefficients, elementary laser types and applications of LASER.	PO_3, PO_5
CO_3	Analyze magnetic field and forces, electric field and usage of quantum theory.	PO_2, PO_4
CO_4	Evaluate Thermo electric effect – Seebeck effect and Peltier effect	PO_3, PO_9

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2					2						
CO_2			2		1							
CO_3		1		1								
CO_4			2						1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

1. Determine the radius of Curvature of Plano convex lens by forming Newton's rings.
2. Determine the Numerical aperture of the given optical fibre by using Laser diode.
3. Draw the current Voltage (V-I) Characteristics of the given P-N-Junction diode.
4. Determine the plank's constant using photocell (Frequency of Blue- 7.406x1014 Hz, Green- 6x1014, Orange 5.26x1014 , Red- 4.68x 1014).
5. Determine the Physical Characteristics of the given Thermistor.
6. Determine the specific rotation of liquid by using polarimeter.
7. Determine the Energy gap of given semiconductor.
8. Determine the wavelength of a given laser source using diffraction grating

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	Beiser : Modern Physics
2	Mani and Damask : Modern Physics

Reference Books:

1	Resnick and Halliday : Physics
2	C. Kittel (Wiley Eastern): Introduction to Solid Stat

Course Code	Course Title	Lecture			Semester: I
BTCS141ESP	Basic Electrical Engineering Lab	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic Electrical Engineering

Course Objectives:

1. To experiment the basics of Single and Three Phase transformers.
2. To acquire the concepts of D.C. Machines, construction, armature reaction and characteristics.
3. To understand the basic concept of a Three-phase induction motor and its torque slip characteristics.
4. To evaluate the efficiency of the different machines by analyzing their test results.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Explain the concept of circuit laws and network theorems and apply them to laboratory measurements.	PO_1, PO_2, PO_6
CO_2	Understand to systematically obtain the equations that characterize the performance of an electric circuit as well as solving both DC Machines and single-phase transformer.	PO_3, PO_6
CO_3	Analyze the principles of operation and the main features of electric machines and their applications	PO_9
CO_4	Evaluate the skills in using electrical measuring devices.	PO_4

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	1	1				1						
CO_2			1			1						
CO_3									1			
CO_4				1								

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

List of experiments/demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Verification of Thevenin's and Norton Theorems.
3. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
4. Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
5. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
6. To Determine the Performance Characteristics of a Series Motor.
7. To Determine the Performance Characteristics of a Shunt Motor.
8. To Determine the Performance Characteristics of a Compound Motor.
9. Speed Control of DC Shunt Motor.
10. To Determine the Load Characteristics of a Shunt Generator.
11. To Determine the Load Characteristics of a Single Phase Induction Motor.
12. To Determine the Performance Characteristics of a Three Phase Induction Motor.
13. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement).
14. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super-synchronous speed.
15. Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.

16. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear	
Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.	
Text Books:	
1	Basic Electrical Engineering, S.N. Singh, PHI, Learning Private Limited.
2	Electrical Machines M. N. Bandyopadhya, PHI, Learning Private Limited.
Reference Books:	
1	Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
2	Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
3	(Corresponding set of) CAD Software Theory and User Manuals

Course Code	Course Title	Lecture			Semester: I
BTCS141HST	Universal Human Values	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	2	End Semester	:	35
Instruction Mode	:	Theory & Practical	Exam Duration	:	2 Hrs.

Prerequisite(s): No Prerequisite

Course Objectives:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To understand the meaning of happiness and prosperity for a human being.
3. To learn to initiate a process of dialogue within themselves to know what they 'really want to be' in their life and profession.
4. To understand the harmony at all levels of human living and applying understanding of harmony in existence in their profession and lead an ethical life.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	To become more responsible in life and in handling problems with sustainable solutions while keeping human relationships and human nature in mind.	PO_7 , PO_{12}
CO_2	Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.	PO_8 , PO_{12}
CO_3	To become more aware of themselves and their surroundings(Family, Society, Nature).	PO_9 , PO_{12}
CO_4	Understand the significance of value inputs in a classroom and start applying them in their life and profession.	PO_{10} , PO_{12}

PO_1-Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1							1					2
CO_2								2				3
CO_3									3			1
CO_4										3		2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction to Value Education** Right Understanding, Relationship and Physical Facility(Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.
Unit: 2	**Harmony in the Human Being** Understanding Human Being as the Co-existence of the self and the body, Distinguishing between the needs of the Self ('I') and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Program to ensure Self-Regulation and Health.
Unit: 3	**Harmony in the Family and Society** Harmony in the Family– the Basic Unit of Human Interaction, 'Trust' –the Foundational Value in Relationship, 'Respect'–as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.
Unit: 4	**Harmony in the Nature/Existence:** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.
Unit: 5	**Implications of the Holistic Understanding – a Look at Professional Ethics** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in

	Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.
Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.	
Text Books:	
1	A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019.
2	The Teacher's Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G
Reference Books:	
1	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999
2	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

Course Code	Course Title	Lecture			Semester: II
BTCS241BST	Probability and Statistics	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	1	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic knowledge of Mathematics

Course Objectives:

1. To familiarize the students with statistical techniques.
2. To equip the students with standard concepts and tools.
3. To impart the concept of Measures of Central tendency.
4. To acquire the knowledge of Chi-square test for goodness of fit and independence of attributes.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the ideas of probability and random variables and various discrete	PO_1
CO_2	Apply continuous probability distributions and their properties.	PO_2, PO_3
CO_3	Analyze the basic ideas of statistics including measures of central tendency, correlation and regression.	PO_3, PO_4
CO_4	Evaluate the statistical methods of studying data samples.	PO_5, PO_6, PO_{12}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2											
CO_2		2	2									
CO_3			2	2								
CO_4					1	1						2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Fundamentals of Probability and Random Variables**: Introduction of probability, Conditional Probability, Theorem of Total probability, Baye's Theorem(Without proof) and its applications, Random variable, Types of random variables, Probability mass function and probability density function, Mathematical expectations, Chebyshev's Inequality.
Unit: 2	**Discrete Probability Distributions and Statistical Measures:** Measures of Central tendency, Discrete probability distributions: Binomial and Poisson distributions, mean, variance, moment generating function, and evaluation of statistical parameters for these distributions, Moments, Skewness and Kurtosis.
Unit: 3	**Continuous Probability Distributions**: Continuous probability distributions, Exponential and Normal distributions, mean, variance, moment generating function, and. Evaluation of statistical parameters for these distributions, Bivariate distributions and their properties, distribution of sums and quotients, conditional densities.
Unit: 4	**Curve Fitting, Correlation and Large Sample Tests:** Curve fitting by the method of least squares-Fitting of straight lines, second degree parabolas and more general curves, Correlation, regression, rank correlation. Test of significance- Large sample test for single proportion, difference of proportions, single mean, difference of means and difference of standard deviations.
Unit: 5	**Small Sample Tests and Chi-Square Test:** 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.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1 Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

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

Course Code	Course Title	Lecture			Semester: II
BTCS242BST	Engineering Chemistry	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	2	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): Basic knowledge of Chemistry

Course Objectives:

1. To acquire the knowledge of electrochemistry, corrosion and water treatment which are essential for the Engineers and in industry.
2. To impart the basic knowledge of atomic, molecular and electronic modifications which makes the student to understand the technology based on them.
3. To impart the knowledge of synthetic aspects useful for understanding reaction pathways.
4. To acquire the skills pertaining to spectroscopy and to apply them for medical and other field.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the knowledge of atomic, molecular and electronic changes, band theory related to conductivity.	PO_1, PO_2
CO_2	Apply the required principles and concepts of electrochemistry, corrosion and in understanding the problem of water and its treatments.	PO_3
CO_3	Analyze the knowledge of configurational and conformational analysis of molecules and reaction mechanisms.	PO_2, PO_4
CO_4	Evaluate the required skills to get clear concepts on basic spectroscopy and application to medical and other fields.	PO_4, PO_5

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	1										
CO_2			1									
CO_3		2		1								
CO_4				1	1							

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Molecular structure and Theories of Bonding:** Atomic and Molecular orbitals. Linear Combination of Atomic Orbitals (LCAO), molecular orbitals of diatomic molecules, molecular orbital energy level diagrams of N2, O2 and F2 molecules. π molecular orbitals of butadiene and benzene. Crystal Field Theory (CFT): Salient Features of CFT – Crystal Field Splitting of transition metal ion d- orbitals in Tetrahedral, Octahedral and square planar geometries. Band structure of solids and effect of doping on conductance
Unit: 2	**Water Treatment:** Hardness of water, types of hardness, unites of hardness of water, determination of hardness of water by EDTA method. Boiler troubles - scale and sludge formation in boilers, caustic embrittlement, priming and foaming, Softening of water- Lime soda, permutit and ion exchange process. Problems
Unit: 3	**Electrochemistry and corrosion:** Electro chemical cells – electrode potential, standard electrode potential, types of electrodes – calomel, Quinhydrone and glass electrode. Nernst equation Determination of pH of a solution by using quinhydrone and glass electrode. Electrochemical series and its applications. Numerical problems. Potentiometric titrations. Batteries – Primary (Lithium cell) and secondary batteries (Lead – acid storage battery and Lithium ion battery). Causes and Theories of corrosion – Chemical and electrochemical corrosion, Water line and pitting corrosion; Factors affecting rate of corrosion – Nature of metal and Nature of environment. Corrosion control Methods: using pure metal and alloys, modifying the environment, cathodic protection (sacrificial anodic and impressed current cathodic). Surface coatings: Metallic coatings & methods of application of metallic coatings – hot dipping (galvanization & tinning), electroplating
Unit: 4	**Reactivity of Organic Molecules & Types of Reaction and Mechanism :** Inductive effect, Resonance or Mesomeric effect, Electromeric effect, Hyper conjugation, Carbocation, Carbanion & Free radical. Substitution, Addition and Elimination reaction.;Mechanism of the following reactions

	Aldol condensation, Cannizzaro reaction, Hoffmann reaction & Diels-Alder reaction
Unit: 5	**Spectroscopic techniques and applications**: Principles of spectroscopy, selection rules and applications of electronic spectroscopy. vibrational and rotational spectroscopy. Basic concepts of Nuclear magnetic resonance Spectroscopy, chemical shift. Introduction to Magnetic resonance imaging.
Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.	
Text Books:	
1	Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane.
2	Engineering Chemistry by P.C Jain & Monica Jain, Dhanpatrai Publishing Company (2008)
Reference Books:	
1	Fundamentals of Molecular Spectroscopy, by C. N. Banwell
2	Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan.
3	Engineering Chemistry by S.S. Dara & Mukkati S. Chand & Co,New Delhi(2006)
4	Engineering Chemistry – Shasi Chawla, Dhantpat Rai publishing Company, NewDelhi (2008).
5	Engineering Chemistry – R. Gopalan, D. Venkatappayya, D.V. Sulochana Nagarajan – Vikas Publishers (2008)
6	Engineering Chemistry J.C. Kuriacase & J. Rajaram, Tata McGraw Hills co., New Delhi (2004).

Course Code	Course Title	Lecture			Semester: II
BTCS241EST	Programming for Problem Solving	L	T	P	
Version: 1.3	**Date of Approval: 20th BoS 02-03-2026**	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): No specific requisites

Course Objectives:

1. To understand the various steps in program development.
2. To impart the basic concepts in C programming language.
3. To acquire how to write modular and readable C programs.
4. To learn to write programs (using structured programming approach) in C to solve problems.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand various problem-solving techniques and implement them in 'C' language.	**PO_1, PO_2**
CO_2	Apply the basic terminology used in computer programming and write, compile and debug programs in C language.	**PO_3,**
CO_3	Develop programs involving decision structures, loops and functions using different data types and data structures.	**PO_3, PO_4**
CO_4	Apply and analyze logical skills to program in C language.	**PO_4, PO_5**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	2										
CO_2			2									
CO_3			2	1								
CO_4				1	1							

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Introduction to Programming, Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). Introduction to programming – definitions and developing Algorithms and flowcharts for simple programs. Introduction to C Programming: Origin and history of c programming character set, Identifiers and keywords data types, constants, variables operators, symbolic constants, Expressions, compound statements, structure of C program, Input and output function.
Unit: 2	C Statements – selection statements – if nested if's, the if-else –if ladder the conditional expressions, switch statement nested switch statements, iteration statements – the for loop, for loop variations, the while loop, the do-while loop, declaring variable with in selection and iteration statements, jump statement, the return statement, the go to submit, break statement, exit( ) function, the continue statement, expression statement. Block statements.
Unit: 3	Arrays – Array what is an array? – Array Declaration, Array Initialization – Accessing individual elements of an array – Two Dimensional Arrays – Passing an array element to a function – Rules of using an array. What are strings? String I/O, string Manipulation Functions – The General Form of a Function, elements of function, function categories, types of functions, Function Arguments Call by value, Call by Reference, return statement. Uses of functions. C pre – processor, storage classes – Automatic – Register, Static and external.
Unit: 4	Pointers – definition, pointer variables, pointer expressions, arithmetic pointers, pointers and arrays, initializing pointers and functions and problems with pointers. Structures – definition, accessing structure members, structure assignments, array of structures, passing structures, structure pointers, uses of structures Unions – definitions, difference between structure and union, type def. Files – introduction to streams and files, basics of files – file pointer, opening and closing files, writing and reading character, file functions.
Unit: 5	Principles of OOP: Programming paradigms, basic concepts, benefits of OOP, applications of OOP Introduction to C++: History of C++, structure of C++, basic data types, type casting, type modifiers, operators and control structures, input and output statements in C++. Classes and objects: class specification, member function specification, scope resolution operator, access qualifiers, instance creation.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Let Us C by Yashwanth Kanethar.
2	E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
Reference Books:	
1	Object Oriented Programming with C++ By E.Balaguruswamy.
2	Programming in C, 2nd Edition, Oxford by Pradip Dey, Mannas Ghosh.

Course Code	Course Title	Lecture			Semester: II
BTCS241HST	English Communication	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	2	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): No specific prerequisites.

Course Objectives:

1. To understand the concept of enhancement of the soft and communication skills.
2. To acquire the phonetics & developing vocabulary.
3. To impart the writing applications, letters formal and non-formal, technical writing.
4. To learn the concept of portfolio writing and resume writing.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Read and write paragraphs in English confidently	PO_6, PO_{10}
CO_2	Differentiate among homonyms, homophones, synonyms and antonyms.	PO_6, PO_{10}
CO_3	Read and write the specific details and information such as writing applications, formal letters, CVs, technical reports and project reports.	PO_{12}
CO_4	Communicate with more confident among students, teachers & other stakeholders of the society.	PO_8, PO_{12}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1						2				3		
CO_2						2				3		
CO_3												3
CO_4								1				3

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Oral Communication: 1.1. Communication: Verbal and Non-Verbal 1.2. Conversations and Dialogues 1.3. JAM Sessions and Group Discussions 1.4. Presentation Skills and Interview Skills
Unit: 2	Writing Communication: 2.1. Subject-verb agreement 2.2. Précis Writing and Essay Writing 2.3. Letter Writing and Cover Letters 2.4. Portfolio Writing and Resume Writing

Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.

Text Books:

1	Habeeb,G. (2013) *English for Speakers of Urdu: A Proficiency Course*: Orient Black swan
2	Koneru, A. (2015) *Professional Speaking Skills.*OUP.
3	Kumar, S. & P. Lata (2015). *Communication Skills*. New Delhi: OUP.

Reference Books:

1	O'Brien, T. (2011). *Modern Writing Skills*. New Delhi: Rupa
2	Raymond, M. (2013). *English Grammar in Use*. Cambridge: CUP.
3	Taylor, G. (2009). *English Conversation Practice.* Tata McGraw-Hill.

Course Code	Course Title	Lecture			Semester: II
BTCS242EST	Engineering Mechanics	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Engineering Mathematics & Engineering Physics

Course Objectives:

1. To understand distributed force systems, centroid/ center of gravity and method of finding centroids of composite figures and bodies
2. To acquire the moment of inertia and method of finding moment of inertia of areas and bodies.
3. To interpret the simple given dynamic problems and solve them for positions, velocities and accelerations, etc.
4. To learn the kinetics of the rigid bodies and solve simple problems using work-energy method.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Identify the significance of centroid/ centre of gravity and find centroids of composite figures and bodies.	PO_1, PO_2, PO_9
CO_2	Understand the moment of inertia and method of finding moment of inertia of areas and bodies	PO_3, PO_6
CO_3	Interpret the simple given dynamic problems and solve them for positions, velocities and accelerations, etc.,	PO_6
CO_4	Understand the kinetics of the rigid bodies and solve simple problems using work-energy method.	PO_9

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2							1			
CO_2			2			2						
CO_3						2						
CO_4									1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction to Engineering Mechanics covering-** Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems.
Unit: 2	**Friction covering-** Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction & screw jack .
Unit: 3	**Centroid and Centre of Gravity Covering-**Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia-Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone.
Unit: 4	**Review of Particle Dynamics-** Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular).
Unit: 5	**Introduction to Kinetics of Rigid Bodies Covering-**Basic terms, general principles in dynamics; Types of motion, Instantaneous center of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation;

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill.

2	R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
Reference Books:	
1	Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications.
2	Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.

Course Code	Course Title	Lecture			Semester: II
BTCS242BSP	Engineering Chemistry Lab.	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Engineering Chemistry

Course Objectives:

1. To acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
2. To impart practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.
3. To develop the experimental skills both manually and by instrumentation of "qualitative and quantitative analysis" of solutions.
4. To impart with basic titration set up and methodologies for determining strength, hardness and alkalinity of various unknown solutions and water samples.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.	PO_1, PO_3, PO_4
CO_2	Conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.	PO_3
CO_3	Gain acquaintance in the determination the amount of hardness and chloride in the various samples of water for general purpose and their use its industries involving boilers.	PO_4, PO_6, PO_7
CO_4	Skills in estimating acidity/alkalinity in given water samples.	PO_7, PO_9

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2		2	1								
CO_2			2									
CO_3				1		1	2					
CO_4							2		1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

List of experiments/demonstrations:

1. Determination of carbonate and bicarbonate in a given mixture
2. Determination of temporary and permanent hardness in water sample using EDTA as standard solution
3. Determination of copper using standard sodium thiosulphate
4. Determination of chloride content in bleaching powder
5. Determination of iron content in the given water sample by Mohr's methods
6. pH- metric titration of acid and base
7. Conductometric titration of acid and base
8. Titration of acid and base by Potentiometry
9. Recording of Cu +2 Spectrum, absorptivity (demo only) determination of λmax and molar concentration by Spectrophotometer
10. Preparation of organic compound benzoic acid
11. Determination of surface tension and viscosity
12. Ion exchange column for removal of hardness of water
13. Synthesis of a polymer/drug
14. adsorption of acetic acid by charcoal

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	Practical Engineering Chemistry by K. Mukkanti, etal, B.S. Publications, Hyderabad.
2	Inorganic quantitative analysis, Vogel.

Reference Books:

1	Text Book of engineering chemistry by R. N. Goyal and Harrmendra Goel.

2	A text book on experiments and calculation Engg. S.S. Dara.
3	Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications.

Course Code	Course Title	Lecture			Semester: II
BTCS241ESP	Programming for Problem Solving Lab	L	T	P	
Version: 1.3	**Date of Approval: 20th BoS 02-03-2026**	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Programming for Problem Solving

Course Objectives:

1. To provide the basic knowledge of programming languages.
2. To learn the syntax and semantics of 'C' language with the help of control structures, iterative control structures.
3. To develop programs using 'C' language with the help of functions, array, pointer and structures.
4. To impart the basic terminology used in computer programming for writing and debugging programs for problem solving.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand various problem-solving techniques and will be able to implement them in 'C' language.	PO_1, PO_2
CO_2	Apply the basic terminology used in computer programming and write, compile and debug programs in C language.	PO_3, PO_5
CO_3	Develop programs involving decision structures, loops and functions using different data types and data structures.	PO_4, PO_9
CO_4	Analyze and evaluate difference between call by value and call by reference.	PO_4

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	3										
CO_2			2		2							
CO_3				1					1			
CO_4				1								

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

List of Experiments:

1. Write C program to input and output the text message.
2. Write C Program to perform all arithmetic operations.
3. Write C Program to utilize the math function.
4. Write C Program to perform the mathematical expressions.
5. Write C Program for Local and Global Variables.
6. Write C Program for internal static and external static variables.
7. Write C Program to find the roots of a Quadratic equation.
8. Write C Programs for all the Operators. (Arithmetical, Logical, Relational, Bitwise).
9. Write C Programs for Increment and Decrement Operators.
10. Write C Programs to implement the Ternary Operator.
11. Write C Programs for special Operators.
12. Write C Programs for all the Control Structures. (Sequential Control Structures, Conditional Control Structures, Iterative Control Structures).
13. Write C Programs to display the different types of patterns using nested for loop.
14. Write C Program for Statements. (Switch, break, goto, continue etc.,).
15. Write C Program to print biggest number from n numbers.
16. Write a C Program to find the given integer number is even or odd number.
17. Write a C Program to calculate the factorial of a given number.
18. Write a C Program to swap the two numbers using temp variable and without using temp variable.
19. Reading and printing a single dimensional array of elements.
20. Ascending and descending of an array.
21. Sum of all odd numbers and sum of all even numbers in a single dimensional array.
22. Mathematical operations on single dimensional arrays.
23. Reading and Printing a multi-dimensional array of elements.
24. Mathematical operations on multi-dimensional array of elements.
25. Passing an array element to a function.
26. Reading and Printing a string.

27. C Programs on String functions. **28.** Write a C program to calculate string length by writing the user-define function. **29.** Function declaration and initialization. **30.** C Program to differentiate the parameters and arguments in functions. **31.** Programs for different types of inbuilt functions. **32.** Call by value and Call by reference programs in functions. **33.** Write a program to swap the given 2 number using passing by reference. **34.** Write C Programs to perform all valid arithmetic operations using pointers. **35.** C programs on Structures and accessing of members of the structures. **36.** Write a C program to print a book information (Book name, Book no, author name) by writing a structure. **37.** Write a C program by passing structure elements to a function and display employee Information (emp no, emp name, emp salary, and emp address). **38.** C Programs on Reading a file from the secondary storage device. **39.** C Program on writing and appending a file on the secondary storage device. **40.** C Program on Opening and closing a file. **41.** Programs on Classes using C++.
Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:	
1	E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
2	Object Oriented Programming with C++ By E.Balaguruswamy
Reference Books:	
1	Programming in C, 2nd Edition, Oxford by Pradip Dey, Mannas Ghosh
2	Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Code	Course Title	Lecture			Semester: II
BTCS242ESP	Engineering Workshop	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	0	0	6	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	6	Internal Evaluation	:	50
Credits	:	3	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Engineering Mechanics

Course Objectives:

1. To provide hands on experience about use of different engineering materials, tools, equipment.
2. To develop a skill of carpentry, fitting and plumbing with safety at work place and team work.
3. To explains the construction, function, use and application of different working tools, equipment and machines.
4. To Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiselling.	PO_1, PO_3, PO_5
CO_2	Apply to fabricate components with their own hands	PO_3, PO_6, PO_9
CO_3	Analyze practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.	PO_1, PO_3, PO_6
CO_4	Ability to design and model different prototypes in the carpentry trade such as Cross lap joint, Dove tail joint.	PO_3, PO_5, PO_6, PO_9

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2		2		2							
CO_2			2			2			1			
CO_3	2		2			2						
CO_4			2		2	2			1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

1. **Carpentry:** Study of hand tools like hacksaws, jack planes, chisels and gauges for construction of various joints. Practice in planning, chiselling, marking and sawing. Joints –Cross joint, T joint, Dove tail joint.
2. **Fitting:** Study of different fitting tools. Use and setting of fitting tools for marking, center punching, chipping, cutting, filing, drilling, their use, different measuring tools, Files – Material and Classification. Practice in filing, cutting, drilling and tapping. Male and female joints, Stepped joints.
3. **Plumbing:** Study of different plumbing tools. Details of plumbing work in domestic and industrial applications. Study of pipe joints, cutting, threading and laying of pipes different fittings using PVC pipes. Use of special tools in plumbing work. Practice of a domestic line involving fixing of a water tap and use of coupling, elbow, tee, and union etc.

TRADES FOR DEMONSTRATION & EXPOSURE:

1. **House Wiring:** Study of wiring tools, industrial wiring, accessories, earthling, and safety precaution. Practice to make parallel and series connection of three bulbs, stair case wiring, florescent lamp fitting.
2. **Machine Tools:** Study and demonstration on working of machine tools. Specification and block diagram of lathe, Drilling machine and grinder. Common lathe operations such as turning, parting, chamfering and facing. Difference between drilling and boring.
3. **Casting:** Study of Moulding Sands, Pattern, Core Prints, Role of Gate runner, riser, core, casting defects like blow holes & cavities. Practical Work: Mould of any pattern Casting of simple pattern, Solid pattern, Split pattern, multi-piece pattern.

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	Work shop Manual - P.Kannaiah/ K.L.Narayana/ Scitech Publishers.
2	Elements of Workshop Technology (Volume - 1): Hajra Choudhury.
3	Workshop Manual / Venkat Reddy/ BS Publications/Sixth Edition.

Reference Books:

1	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

2	Kalpakjian S. And Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.
3	Gowri P. Hariharan and A. Suresh Babu,”Manufacturing Technology – I” Pearson Education, 2008.
4	Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017.

Course Code	Course Title	Lecture			Semester: II
BTCS241HSP	English Communication LAB	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	0	0	2	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	100
Periods/ Week	:	2	Internal Evaluation	:	50
Credits	:	1	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	2 Hrs.

Prerequisite(s): English Communication

Course Objectives:

1. To communicate and achieve the perfection of understanding in English language.
2. To understand the spoken English.
3. To understand the written English.
4. To learn business communications in professional English language.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Student will be able to understand, comprehend.	PO_6, PO_{10}
CO_2	Analyze the professional and soft communication skills	PO_2
CO_3	Learn the perfection of understanding in English language.	PO_9, PO_{10}
CO_4	Can read, write and communicate effectively in English.	PO_{10}, PO_{12}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1						1				3		
CO_2		2										
CO_3									1	3		
CO_4										3		2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Introduction to Phonetics – Speech Sounds – Vowels & Consonants
Unit: 2	Structure of Syllables – weak forms & strong forms
Unit: 3	Minimal pairs – word accent and stress shifts
Unit: 4	Intonation and common errors in pronunciation
Unit: 5	Conversation practice – oral presentation skills a. Greeting and leave taking, introducing oneself and others b. Apologizing, interrupting, requesting and making polite conversation c. Giving instructions and directions: speaking of hypothetical situations d. Narrating, expressing opinions and telephone interactions

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	"Enjoying Every day English", Published by Sangam Books, Hyderabad
2	Innovate with English: A Course in English for Engineering Students, edited by T Samson, Foundation Books.

Reference Books:

1	English Grammar Practice, Raj N Bakshi, Orient Longman
2	Technical Communication by Daniel Riordan. 2011. Cengage Publications. New Delhi
3	Effective English, edited by E Suresh Kumar, A RamaKrishna Rao, P Sreehari, Published by Pearson
4	Handbook of English Grammar& Usage, Mark Lester and Larry Beason, Tata Mc Graw –Hill.
5	Spoken English, R.K. Bansal & JB Harrison, Orient Longman
6	Technical Communication, Meenakshi Raman, Oxford University Press
7	Objective English Edgar Thorpe & Showick Thorpe, Pearson Education

Course Code	Course Title	Lecture			Semester: III
BTCS341EST	Analog Electronic Circuits	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Engineering Physics

Course Objectives:

1. To learn and explore the techniques of circuit analysis and design.
2. To impart the knowledge of signals, Laplace transformation, frequency response.
3. To experiment with analog electronic circuits and signal processing.
4. To provide the knowledge of instrumentation amplifier and conversion.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the characteristics of transistors.	PO_1
CO_2	Design and analyze various rectifier and amplifier circuits.	PO_2, PO_3
CO_3	Analyze the sinusoidal and non-sinusoidal oscillators.	PO_2, PO_5
CO_4	Evaluate the functioning of OP-AMP and design OP-AMP based circuits.	PO_4

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	1											
CO_2		2	2									
CO_3		2			1							
CO_4				1								

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave Rectifiers, Zener diodes, clamping and clipping circuits. Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits
Unit: 2	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: 3	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: 4	Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion.
Unit: 5	Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector. Monoshot.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Robert Boylested, Louis Nashelky, “Electronic Devices and Circuit Theory”, Pearson Education, New Delhi, India.
2	A. S. Sedra and K. C. Smith, “Microelectronic Circuits”, New York, Oxford University Press, 1998.
3	Jacob Millman, Christor C. Halkias, “ Electronic Devices and Circuits” , McGraw Hill Book company, New Delhi, India.

Reference Books:

1	E. Norman lurch, “Fundamental of Electronics” , John Wiley and Sons, New York, USA.
2	Donald L. Schilling, Charles Belove, “Electronic Circuits: Discrete and Integrated,” McGraw Hill Book company, Singapore.
3	P. R. Gray, R. G. Meyer and S. Lewis, “Analysis and Design of Analog Integrated

	Circuits", John Wiley & Sons, 2001.
4	J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.

Course Code	Course Title	Lecture			Semester: III
BTCS341PCT	Data Structure & Algorithms	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Programming for Problem Solving

Course Objectives:

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

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Analyze the algorithms to determine the time and computation complexity and justify the correctness.	PO_1, PO_2
CO_2	Implement search problems such as Linear Search and Binary Search	PO_1, PO_2, PO_3
CO_3	Develop given problem of Stacks, Queues and linked list and analyze the same to determine the time and computation complexity.	PO_3, PO_4, PO_{12}
CO_4	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.	PO_3, PO_4, PO_5

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2	2	2	2									
CO_3			2	2								2
CO_4			2	2	2							

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Introduction to data structures and objectives, basic concepts Arrays: one dimensional, multi-dimensional, Elementary Operations. Analysis of Algorithm: Time Complexity and Space Complexity, Big-O Notation, Omega Notation, Theta Notation.
Unit: 2	Stacks: Representation, elementary operations and applications such as infix to postfix, postfix evaluation, parenthesis matching Queues: Simple queue, circular queue, dequeue, elementary operations and applications. Recursion Technique, Tower of Honoi Problem.
Unit: 3	Linked lists: Linear, circular and doubly linked lists, elementary operations and applications such as polynomial manipulation. Sorting: what is sorting, Bubble Sort, Selection Sort, Insertion Sort, Shell Sort, Merging, Merge Sort, Radix Sort, Quick Sort, Heap Sort, Binary Tree Sort, Address Calculation Sort, Binary Search.
Unit: 4	Trees: Binary tree representation, tree traversal, complete binary tree, heap, binary search tree, height balanced trees like AVL tree, Huffman Tree, B Tree, B+ Tree and other operations and applications of trees.
Unit: 5	Graph: Undirected Graph, Directed Graph, Representation of Graph, Operation on Graph, Traversal in Graph, BFS (Breadth First Search), DFS (Depth First Search), Spanning Tree. Algorithm: Warshall's Algorithm, Shortest Path Algorithm (Dijkstra), Prim's Algorithm, Kruskal's Algorithm.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.
2	Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and .Mount, Wiley student edition, John Wiley and Sons.

Reference Books:

1	Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition
2	Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson
3	Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
4	Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education.

Course Code	Course Title	Lecture			Semester: III
BTCS342EST	Digital Electronics	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Engineering Physics

Course Objectives:

1. To impart the basic concepts of digital electronics.
2. To understand concepts about various logical gates.
3. To understand basic concepts about Boolean Algebra.
4. To enable to design the digital logic.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Implement working of logic families and logic gates.	PO_1, PO_2
CO_2	Design and implement Combinational and Sequential logic circuits.	PO_3, PO_9
CO_3	Understand the process of Analog to Digital conversion and Digital to Analog conversion.	$PO_1, PO_3,$
CO_4	Implement the given logical problem using PLDs.	PO_3, PO_4

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	1										
CO_2			3						2			
CO_3	2		3									
CO_4			3	2								

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Fundamentals of Digital Systems and logic families** 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 lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.
Unit: 2	**Combinational Digital Circuits** 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 look ahead 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** A 1-bit memory, the circuit properties of Bi stable 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 Converters** Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs , 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/D 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. 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).
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
2	Mansaf Alam, Bashir Alam, “Digital Logic Design”, PHI,2016
Reference Books:	
1	A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2	Anil K.Maini,”Digital Electronics”, Wiley,2016.

Course Code	Course Title	Lecture			Semester: III
BTCS341BST	Differential Calculus and Numerical Analysis	L	T	P	
Version: 1.2	Date of Approval: 20th BoS 02-03-2026	3	1	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Probability And Statistics

Course Objectives:

1. To introduce the basic concepts of differential equations, partial differential equations, Laplace transformation and numerical analysis.
2. To explore a variety of various mathematical structures by focusing on mathematical objects, operations, and resulting properties.
3. To understand and learn uses and applications of Ordinary and Partial differential equations, Laplace transformation and Numerical analysis in the field of engineering and technology.
4. To impart the knowledge of numerical integration and Euler's method.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Demonstrate the ability to solve problems using Ordinary and Partial differential equations, Laplace transformation and Numerical analysis	PO_1, PO_2
CO_2	Learn the overview of differential equations.	PO_1, PO_{12}
CO_3	Use of equations reducible to exact form using Integrating factors - Linear, Bernoulli 's equations.	PO_3
CO_4	Learn the applications to Newton's Law of Cooling – Law of natural growth and decay.	PO_4, PO_9

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2	2											2
CO_3			2									
CO_4				2					2			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**First-Order Differential Equations and Applications:** Differential Equations an overview –Exact Differential Equations, Equations reducible to Exact Differential Equations using Integrating factors, Linear, Bernoulli`s Equations, Applications to Newton's Law of Cooling, Law of Natural Growth and Decay, Orthogonal Trajectories in Cartesian and Polar form.
Unit: 2	**Higher-Order Differential Equations and Applications:** Linear Differential Equations of Higher Order with Constant Coefficients, Complementary Function and Particular Integral, General form of Particular Integral and Special types such as e^{ax}, $cos(ax)$, $sin(ax)$, x^m, $e^{ax}.V$, $x.V$, Method of Variation of Parameters for a second order Differential Equation, Applications to Bending of Beams, Electrical Circuits and Simple Harmonic Motion.
Unit: 3	**Partial Differential Equations and Boundary Value Problems:** Formation of Partial Differential Equations by eliminating the arbitrary constants and arbitrary functions, Solution of Partial Differential Equations (Lagrange's method), Nonlinear Differential Equations of order one (Special forms), Method of Separation of Variables for Solving One Dimensional Wave Equation and Heat Equation and Problems.
Unit: 4	**Laplace Transforms and Their Properties:** Laplace Transform of Standard Functions, Inverse Transform, First Shifting Theorem, Transform of Derivatives and Integrals, Unit Step Function, Second Shifting Theorem, Dirac-delta Function, Convolution Theorem, Periodic. Function, Differentiation and Integration of Transforms, Application of Laplace Transform to Ordinary Differential Equations.
Unit: 5	**Numerical Methods and Applications:** Numerical Integration, Trapezoidal rule, Simpson's One- Third rule, Simpson's Three-Eighth rule and Weddle's rule, Numerical Differentiation, Numerical Solution of Ordinary Differential Equations by Euler's Method, Euler's Modified Method and Runge -Kutta Method.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Differential Calculus by shantinarayana
2	Partial Differential Equation by Sneddon
3	Laplace Transform by Schaum's series
Reference Books:	
1	Numerical Analysis by Shastry
2	Engineering Mathematics by B.V Ramana

Course Code	Course Title	Lecture			Semester: III
BTCS341PCP	Data structure & Algorithms LAB	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Data structure & Algorithms

Course Objectives:

1. To understand the linear and non-linear data structures and algorithms.
2. To identify the suitable data structure and algorithm for the given real-world problem.
3. To gain knowledge in practical applications of data structures and algorithms.
4. To experiments the various applications of Searching and sorting.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Design and analyze the time and space efficiency of the data structure and algorithms.	PO_3
CO_2	Implement the appropriate data structure for given problem and algorithms.	PO_3, PO_4, PO_5
CO_3	Design and analyze data structure and algorithms.	PO_2, PO_3
CO_4	Conceptualize and build data structure based on application needs.	PO_4, PO_9

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1			2									
CO_2			2	2	2							
CO_3		2	2									
CO_4				2					1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

1. Implementation of array operations, Structures & Unions.
2. Stacks, Queues, Circular Queues, Priority Queues, Multiple stacks and queues.
3. Infix to postfix expression using stack
4. Implementation of linked lists: stacks, queues, single linked lists.
5. Implementation of polynomial operations. Doubly linked lists
6. Tree traversal: AVL tree implementation, application of trees.
7. Implementation of Hash Table.
8. Searching and sorting
9. Traversal of graph

Note: Students can write the more programs based on prescribed syllabus.

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	Data structures, Algorithms and Applications in C++, S. Sahni, University Press (India) Pvt. Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd
2	Data structures and Algorithms in C++, Michael T. Goodrich, R. Tamassia and .Mount, Wiley student edition, John Wiley and Sons.

Reference Books:

1	Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition
2	Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson
3	Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.

Course Code	Course Title	Lecture			Semester: III
BTCS342ESP	Digital Electronics LAB	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Digital Electronics

Course Objectives:

1. To impart the basic knowledge of various logic gates.
2. To understand combinational circuits and sequential circuits.
3. To acquire the knowledge of Flip-Flop.
4. To design Counters and shift registers.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Able to identify, configure and use off-the-shelf digital ICs	PO_1, PO_2
CO_2	Able to realize and troubleshoot combinational and sequential digital circuits.	PO_2
CO_3	Able to employ MSI ICs of appropriate configuration for realizing a digital system.	PO_3, PO_4
CO_4	Able to design and implement simple digital system for a real-life problem.	PO_3, PO_4, PO_9

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	1										
CO_2		2										
CO_3			2	2								
CO_4			2	2					1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

1. Bread Board Implementation of various logic gates.
2. Bread Board Implementation of various logic gates using NAND gate.
3. Bread Board Implementation of various logic gates using NOR gate.
4. Bread Board implementation of Binary Adder (Half and Full) using general gates.
5. Bread Board implementation of Combinational Circuits.
6. Bread Board implementation of Adder/Subtractor.
7. Bread Board Implementation of Flip-Flops.
8. Experiments with clocked Flip-Flop.
9. Design of Counters.
10. Bread Board implementation of counters & shift registers.

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
2. Mansaf Alam, Bashir Alam, “Digital Logic Design”, PHI,2016

Reference Books:

1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. Anil K.Maini,”Digital Electronics”, Wiley,2016.

Course Code	Course Title	Lecture			Semester: III
BTCS342PCP	Python Lab	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	1	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	3	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Any computer programming course

Course Objectives:

1. To learn the fundamentals of writing Python programming.
2. To understand core Python scripting elements such as variables and flow control structures.
3. To read and write Python files.
4. To impart the knowledge of Python standard library and Explore Python's object-oriented features.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Implement scripting and the contributions of scripting languages.	PO_1
CO_2	Apply Python especially the object-oriented concepts.	PO_3
CO_3	Analyze and apply built-in objects of Python.	PO_3
CO_4	Apply Python standard library and Explore Python's object-oriented features	PO_5, PO_9

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2											
CO_2			3									
CO_3			3									
CO_4					2				1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction:** History, Features, setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator, Input-Output, Printing on screen, Functions, If, If- else, Nested if-else, Looping, For, While, Nested loops, Control Statements, Break, Continue, Pass
Unit: 2	**String Manipulation and Lists:** **Strings:** Accessing Strings, Basic Operations, String slices, Function and Methods **Lists:** Introduction, accessing list, Operations, Working with lists, Function and Methods
Unit: 3	**Functions and modules:** Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables, Importing module, Math module, Random module, Packages, Composition
Unit: 4	**Regular expressions:** Match function, Search function, Matching VS Searching, Modifiers, Patterns
Unit: 5	Reading data from keyboard, Opening and closing file, Reading and writing files, **Database:** Introduction, Connections, Executing queries, Transactions, Handling error

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	Sheetal Taneja and Naveen Kumar, "Python Programming - A Modular Approach", Pearson education.
2	Cay S. Horstmann and Rance D. Necaise, "Python for Everyone", Wiley.

Reference Books:

1	Allen Downe, "Learning With Python", Wiley.
2	Jake VanderPlas, "Python Data Science Handbook", O'Reilly' Publisher

Course Code	Course Title	Lecture			Semester:
BTCS341NCT	Environmental Sciences	L	T	P	III
Version: 1.3	**Date of Approval: 20th BoS 02-03-2026**	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	-	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): No specific requisite.

Course Objectives:

1. To impart the knowledge of importance of Natural resources: Water resources; use and over utilization of surface and ground water.
2. To study energy resources, growing energy needs, renewable and non – renewable energy sources.
3. To learn causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution and solid waste management.
4. To learn Water conservation and environmental ethics: Climate change, global warming, acid rain, ozone layer depletion and Disaster Management.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Demonstrate the importance of Natural resources.	**PO_1, PO_2**
CO_2	Explain renewable and non – renewable energy sources.	**PO_3, PO_5, PO_7**
CO_3	Understand the mechanism to control and measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution and solid waste management.	**PO_4, PO_8, PO_9**
CO_4	Develop the working principles of disaster mitigation, disaster management cycle. Analyze disaster management with causes, effects and control measures.	**PO_3, PO_4, PO_{12}**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	1	1										
CO_2			1		1		2					
CO_3				2				1	1			
CO_4			1	2								2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Environmental Studies:** Definition, scope and importance, need for public awareness. **Natural resources:** Water resources; use and over utilization of surface and ground water, floods, drought, conflicts over water, dams - benefits and problems, water logging, salinity. Energy resources, growing energy needs, renewable and non – renewable energy sources.
Unit: 2	**Environmental Pollution:** Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution and solid waste management. **Environment Protection Act:** Air, water, forest and wild life acts, issues involved in enforcement of environmental legislation.
Unit: 3	**Social Aspects and the Environment:** Water conservation and environmental ethics: Climate change, global warming, acid rain, ozone layer depletion. **Disaster Management:** Types of disasters, impact of disasters on environment, infrastructure and development. Basic principles of disaster mitigation. disaster management cycle and disaster management in India.

Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.

Text Books:

1	A.K. De, Environmental Chemistry, New Age Publications, 2002.
2	E.P. Odum, Fundamentals of Ecology, W.B. Sunders Co., U.S.A.

Reference Books:

1	G.L. Karia and R.A. Christain, Waste Water Treatment, Concepts and Design Approach, Prentice Hall of India, 2005.
2	Benny Joseph, Environmental Studies, Tata McGraw – Hill, 2005.
3	V.K. Sharna, Disaster Management, National Centre for Disaster Management, IIPE, Delhi, 1999.

Course Code	Course Title	Lecture			Semester: IV
BTCS441PCT	Database Management Systems	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Data Structure and Algorithm

Course Objectives:

1. To understand the concept of data planning and database design for serving different types of users with varying skill levels.
2. To handle different user views of the same stored data, combining interrelated data, setting standards, controlling concurrent updates so as to maintain data integrity.
3. To manage, plan and coordinate restart and recovery operations across multiple users for a large complex system.
4. To acquire the concept of file organization and indexing.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand relational database theory, and be able to write relational algebra expressions for queries, logical design of databases, including the E-R method and normalization approach.	PO_3
CO_2	Apply and analyze the database storage structures and access techniques like file and page organizations.	PO_2, PO_3
CO_3	Analyze and apply indexing methods including B-tree, hashing, query evaluation techniques and query optimization.	PO_3, PO_5
CO_4	Evaluate various issues of transaction processing and concurrency control by designing and development of a database application system as part of a team.	PO_4, PO_9

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1			2									
CO_2		2	3									
CO_3			3		2							
CO_4				1					1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Data base System Applications, data base System VS file System – View of Data – Data Abstraction – Instances and Schemas – data Models – the ER Model – Relational Model – Other Models – Database Languages – DDL – DML – database Access for applications Programs – data base Users and Administrator – Transaction Management – data base System Structure – Storage Manager – the Query Processor. History of Data base Systems. Data base design and ER diagrams – Beyond ER Design Entities, Attributes and Entity sets – Relationships and Relationship sets – Additional features of ER Model – Concept Design with the ER Model – Conceptual Design for Large enterprises.
Unit: 2	Introduction to the Relational Model – Integrity Constraint Over relations – Enforcing Integrity constraints – Querying relational data – Logical data base Design – Introduction to Views – Destroying /altering Tables and Views. Relational Algebra – Selection and projection set operations – renaming – Joins – Division – Examples of Algebra overviews – Relational calculus – Tuple relational Calculus – Domain relational calculus – Expressive Power of Algebra and calculus.
Unit: 3	Form of Basic SQL Query – Examples of Basic SQL Queries – Introduction to Nested Queries Correlated Nested Queries Set – Comparison Operators – Aggregative Operators – NULL values – Comparison using Null values – Logical connectivity's – AND, OR and NOT – Impact on SQL Constructs – Outer Joins – Disallowing NULL values – Complex Integrity Constraints in SQL Triggers and Active Data bases. Schema refinement – Problems Caused by redundancy Decompositions – Problem related to decomposition – reasoning about FDS – FIRST, SECOND, THIRD Normal forms – BCNF – Lossless join Decomposition – Dependency preserving Decomposition – Schema refinement in Data base Design – Multi valued Dependencies – FORTH Normal Form.
Unit: 4	Transaction Concept- Transaction State- Implementation of Atomicity and Durability Concurrent – Executions – Serializability- Recoverability – Implementation of Isolation – Testing

	for serializability- Lock –Based Protocols – Timestamp Based Protocols- Validation- Base Protocols – Multiple Granularity. Recovery and Atomicity – Log – Based Recovery – Recovery with Concurrent Transactions – Buffer Management – Failure with loss of nonvolatile storage-Advance Recovery systems- Remote Backup systems.
Unit: 5	Data on External Storage – File Organization and Indexing – Cluster Indexes, Primary and Secondary Indexes – Index data Structures – Hash Based Indexing – Tree base Indexing Comparison of File Organizations – Indexes and Performance Tuning- Intuitions for tree Indexes – Indexed Sequential Access Methods (ISAM) – B+ Trees: A Dynamic Index Structure.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill 3rd Edition
2	Data base System Concepts, Silberschatz, Korth, McGraw hill, V edition
Reference Books:	
1	Fundamentals of Database Systems, Elmasri Navrate Pearson Education
2	Introduction to Database Systems, C.J.Date Pearson Education

Course Code	Course Title	Lecture			Semester: IV
BTCS442PCT	Computer Organization and Architecture	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Digital Electronics

Course Objectives:

1. To understand the organization of the classical von Neumann machine and its major functional Modules.
2. To learn system organization and structure through instruction cycles.
3. To provide basic concepts of interrupts and how interrupts are used to implement I/O control and data transfers.
4. To identify various types of buses in a computer system and illustrate how data transfers are performed.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Apply and analyze computer organization, computer arithmetic, and CPU design.	PO_2, PO_3
CO_2	Understand I/O system and interconnection structures of computer.	PO_2, PO_6
CO_3	Design and analyze different interrupts, I/O techniques, PLDs and memory organization.	PO_3
CO_4	Implement learning skills and be able to develop different hardware for computer organization.	PO_3, PO_4

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1		1	2									
CO_2		2				1						
CO_3			2									
CO_4			2	2								

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Introduction: Function and structure of computer Functional components of a computer, Interconnection of components, Performance of a computer. Computer Organization and Architecture Basic structure of General purpose Computer with instruction set, Basic Computer and registers, Hardware Organization.
Unit: 2	Registers Microoperations and Arithmetic Logic Structure: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Adder-Subtractor, Arithmetic Logic Shift Unit.
Unit: 3	CPU Organization: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control Organization of a control unit-Operations of a control unit, Hardwired control unit, Microprogrammed control unit.
Unit: 4	Input Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, DMA controlled I/O, Direct Memory Access, Input-Output Processor
Unit: 5	Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Computer Systems Architecture – M.Moris Mano, IIIrd Edition, Pearson/PHI
2	Computer Organization and Architecture–William Stallings Sixth Edition, Pearson/PHI

Reference Books:

1	Computer Organization – Carl Hamacher, Zvonks Vranesic, SafeaZaky, Vth Edition, McGraw Hill
2	Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition PHI/Pearson
3	Fundamentals of Computer Organization and Design, -Sivaraama Dandamudi Springer Int. Edition.
4	Computer Architecture a quantitative approach, John L. Hennessy and David A. Patterson, Fourth Edition Elsevier

Course Code	Course Title	Lecture			Semester: IV
BTCS443PCT	Discrete Mathematics	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	1	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45Hrs.	Maximum Score	:	100
Periods/Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3Hrs.

Prerequisite(s): Differential Calculus

Course Objectives:

1. To understand variety of various mathematical structures by focusing on set theory, Algebraic structures with binary operation, mathematical objects, operations, and resulting properties.
2. To develop formal logical reasoning techniques and notation and demonstrate the application of logic to analyzing and writing proofs, techniques for counting, permutations and combinations
3. To impart the concept of relation through various representations of Graphs, DFS, BFS, Spanning Trees, and Planar Graphs.
4. To acquire the knowledge of graph theory and applications, isomorphism and subgraphs, multi graphs and Euler circuits, Hamiltonian graphs, Chromatic Numbers.

Course Outcomes(CO):

Cos No.	Statement	Mapped Program Outcomes(POs)
CO_1	Understand Well-formed formulas, Truth Tables, tautology, equivalence implication, Normal forms, Quantifiers, universal quantifiers.	PO_1,PO_2
CO_2	Analyze operations on set theory, Algebraic structures with one binary operation, mathematical objects, operations, And resulting properties.	PO_2,PO_3
CO_3	Evaluate the application of logic to analyzing and writing proofs, Techniques for counting, permutations and combinations	PO_3
CO_4	Apply the concepts of Graphs, DFS, BFS, Spanning Trees, and Planar Graphs. Graph Theory and other engineering applications	PO_3,PO_5

PO1- Engineering Knowledge, **PO2**- Problem analysis, **PO3**- Design/development of solutions, **PO4**- Conduct investigations of complex problems, **PO5**- Modern tool usage, **PO6**- The engineer and society, **PO7**- Environment and sustainability, **PO8**- Ethics, **PO9**- Individual or team work, **PO10**- Communication, **PO11**- Project management and finance,
PO12-Life-long Learning

Mapping of course out comes with program out comes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	1										
CO_2		1	2									
CO_3			2									
CO_4			2		1							

1–Reasonable; 2–Significant; 3–Strong

Detailed Contents:

Unit:1	**Foundations of Mathematical Logic:** Statements and notations, Connectives, Well-formed formulas, Truth Tables, tautology, equivalence implication, Normal forms, Quantifiers, universal quantifiers. Predicates: Predicative logic, Free& Bound variables, Rules of inference, Consistency, proof of contradiction, Automatic Theorem Proving.
Unit:2	**Relations, Functions, and Algebraic Structures:** Properties of binary Relations, equivalence, transitive closure, compatibility and partial ordering relations, Lattices, Hasse diagram, Functions, Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Subgroups, Normal subgroup, Homomorphism's, Cosets, Lagrange's theorem, definitions and examples of Rings and Field.
Unit:3	**Combinatorics and Counting Principles:** Basics of counting, Combinations & Permutations, with repetitions, Constrained repetitions, Binomial Coefficients, Binomial and Multinomial theorem, the principles of Inclusion–Exclusion, Pigeon hole principles and its properties.

Unit:4	**Recurrence Relations and Generating Functions:** Generating Functions, Function of Sequences, Calculating Coefficients of generating functions, Recurrence relations, solving recurrence relation by substitution and Generating functions, the method of Characteristic, Roots solution of Inhomogeneous Recurrence Relations.
Unit:5	**Graph Theory and Its Applications:** Representation of Graphs, DFS, BFS, Spanning Trees, Planar Graphs. Graph Theory and Applications, Basic Concepts, Isomorphism and Subgraphs, Multigraphs and Eulercircuits, Hamiltonian graphs, Chromatic Numbers.
Examination and Evaluation Pattern: It includes both internal evaluation (30marks) comprising two class sessional exams/assignments/quiz/seminar presentation etc. and external evaluation (70marks) which Is mainly end semester examination.	
Text Books	
1	Mathematical Foundation of Computer Science–Shahnaz Bathul ,PHI.
2	Elements of Discrete Mathematics-A Computer Oriented Approach, C. L. Liu, D.P. Mohapatra, 3rd edition, TMH.
3	Discrete Mathematics for Computer Scientists & Mathematicians,second edition, J. L. Mott, A. Kandel, T. P. Baker, PHI
4	Discrete and Combinatorial Mathematics-AnAppliedIntroduction-5th Edition–Ralph.P.Grimaldi, Pearson Education
Reference Books:	
1	Discrete Mathematics and its applications, 6th edition, K. H. Rosen, TMH.
2	Discrete Mathematical Structures, Mallik and Sen, Cengage Learning
3	Discrete Mathematical Structures, Bern and Kolman, Robert C. Busby, Sharon Cutler Ross, PHI/ Pearson Education
4	Discrete Mathematics with Applications, Thomas Koshy, Elsevier.
5	Logic and Discrete Mathematics, Grass Man and Tremblay ,Pearson Education

Course Code	Course Title	Lecture			
BTCS444PCT	Object Oriented Programing Using Java	L	T	P	**Semester:** IV
Version: 1.2	**Date of Approval:**	2	1	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Programming for Problem Solving

Course Objectives:

1. To understand the concept of object-oriented programming principle using JAVA programming language.
2. To demonstrate the principles of object-oriented features such as classes, class hierarchies, polymorphism using Java programming language.
3. To acquire the knowledge of error and exception handling.
4. To introduce the web development technologies and framework for real time applications.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the principles of object-oriented programming paradigm specifically including abstraction, encapsulation, inheritance and polymorphism.	**PO_1, PO_2,**
CO_2	Demonstrate best practices in designing classes and class hierarchies from problem statements using sub-classing, abstract classes, and interfaces to achieve polymorphism in object-oriented software.	**PO_3**
CO_3	Demonstrate informed use of exception handling mechanism within and across software components.	**PO_4, PO_5**
CO_4	Apply database handling and writing JDBC programs.	**PO_5, PO_9**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2			3									
CO_3				2	2							
CO_4					2				1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Java Basics -** Review of OOP concepts, History of Java, Java buzzwords, comments, data types, variables, constants, scope and life time of variables, operators, operator hierarchy, expressions, type conversion and casting, enumerated types, control flow-block scope, conditional statements, loops, break and continue statements, simple java program, arrays, recursion.
Unit: 2	**Classes and Objects:** Abstraction, encapsulation, classes, objects, constructors, methods, parameter passing, access control, this keyword, overloading methods and constructors, static fields and methods, garbage collection, String Handling, Enumerations, Object class and its methods.
Unit: 3	**Inheritance & Polymorphism** – Inheritance concept, benefits of inheritance, Super classes and Sub classes, Member access rules, super keyword, final classes, methods and variables, Polymorphism - dynamic binding, method overriding, dynamic method dispatch, abstract classes and methods, Interfaces – Interfaces vs. abstract classes, defining an interface, implementing interfaces, accessing implementations through interface references, extending interface, Packages-Defining, Creating and Accessing a Package.
Unit: 4	**Defensive programming**– Dealing with errors, benefits of exception handling, the classification of exceptions- exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, re-throwing exceptions, built in exceptions, creating own exception sub classes.
Unit: 5	**Java Web Development Technologies** – JDBC, Developing CRUDS application using JDBC, Introducing- Java Servlet, JSP, and web development frameworks.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Herbert schildt, Java: the complete reference, Latest edition, McGraw Hill.

2	Nick Samoylov, Learn Java 17 Programming, Latest edition, Packt Publishing Limited.
Reference Books:	
1	Kathy Sierra, Bert Bates, Trisha Gee, Head First Java, Latest Edition, O'Reilly
2	Mahmoud Parsian, JDBC Recipes: A Problem-Solution Approach, Apress

Course Code	Course Title	Lecture			Semester: IV
BTCS440PCT	Java Programming LAB	L	T	P	
Version: 1.3	**Date of Approval:** 19th BoS 27-02-2024	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Programming for Problem Solving

Course Objectives:

1. To understand the concept of object-oriented programming principle using Java programming language.
2. To apply the concept of classes and to develop Java programs based on these concepts.
3. To apply the principles of inheritance, polymorphism and exception handling in Java.
4. To apply and develop a small case studies based on principle of OOP and JDBC.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the principles of object-oriented programming paradigm specifically including abstraction, encapsulation, inheritance and polymorphism.	PO_1, PO_2
CO_2	Demonstrate best practices in designing classes, class hierarchies, sub-classing, abstract classes, and interfaces.	PO_3
CO_3	Apply the principles of inheritance, polymorphism and exception handling in Java.	PO_4, PO_5
CO_4	Develop a small case studies based on principle of OOP and JDBC.	PO_5, PO_9

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2											
CO_2			3									
CO_3			2		2				1			
CO_4				2					1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

1. A father left 17 camels to his three sons and, according to the will, the eldest son should be given a half of all camels, the middle son the one-third part and the youngest son the one-ninth.
   a. How will you divide camels without killing any one?
   b. Can you find any other problem of such nature and how can you generalize solution of such type of problem? Prepare flowchart.
   c. Write Java code to implement the solution.
2. Given a square matrix, write a Java program to do the following:
   a. Check whether the sum of elements in primary/major diagonal are sum of elements in secondary/minor diagonal are equal or not?
   b. If it is not equal, exchange the elements of the diagonal.
   c. If it is equal, then check how many elements are not equal in primary diagonal with that of secondary diagonal.
3. Develop a class RationalNumber having two member variables numerator & denominator. Your implementation should use efficient representation for a rational number, i.e. (500 / 1000) should be represented as (½).
   a. Provide necessary constructor, getter & setter and methods.
   b. Define a method to check whether the given object of RationalNumber is rational or not. If it is rational convert, it to minimum form.
   c. Provides methods for add, subtract, multiply and divide two RationalNumbers.
4. Define a class that stores the data related to your mark sheet and generate the consolidated mark sheet with CGPA.
   a. Provide necessary constructor, getter & setter and methods.
   b. Provide necessary member variable & methods for keep track of the credits score, backlogs, appearance in improvement exams along with scores.
   c. There is a policy that any students ever having backlogs or appeared in any improvement exam will not be considered as gold medal. Your program shall also be able to keep track of those students.

5. Define a class Point having x and y coordinates. Provide necessary constructor, getter & setter methods and do the following:
    a. Define a method calculate Distance() that takes a Point object p1 as argument and calculates the distance of p1 from the current Point object.
    b. Define a method isOnStrightLine( ) that takes a Point object p2 as argument and check whether Point p2 is on the straight line formed by p1 and previous Point object.
    c. Define a class Point Collection that can store multiple such Points with the provision of addition, deletion, modification, searching and printing facilities.
6. Define a class Person with necessary fields, constructors and methods. Write Java program to do the following:
    a. Define two subclasses with fields, constructors and methods that inherits Person: Student & Professor. Define two classes with fields, constructors and methods: Course and Registration.
    b. The Registration class keep the relation between a Course, Professor and Student. Every Course can be taught by one or more Professors. A Professor may teach many Courses. A Student can register to multiple courses but if he/she register a course under one professor he/she can't register the same course under another professor. Maximum limit is 40 for course under one professor. Course can be selected on FCFS basis.
    c. With the help of above description, write a Java program to manage and present the informations such as number of students registered in a course, list of students registered in a course, number of courses taught by a professor, number of students taught by a professor, list of courses taught a professor, list of students registered in a course under a professor, list of courses taught by more than one professor, professor having maximum & minimum number of students, professor teaching maximum & minimum number of courses, Number and list of students who couldn't registered due to no vacancy, total vacancy and the professor & course list having vacancies etc.
7. Define an interface Queue and then implement it in class CircularQueue & LinkedQueue.
    a. Define a class Node that will be the members of CircularQueue & LinkedQueue. Members of Node shall be private.
    b. Define your own exception such as UnderflowQueueException and OverflowQueueException.
    c. Use different packages and accessibility specifies to defining and limiting the visibility of your class. Also demonstrate the use the concept of dynamic method dispatch in your program.
8. Develop a small case for your Library for the following:
    a. Provides a unique accession number to each book, do necessary record keeping of books, ebooks, journals, magazines, newspapers etc.
    b. Maintain Issue and Return Register.
    c. Provide different kinds of reports such as total available books by titles, subjects, authors, most used book, list of books pending for return etc.
9. Develop CRUDS applications using JDBC that maintains the list of software companies with the following information:
    a. CEO, Headquarter City, Total Turnover, Total Manpower, Average Salary of Freshers.
    b. Define a class Alumni for the purpose of maintaining the information about the alumni of your University.
    c. Maintain a list of alumni who are working with these companies with necessary details.

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:	
1	Java; the complete reference, 9th editon, Herbert schildt, TMH.
2	Understanding OOP with Java, updated edition, T. Budd, Pearson education.
Reference Books:	
1	Programming with java , E Balagurusamy, McGraw-Hill; Sixth edition (25 March 2019);
2	Introduction to OOP, second edition, T. Budd, pearson education.

Course Code	Course Title	Lecture			Semester: IV
BTCS441PCP	Database Management Systems LAB	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Database Management Systems

Course Objectives:

1. To acquire the knowledge of DBMS, in terms of use and implementations.
2. To understand the concept of data planning and database design for serving different types of users with varying skill levels.
3. To handle different user views of the same stored data, combining interrelated data, setting standards, controlling concurrent updates so as to maintain data integrity.
4. To write program by the use of PL/SQL.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the relational database theory, and be able to write relational algebra expressions for queries, logical design of databases, including the E-R method and normalization approach.	PO_3
CO_2	Illustrate commercial relational database system by writing SQL.	PO_3, PO_5
CO_3	Analyze the database storage structures.	PO_2, PO_6, PO_9
CO_4	Build Access techniques like file and page organizations, indexing methods including B-tree, hashing, query evaluation techniques and query optimization.	PO_3, PO_5

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1			2									
CO_2			2		2							
CO_3		2				2			1			
CO_4			3		2							

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

1. Create a database table, add constraints (primary key, unique, check, Not null), insert rows,
2. update and delete rows using SQL DDL and DML commands.
3. Create a set of tables, add foreign key constraints and incorporate referential integrity.
4. Query the database tables using different 'where' clause conditions and also implement aggregate functions.
5. Query the database tables and explore sub queries and simple join operations.
6. Query the database tables and explore natural, equi and outer joins.
7. Write user defined functions and stored procedures in SQL.
8. Execute complex transactions and realize DCL and TCL commands.
9. Write SQL Triggers for insert, delete, and update operations in a database table.
10. Create View and index for database tables with a large number of records.
11. Create an XML database and validate it using XML schema.
12. Create Document, column and graph based data using NOSQL database tools.

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	Fundamentals of Database Systems, Elmasri Navrate Pearson Education
2	Introduction to Database Systems, C.J.Date Pearson Education

Reference Books:

1	Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill 3rd Edition
2	Data base System Concepts, Silberschatz, Korth, McGraw hill, V edition

Course Code	Course Title	Lecture			Semester: IV
BTCS441HST	Technology and Society	L	T	P	
Version: 1.2	Date of Approval: 16th BoS 17-11-2022	1	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	1	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): No specific requisite.

Course Objectives:

1. To impart the scientific and technological developments affect society and the environment.
2. To understand the applications of science and technology in societal context.
3. To address science and technology to real-world problems.
4. To learn contributions, governance and ethical issues in the context of emerging technologies.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO1	Understand the scientific debates and ethical concerns of such issues as global warming, biotechnology, GMO foods, healthcare, innovation, and economic competitiveness.	PO1, PO2
CO2	Articulate ways in which society is transformed by science and technology.	PO3, PO6
CO3	Able to integrate, synthesize, and apply knowledge of the relationship between science and technology and societal issues in both focused and broad interdisciplinary contexts.	PO1, PO2, PO3,
CO4	Apply science and technology to real-world problems	PO7, PO8, PO9, PO12

PO1- Engineering Knowledge, **PO2**- Problem analysis, **PO3**- Design/development of solutions, **PO4**- Conduct investigations of complex problems, **PO5**- Modern tool usage, **PO6**- The engineer and society, **PO7**- Environment and sustainability, **PO8**- Ethics, **PO9**- Individual or team work, **PO10**- Communication, **PO11**- Project management and finance, **PO12**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2										
CO2			2			2						
CO3	2	2										
CO4							2	2	2			2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction and Thinking about Technology and Society**: Technological determinism and Techno social System, Technologies all around you, Relationship between technology and society, Role of Technology in Society, Role of society in development and use of Technology, technologies impact on society.
Unit: 2	**Social media and civic engagement:** Social structure and practice, Internet and cause o f social isolation, Social Construction of Technology (SCOT),War and Social Technologies Critics, Actor-Network theory
Unit: 3	**Risk and Disasters** Automation in the workplace, Socially constructing automation in the workplace, Technology and inequality, Technological Disasters and Normal Accidents **The Future of Technology-**The directions for future work
Unit: 4	**The Environment, and Waste** The Environmental History of Computing, Identify the causes of climate change, Assess the various impacts of climate change including economic, geopolitical, biological, meteorological, etc. the global political economy of waste
Unit: 5	**Gender and Technology**: Gender influences technologies and social organization of scientific and technical workspaces, technologies as both 'liberating' and 'limiting' women.

Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.	
Text Books:	
1	Technology and Society – 2010,by R.V.G Menon, Publisher: Pearson Education India; First edition (2010)
2	Impact of Science and Technology on Society – 2012,by Ishwar Singh , Publisher: S.K. Kataria & Sons; Reprint 2012 edition
3	Berger, Peter L. and Thomas Luckmann 1966. The Social Construction of Reality: A Treatise in the Sociology of Knowledge, New York: Anchor Books.
4	Latour, B. 2005. Reassembling the Social: An Introduction to Actor–Network Theory, Oxford, New York: Oxford University Press
Reference Books:	
1	Science Technology And Society – 2014,By K Siddhartha, Publisher: Kisalaya Publication; 1 Edition
2	Book: "The Future: Six Drivers of Global Change"
3	Jasanoff, Sheila et al. (eds.). 1995. Handbook of Science and Technology Studies. Thousand Oaks, CA: Sage Publications
4	Weinberg, Alvin. 1966. "Can Technology Replace Social Engineering?" TATF 23-30.

Course Code	Course Title	Lecture			Semester: IV
BTCS445PCT	Quantitative Skill	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	1	1	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	2	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): No specific requisites.

Course Objectives:

1. Develop effective business and professional etiquette
2. Enhance time and task management capabilities
3. Build impactful presentation and communication skills
4. Strengthen logical and analytical reasoning
5. Apply quantitative aptitude for problem-solving.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Demonstrate professional etiquette and communication in diverse settings.	PO_2,PO_6, PO_8, PO_{10}, PO_{11},PO_{12}
CO_2	Present ideas effectively using verbal, non-verbal, and visual communication.	PO_3,PO_9,PO_{10},PO_{11},
CO_3	Apply quantitative and reasoning skills to solve analytical and real-life problems.	PO_3,PO_2,PO_4,PO_5,PO_{10},PO_{12}
CO_4	Integrate soft skills and analytical reasoning for better professional performance.	PO_2,$P0_3$,PO_6,PO_8,PO_9,PO_{10},PO_{11}
CO_1	Demonstrate professional etiquette and communication in diverse settings.	PO_2,PO_6, PO_8, PO_{10}, PO_{11},PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1		1				2		2	2	3	2	2
CO_2			2						2	3	2	
CO_3		3	2	3	2					2		2
CO_4		2	2			1		2	3	3	2	

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Business Etiquette: Self-Assessment, consistency, strategic management, networking skills, interview and post interview etiquette, Workplace Etiquette, E-Mail Etiquette, Cultural etiquette **Social etiquette**: social and interpersonal communication
Unit: 2	**Time Management Skill:** Importance of time management, effective Time Management, Create Plan, goal Setting, Fix deadlines, Project Scheduling, Communication, Procrastination **Presentation Skill:** Storytelling, Verbal Communication, Body language, Stage presence, Active Listening, Posture, Voice Projection.
Unit: 3	**Quantitative Ability:** Number system, Percentages, Profit & loss, Ratio & Proportion, time & Work, Time speed distance, Blood Relations, Ages related problems, Mixtures and Allegations, Boats and streams, problems on Trains, Partnership, Data Interpretation
Unit: 4	**Verbal Reasoning:** Syllogism, Coding Decoding, Blood Relation, Logical Venn Diagram, Problems on Calendar, Direction Sense Test, Odd one Out, Statement and Arguments, Analogy.
Unit: 5	**Non-Verbal Reasoning:** Seating Arrangement, Data sufficiency, Alphanumeric series, Logical Based Puzzle, Mirror Image, Cube and Cuboid

Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.

Text Books:

1	Quantitative Techniques for Management, N.D. Vohra, McGraw Hill Education.
2	Quantitative Techniques, C.R. Kothari, Vikas Publishing House.

Reference Books:

1	Dale Carnegie,(2016).How to win Friends and Influence People. Gallery Books, New York
2	Scott Peck. M. (2003). Road Less Travelled Bantam Press, New York City.
3	SMART,(2018). Place Mentor, 1st edition Oxford University Press,Chennai.

Course Code	Course Title	Lecture			Semester-IV
BTCS441NCT	Essence of Indian Knowledge Tradition	L	T	P	
Version: 1.3	**Date of Approval: 20th BoS 02-03-2026**	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	-	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): No specific requisites.

Course Objectives:

1. To understand the foundations of Indian philosophical, scientific, and cultural knowledge systems.
2. To explore the relevance of Indian traditions in the context of sustainability, ethics, and modern life.
3. To gain insights into ancient contributions to mathematics, medicine, architecture, and logic.
4. To develop awareness of Indian value systems and their integration into education and leadership.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Recall the foundations of Indian philosophical and scientific traditions	**PO1, PO12**
CO_2	Explain the Indian epistemological framework and logic systems	**PO1, PO8**
CO_3	Compare ancient Indian sciences with modern scientific approaches	**PO1, PO7**
CO_4	Discuss relevance of traditional values and ethics in contemporary contexts	**PO6, PO7, PO8**
CO5	Reflect on Indian wisdom to propose applications in technology or management	**PO6, PO7, PO8, PO11, PO12**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2											1
CO_2	2							1				
CO_3	3					1	1					
CO_4						2	1	3				
CO5						2	1	1			1	2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction to Indian Knowledge Systems**: Overview of Indian intellectual traditions, Vedas, Upanishads, Darshanas (philosophical systems), Importance of Sanskrit in knowledge transmission.
Unit: 2	**Epistemology and Logic:** Means of knowledge (Pramāṇas): perception, inference, verbal testimony, Nyāya system and Indian logic, Indian approaches to knowledge classification.
Unit: 3	**Science and Technology in Ancient India:** Contributions to mathematics, astronomy, metallurgy, medicine (Ayurveda), Architecture and town planning (e.g., Vāstu Shāstra, Harappa), Water management, sustainable agriculture.
Unit: 4	**Values, Ethics, and Social Systems:** Concepts of Dharma, Artha, Kāma, Mokṣa, Gurukul system and educational values, Role of family, community, and women in ancient society.
Unit: 5	**Relevance in Modern Times:** Integration of Indian knowledge in NEP 2020, Environmental ethics and sustainable living, Applications in management, leadership, holistic health

Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.

Text Books:

1	Mathematical Foundation of Computer Science – Shahnaz Bathul, PHI.
2	Elements of Discrete Mathematics- A Computer Oriented Approach,C.L.Liu, D.P. Mohapatra,3edition,TMH.
3	Discrete Mathematics for Computer Scientists & Mathematicians, second edition, J.L.Mott, A. Kandel, T.P. Baker, PHI
4	Discrete and Combinatorial Mathematics- An Applied Introduction-5th Edition– Ralph. P.Grimaldi, Pearson Education

Reference Books:

1	Discrete Mathematics and its applications, 6th edition, K.H. Rosen, TMH.
2	Discrete Mathematical Structures, Mallik and Sen, Cengage Learning
3	Discrete Mathematical Structures, Bernand Kolman, Robert C. Busby, Sharon Cutler Ross, PHI/ Pearson Education
4	Discrete Mathematics with Applications, Thomas Koshy, Elsevier.
5	Logic and Discrete Mathematics, Grass Man and Tremblay, Pearson Education

Course Code	Course Title	Lecture			Semester: V
BTCS541PCT	Operating Systems	L	T	P	
Version: 1.3	**Date of Approval: 20th BoS 02-03-2026**	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Analog Electronic Circuits/ Digital Electronics

Course Objectives:

1. To understand fundamental operating system abstractions such as processes, threads, files, semaphores, IPC abstractions, shared memory regions, etc.,
2. To learn how the operating system abstractions can be used in the development of application programs, or to build higher level abstractions,
3. To acquire the principles of concurrency and synchronization, and apply them to write correct concurrent programs/software.
4. To impart the knowledge of various kinds of design principle of operating systems.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Demonstrate how to manage multiple tasks that execute at the same time and share resources including processes and threads, context switching, synchronization, schedule CPU time, and deadlock.	**PO_1, PO_2, PO_4**
CO_2	Design, implement and evaluate a computer-based system, process, components, or program to meet desired needs in context of operating system.	**PO_3**
CO_3	Identify the System calls, protection, interrupts and know Input/output, disk access, file systems facilities.	**PO_4**
CO_4	Apply semaphores and monitors for classical and real-world synchronization scenarios	**PO_3, PO_4, PO_6**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	1		1								
CO_2			2									
CO_3				1								
CO_4			2	1		2						

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**System Software:** Machine, Assembly and High-Level Languages; Compilers and Interpreters; Loading, Linking and Relocation; Macros, Debuggers. **Basics of Operating Systems:** Operating System Structure, Operations and Services; System Calls, Operating-System Design and Implementation; System Boot.
Unit: 2	**CPU Scheduling:** Scheduling Criteria and Algorithms; Thread Scheduling, Multiple-Processor Scheduling, Real-Time CPU Scheduling. **Deadlocks:** Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance and Detection; Recovery from Deadlock.
Unit: 3	**Memory Management:** Contiguous Memory Allocation, Swapping, Paging, Segmentation, Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files. **Disk Management:** Mass-Storage Structure, Disk Structure, Scheduling and Management, RAID Structure.
Unit: 4	**File and Input/Output Systems:** Access Methods, Directory and Disk Structure; File-System Mounting, File Sharing, File-System Structure and Implementation; Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance; Recovery, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Requests to Hardware Operations.
Unit: 5	**Security:** Protection, Access Matrix, Access Control, Revocation of Access Rights, Program Threats, System and Network Threats; Cryptography as a Security Tool, User Authentication, Implementing Security Defenses. **Windows and Linux Operating Systems:** Design Principles, File Systems, Input and Output; Inter-process Communication, Network Structure.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:	
1	Silberschatz, Galvin and Gagne, “Operating Systems Concepts”, Wiley
2	SibsankarHalder and Alex A Aravind, “Operating Systems”, Pearson Education
Reference Books:	
1	Harvey M Dietel, “An Introduction to Operating System”, Pearson Education
2	D M Dhamdhere, “Operating Systems: A Concept based Approach”, McGraw Hill
3	Charles Crowley, “Operating Systems: A Design-Oriented Approach”, Tata McGraw Hill Education”.
4	Stuart E. Madnick & John J. Donovan. Operating Systems. McGraw Hill

Course Code	Course Title	Lecture			Semester: V
BTCS542PCT	Design & Analysis of Algorithms	L	T	P	
Version: 1.3	**Date of Approval: 20th BoS 02-03-2026**	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Data Structure & Algorithm

Course Objectives:

1. To understand the concepts and skills of algorithm design, implemental some well-known algorithms and analyze the performance of algorithms
2. To define the complexity of algorithms, Reasoning about the correctness of the algorithm
3. To impart the concept of behaviors of algorithms and the notion of tractable and intractable problems.
4. To provide the knowledge of problem solving such as travelling sales person problem.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Analyze a given algorithm and express its time and space complexities in asymptotic notations and Solve recurrence equations using Iteration Method, Recurrence Tree Method and Master's Theorem.	**PO_1, PO_2, PO_3**
CO_2	Design algorithms using Divide and Conquer Strategy and Compare Dynamic Programming and Divide and Conquer Strategies.	**PO_3, PO_4**
CO_3	Solve Optimization problems using Greedy strategy and Design efficient algorithms using Back Tracking and Branch Bound Techniques for solving problems.	**PO_4, PO_9**
CO_4	Classify computational problems into P, NP, NP-Hard and NP-Complete and to understanding about writing algorithms and step by step approach in solving problems with the help of data structures.	**PO_2, PO_4**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2	3									
CO_2			3	2								
CO_3				2					1			
CO_4		2		2								

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction:** Algorithm, Pseudo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation- O notation, Omega notation, Theta notation **Divide and Conquer:** Structure of divide-and-conquer algorithms; Binary search; Merge Sort; Quick sort.
Unit: 2	**Greedy Method:** General method- Knapsack problem – job sequencing with deadlines– minimum-cost spanning trees: Prim's and Kruskal's algorithms – Single source shortest paths: Dijkstra's algorithm.
Unit: 3	**Dynamic Programming:** General method – Multistage Graphs – All pairs shortest paths, Single source shortest paths – optimal binary search trees – 0/1 Knapsack problem traveling sales person problem
Unit: 4	**Back Tracking:** General method – n-queen problem – sum of subsets problem – graph colouring – Hamiltonian cycles – Knapsack problem.
Unit: 5	**Branch and Bound:** Least Cost (LC) search, bounding – LC branch and bound – FIFO branch and bound – Travelling sales person problem, Computability classes – P, NP, NP-complete and NP-hard.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, "Introduction to Algorithms", Printice Hall of India.
2	Anany Levitin, "Introduction to the Design & Analysis of Algorithms", Pearson Education, 2007.

Reference Books:

1	RCT Lee, SS Tseng, RC Chang and YT Tsai, “Introduction to the Design and Analysis of Algorithms”, Mc Graw Hill, 2005.
2	E. Horowitz & S Sahni, "Fundamentals of Computer Algorithms", Berman, Paul,” Algorithms”, Cengage Learning.
3	Aho, Hopcraft, Ullman, “The Design and Analysis of Computer Algorithms” Pearson Education, 2008.

Course Code	Course Title	Lecture			Semester: V
BTCS541HST	Organizational Behavior	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	2	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): No specific requisites.

Course Objectives:

1. To develop cognizance of the importance of human behaviour.
2. To describe how people behave under different conditions.
3. To analyses specific strategic human resources demands for future action.
4. To synthesize related information and evaluate options for the most logical and optimal solution such that they would be able to predict and control human behaviour and improve results.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the applicability of the concept of organizational behaviour	PO_1, PO_2, PO_6
CO_2	Demonstrate the applicability of analyzing the complexities associated with management of individual behaviour in the organization.	PO_9, PO_{10}, PO_{11}
CO_3	Analyze the complexities associated with management of the group behaviour in the organization.	PO_8, PO_9
CO_4	Evaluate how the organizational behaviour can integrate in understanding the motivation (why) behind behaviour of people in the organization.	PO_8, PO_9, PO_{10}, PO_{11}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2				1						
CO_2									2	3	3	
CO_3								2	2			
CO_4								2	2	3	3	

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction:** Meaning, Fundamental concepts, Definition, Approaches to OB, Characteristics and limitations of OB, Challenges and Opportunities of OB, Models of OB.
Unit: 2	**Personality:** Definition, Features, Big five model, MBTI, Johari Window, Managerial Implications of Personality. Perceptions and Attributions: Definition, Features, factors affecting perception, Process. Attribution, perceptual and attribution errors, Managerial Implications of Perception.
Unit: 3	Learning: Definition, Features, Classical and operant conditioning, social learning theory, Behavioural modification. Attitude: Definition, Features, ABC model of Attitude, Managerial Implications of Attitude.
Unit: 4	**Motivation:** Concept, Definition, Features, Types of Motivation, Process, Managerial Implications of Motivation. Leadership: Concept, Definition, Leadership Styles, Transactional and Transformational Leadership, Leadership development.
Unit: 5	**Groups and Teams:** Definition, Features, Group development stages, Group vs. Teams, Managing and developing effective teams. Conflict Management: Definition, Features, Types of Conflict, Conflict Resolution Strategies, Relationship between Conflict and Performance. Organizational Culture: Elements and dimensions of organizational culture, Importance of organizational culture in shaping the behaviour of people.

Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.

Text Books:

1	Robbins, S. P., & Judge, T. (2013). Organizational behavior (15th ed.). Boston: Pearson.
2	Newstrom J. W., & Davis, K. (2011). Human behavior at work (12th ed.). Tata McGraw Hill
3	Nelson, D , Quick, J.C., & Khandelwal, P., (2011). ORGB . Cengage Learning.
4	Udai Pareek, Understanding Organizational Behavior, 2nd Edition, Oxford Higher Education, 2004.

Reference Books:

1	Pareek. U. (2010). Understanding Organizational Behavior (2nd ed.). Oxford University Press
2	Schermerhorn, J. R., Osborn, R.N., Hunt, M.U.J (2016). Organizational Behavior (12th ed.). Wiley

Course Code	Course Title	Lecture			Semester: V
BTCS542HST	History of Sciences & Technology in India	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	2	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): Basic knowledge of science

Course Objectives:

1. To acquire the knowledge the origin and development of astronomy in ancient India.
2. To understand the origin and growth of mathematics in ancient India.
3. To identify the origin and development of copper, gold, Iron and other metal in ancient India.
4. To know the prominent scientist of India since beginning and their achievement.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Recognize the development of Science Beginning and their achievement	PO_6, PO_7, PO_8
CO_2	Assess the growth of engineering in ancient India.	PO_9
CO_3	Find the significance of metallurgy in ancient India.	PO_7, PO_9
CO_4	Gain the knowledge of history from ancient India to modern India	PO_8, PO_{10}, PO_{12}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1						2	2					
CO_2									2			
CO_3							2		2			
CO_4								2		2		2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Science and Technology- The Beginning Development in different branches of Science in Ancient India: Astronomy, Mathematics, Engineering and Medicine. Developments in metallurgy: Use of Copper, Bronze and Iron in Ancient India. Development of Geography: Geography in Ancient Indian Literature.
Unit: 2	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. Developments in the fields of Mathematics, Chemistry, Astronomy and Medicine. Innovations in the field of agriculture - new crops introduced new techniques of irrigation etc.
Unit: 3	Developments in Science and Technology in Colonial India Early European Scientists in Colonial India- Surveyors, Botanists, Doctors, under the Company‘s Service.
Unit: 4	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: 5	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 and Dr. Vikram Sarabhai.

Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.

Text Books:

1	George G Joseph, Crest of the Peacock, Non-European roots of mathematics, Third edition, Princeton University Press, Princeton, NJ, 2011.
2	Agrawal, D.P., Ancient Metal Technology and Archaeology of South Asia (A Pan-Asian Perspective), Aryan Books International, New Delhi, 2000

Reference Books:

1	Cunningham , Alexander , The Ancient Geography of India. Indological Book House, Varanasi, 1963.
2	Dey, N. L., The Geographical Dictionary of Ancient and Medieval India. Luzac and Co., London, 1927.

Course Code	Course Title	Lecture			Semester: V
BTCS543PCT	Theory of Computation	L	T	P	
Version:	Date of Approval: 16th BoS	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Pre-requisites: Discrete Mathematics

Course Objectives:

1. To understand the foundations of computation including finite automata and formal languages.
2. To construct finite automata and equivalent regular expressions for recognizing regular languages.
3. To design context-free grammars and pushdown automata for context-free languages.
4. To analyze the capabilities and limitations of Turing machines.
5. To evaluate decidability, undecidability, and NP-completeness of computational problems.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO1	To understand the foundations of computation including finite automata and formal languages.	PO1, PO2, PO4, PO12
CO2	To construct finite automata and equivalent regular expressions for recognizing regular languages.	PO1, PO2, PO3, PO4, PO5, PO12
CO3	To design context-free grammars and pushdown automata for context-free languages.	PO1, PO2, PO3, PO4, PO5, PO12
CO4	To analyze the capabilities and limitations of Turing machines.	PO1, PO2, PO4, PO5, PO12
CO5	To evaluate decidability, undecidability, and NP-completeness of computational problems.	PO1, PO2, PO4, PO5, PO12

PO1- Engineering Knowledge, **PO2**- Problem analysis, **PO3**- Design/development of solutions, **PO4**- Conduct investigations of complex problems, **PO5**- Modern tool usage, **PO6**- The engineer and society, **PO7**- Environment and sustainability, **PO8**- Ethics, **PO9**- Individual or team work, **PO10**- Communication, **PO11**- Project management and finance, **PO12**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	2	1	2							1	
CO_2	3	2	2	2							1	
CO_3	3	2	2	2							1	
CO_4	3	2	1	3							1	
CO5	3	3	1	3							1	

3 – High; 2 – Medium; 1 – Low

Detailed Contents:

Unit: 1	AUTOMATA AND REGULAR EXPRESSIONS Need for automata theory , Introduction to formal proof – Finite Automata (FA) , Deterministic Finite Automata (DFA) , Non-deterministic Finite Automata (NFA) , Equivalence between NFA and DFA , Finite Automata with Epsilon transitions , Equivalence of NFA and DFA, Equivalence of NFAs with and without ε-moves, Conversion of NFA into DFA , Minimization of DFAs.
Unit: 2	REGULAR EXPRESSIONS AND LANGUAGES Regular expression, Regular Languages- Equivalence of Finite Automata and regular expressions, proving languages to be not regular (Pumping Lemma), Closure properties of regular languages, Mealy Machine, Moore Machine.
Unit: 3	CONTEXT FREE GRAMMAR Types of Grammar - Chomsky's hierarchy of languages -Context-Free Grammar (CFG) and Languages , Derivations and Parse trees – Ambiguity in grammars and languages, Normal forms for CFG , Simplification of CFG- Chomsky Normal Form (CNF) and Greibach Normal Form (GNF) , Pumping lemma for CFL , Closure properties of Context Free Languages
Unit: 4	Push Down Automata (PDA): Definition, Moves - Instantaneous descriptions, Languages of pushdown automata, Equivalence of pushdown automata and CFG-CFG to PDA-PDA to CFG, Deterministic Pushdown Automata.
Unit: 5	Turing Machine: Basic model, definition and representation, Instantaneous Description, Language acceptance by TM Decidability and Recursively enumerable languages, The Post Correspondence Problem, The classes of P and NP

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:	
1	K.L.P.Mishra and N.Chandrasekaran, “Theory of Computer Science: Automata Languages and Computation”, 3rd Edition, Prentice Hall of India, 2006.
2	Hopcroft J.E., Motwani R. & Ullman J.D., "Introduction to Automata Theory, Languages and Computations", 3rd Edition, Pearson Education, 2008
Reference Books:	
1	John C Martin , "Introduction to Languages and the Theory of Computation", 4th Edition, Tata McGraw Hill, 2011
2	Peter Linz, "An Introduction to Formal Language and Automata", 6th Edition, Jones & Bartlett, 2016.

Course Code	Course Title	Lecture			Semester: V
BTCS542PCP	Design & Analysis of Algorithms LAB	L	T	P	
Version: 1.3	**Date of Approval: 20th BoS 02-03-2026**	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Design & Analysis of Algorithms

Course Objectives:

1. To write programs to solve problems using divide and conquer strategy.
2. To develop programs to solve problems using backtracking strategy.
3. To experiment programs to solve problems using greedy and dynamic programming techniques.
4. To implement various problems of searching and sorting.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Implement various data structures (viz. Stacks, Queues, Linked Lists, Trees, Graphs) and algorithms like Greedy, Dynamic, Divide & Conquer etc.	PO_2, PO_3, PO_5
CO_2	Analyze step by step and develop algorithms to solve real world problems.	PO_2, PO_3, PO_5, PO_9
CO_3	Use and implement appropriate algorithms for the required problems using a programming language.	PO_2, PO_3, PO_4
CO_4	Analyze the space and time complexity of a given problem	PO_4, PO_9

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1		2	2		2							
CO_2		2	2		2				1			
CO_3		2	2	2								
CO_4				2					1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

1. Sort a given set of elements using the quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the 1st to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
2. Implement merge sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
3. Implement 0/1 Knapsack problem using Dynamic Programming.
4. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
5. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
6. Find a subset of a given set S = $\{s_1, s_2, ..., s_n\}$ of n positive integers whose sum is equal to a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions {1, 2, 6} and {1, 8}. A suitable message is to be displayed if the given problem instance doesn't have a solution.
7. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
8. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.
9. Implement N Queen's problem using Back Tracking.
10. Implement the travelling salesperson problem (TSP) using dynamic programming.

Note: Students can implement more algorithms based on prescribed syllabus.

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	Data structures, Algorithms and Applications in java, 2nd Edition, S. Sahani, Universities Press.
2	Data structures and Algorithms in java, 3rd edition, A. Drozdek, Cengage Learning.

Reference Books:

1	Data structures with Java, J. R. Hubbard, 2nd edition, Schaum's Outlines, TMH.
2	Data Structures using Java, D. S. Malik and P.S. Nair, Cengage Learning

Course Code	Course Title	Lecture			Semester: V
BTCS541PCP	Operating Systems LAB	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Operating Systems

Course Objectives:

1. To write programs in Linux environment using system calls.
2. To implement the scheduling algorithms.
3. To develop solutions for synchronization problems using semaphores.
4. To impart the knowledge of file organization techniques.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the concept of Linux environment.	PO_1
CO_2	Develop application programs using system calls in UNIX.	PO_3, PO_5
CO_3	Implement inter-process communication between two processes.	PO_5
CO_4	Design and solve synchronization problems.	PO_3, PO_9

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2											
CO_2			2		2							
CO_3					2							
CO_4			2						1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

1. Basics of UNIX commands.
    a. Git Bash
    b. File & Directory operations such as listing, copying, moving, deleting, creating and navigating.
    c. System Information Commands such as Kernel information, Memory Usage, Disk Usage, Process Management, Network Configuration commands.
2. Shell programming
    a. Bourne Again Shell (bash)
    b. Shell programs on Operations on numbers such as addition, subtraction, Division, Multiplication, Even/Odd, Get User Input, For Loop, While Loop, Factorial Calculation, Reverse a String, Fibonacci Series, Check Internet Connectivity etc.
3. Implementation of CPU scheduling: Understanding the Algorithm, practical programs and Performance Evaluation metrics such as Average Waiting Time, Average Turnaround Time, Throughput, CPU Utilization, and Response Time for each of the following:
    a. First Come First Serve Algorithm
    b. Shortest Job First and Shortest Remaining Time First Algorithm
    c. Round Robin Algorithm
    d. Priority ALgorithm
4. Implement file allocation strategies: Understanding the Algorithm and practical programs of the following
    a. Contigious File Allocation
    b. Linked File Allocation
    c. Indexed File Allocation
5. Implement File Organization Techniques: Understanding the Algorithm and practical programs of the following
    a. Sequential File Organization
    b. Random or Direct File Organization
    c. Serial File Organization
    d. Indexed-Sequential File Organization
    e. Heap File Organization

6. Implement the page replacement algorithms: Understanding the Algorithm and practical programs of the following a. First in First Out Algorithm b. Least Recently Used Algorithm c. Optimal Page Replacement Algorithm	
Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.	
Text Books:	
1	An Introduction to Operating Systems, P.C.P Bhatt, 2nd edition, PHI.
Reference Books:	
1	Modern Operating Systems, Andrew S Tanenbaum, 3rd Edition, PHI
2	Unix System Programming Using C++, Terrence Chan, PHI/Pearson.

Course Code	Course Title	Lecture			Semester: V
BTCS541NCT	Constitution of India	L	T	P	
Version: 1.3	**Date of Approval: 20th BoS 02-03-2026**	2	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	50
Periods/ Week	:	2	Internal Evaluation	:	15
Credits	:	-	End Semester	:	35
Instruction Mode	:	Lecture	Exam Duration	:	2 Hrs.

Prerequisite(s): No specific pre-requisite.

Course Objectives:

1. To understand the salient features of the Indian Constitution.
2. To learn different ways of acquiring Indian Citizenship.
3. To impart the knowledge of the fundamental rights and fundamental duties of Indian citizens.
4. TO describe the directive principles of state policy and their significance.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Practice the moral values that ought to guide the Engineering profession.	PO_6, PO_8
CO_2	Know the definitions of risk and safety also discover different factors that affect the perception of risk.	PO_6, PO_8
CO_3	Appreciate the Ethical issues and know the code of ethics adopted in various professional bodies and industries.	PO_6, PO_7, PO_8
CO_4	Justify the need for protection of human rights and to know about concept of women empowerment.	PO_6, PO_8, PO_{12}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1						2		2				
CO_2						2		2				
CO_3						2	2	2				
CO_4						2		2				2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Introduction: Constitution' meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy
Unit: 2	Union Government and its Administration: Structure of the Indian Union: Federalism, Centre-State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha
Unit: 3	State Government and its Administration: Governor: Role and Position, CM and Council of ministers, State Secretariat: Organization, Structure and Functions
Unit: 4	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	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

Examination and Evaluation Pattern: It include both internal evaluation (15 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (35 marks) which is mainly end semester examination.

Text Books:

1	'Indian Polity' by Laxmikanth
2	'Indian Administration' by Subhash Kashyap

Reference Books:

1	'Indian Constitution' by D.D. Basu
2	Indian Administration' by Avasti and Ava

Course Code	Course Title	Lecture			Semester: VI
BTCS641PCT	Compiler Design	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Formal Language & Automata Theory

Course Objectives:

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

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Analyze given grammar specification develop the lexical analyzer.	$PO_1, PO_3,$
CO_2	Apply given parser specification design top-down and bottom-up parsers.	PO_3, PO_4, PO_5
CO_3	Develop syntax directed translation schemes.	PO_3, PO_4
CO_4	Implement algorithms to generate code for a target machine.	PO_3, PO_5

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2		2									
CO_2			2	2	2							
CO_3			2	2								
CO_4			2		2							

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**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	**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 (yacc, bison).
Unit: 3	**Semantic Analysis:** Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree. Symbol Table: Its structure, symbol attributes and management. Run-time environment: Procedure activation, parameter passing, value return, memory allocation, and scope.
Unit: 4	**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.
Unit: 5	**Architecture dependent code improvement:** instruction scheduling (for pipeline), loop optimization (for cache memory) etc. Register allocation and target code generation **Advanced topics:** Type systems, data abstraction, compilation of Object Oriented features and non-imperative programming languages.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Principles of compiler design -A.V. Aho .J.D.Ullman; Pearson Education.
2	Modern Compiler Implementation in C- Andrew N. Appel, Cambridge University Press.

Reference Books:

1	lex&yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly
2	Modern Compiler Design- Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, Wiley dreamtech. 3.
3	Engineering a Compiler-Cooper & Linda, Elsevier
4	Compiler Construction, Louden, Thomson.

Course Code	Course Title	Lecture			Semester: VI
BTCS642PCT	Computer Networks	L	T	P	
Version: 1.3	**Date of Approval:** 18th BoS 27-02-2024	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Operating System

Course Objectives:

2. To understand the fundamental concepts of data communications and computer Networks s.
3. To identify the basic components/instrument/equipment and their respective roles in data communication system
4. To incorporate networks skills in various capacities like Networks administrators, Networks designers.
5. To provide the concept of world wide web and their generations.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Demonstrate the different protocols layers of the OSI model & TCP/IP.	PO_1, PO_6
CO_2	Implement and configure the different types of Networks topologies and protocols.	PO_2, PO_3, PO_8
CO_3	Understand the importance of network security in data communication	PO_6
CO_4	Apply the different Networking sub-systems and their functions in a telecommunication system.	PO_2, PO_3, PO_4

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2					2						
CO_2		1	2					2				
CO_3						2						
CO_4		2	2	2								

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Data Communication:** Data and Information; Components of Data Communication system; Data Flow/Data Transmission Mode: Simplex, Half-Duplex, Duplex; Components of Computer Network; Data Communication Medium; Digital and Analog Transmission. **Classification of Computer Networks:** Networks, LAN, MAN, WAN, PAN; Network and its Devices; Network Topology; ARPANET; Internet; Bitrate; Baud Rate; Bandwidth; Throughput and Latency
Unit: 2	**Computer Networks**: Network hardware (Machine, Node, Device); Network software; Network Application; Network Architecture Models/OSI Reference Model; Network port and Address. **Physical Layer:** Transmission media: Guided Media, Unguided Media; Nodes: End, Intermediate; Switching: Circuit switched Network, Packet-Switch;
Unit: 3	**Data Link Layer:** Link-layer addressing; Services; Sub-layers; Framing; Error and Types; Error Detection and Correction Technique; Sliding Window Protocol **Multiple/Media Access Control** – CSMA/CD, CSMA/CA, Reservation, Polling, Token Passing, FDMA, CDMA, TDMA; Link layer Network Devices, Virtual LANs; **IEEE Standards 802.11.**
Unit: 4	**Network Layer:** Routing algorithms, TCP, UDP and SCTP Protocols; Congestion Control Algorithms; Quality of Service; Internetworking; Network layer in the internet (IPv4 and IPv6); IPv6 Packet Format, Mapping Logical to Physical Address (ARP); Flow Control, Error Control and Congestion Control in TCP and SCTP.
Unit: 5	**World Wide Web (WWW):** Uniform Resource Locator (URL), Domain Name Service (DNS), Resolution - Mapping Names to Addresses and Addresses to Names; Electronic Mail Architecture, SMTP, POP and IMAP; TELNET and FTP. **Network Security**: Malwares, Cryptography and Steganography; Secret-Key Algorithms, Public-Key Algorithms, Digital Signature, Virtual Private Networks, Firewalls.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Forouzen, "Data Communication and Networks ing", TMH
2	A.S. Tanenbaum, “Computer Networks s”, 3rd Edition, Prentice Hall India, 1997.
Reference Books:	
1	S. Keshav, “An Engineering Approach on Computer Networks ing”, Addison Wesley, 1997
2	W. Stallings, “Data and Computer Communication”, Macmillan Press, 1989

Course Code	Course Title	Lecture			Semester: VI
BTCS641EST	Software Engineering	L	T	P	
Version: 1.3	**Date of Approval: 20th BoS 02-03-2026**	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Data Structure & Algorithm

Course Objectives:

1. To understand the fundamentals of software engineering including analysis, design, construction, maintenance, quality assurance and project management.
2. To learn appropriate computer science and mathematics principles in the development of software systems.
3. To acquire software requirement elicitation, methods of coding and testing software products.
4. To impart the concept of the measurement techniques, quality control aspects.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand software engineering theory, principles, tools and processes, as well as the theory and principles of computer science.	**PO_1, PO_2**
CO_2	Apply mathematics to the development and maintenance of complex software systems.	**PO_3**
CO_3	Design and test specific software requirements through a productive working relationship with project stakeholders.	**PO_3, PO_5**
CO_4	Verify and validate various software prototypes and to develop quality software metrics.	**PO_4, PO_9**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2			2									
CO_3			2		2							
CO_4				2					1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Software Engineering Fundamentals:** Definition of software product and process, Software Characteristics, Components, Applications, Layered Technologies, Processes and Product, Methods and Tools, Generic View of Software Engineering, Software Crisis, Software development paradigms, Techniques of Process Modelling, Software Process and lifecycle models
Unit: 2	**Software Requirements Analysis & Specification:** System specification, Software requirements specification (SRS) standards, Analysis and Design Modelling: ER Diagram, Dataflow Model, Control Flow Model, Control and Process Specification, Data Dictionary.
Unit: 3	**Software Design:** Software architecture, Modular Design-cohesion and coupling, Process-oriented design, Process and Optimization, Data-oriented design, User-interface design, Real-time software design, Architectural Designing, Interface Design, Procedural Design, Object Oriented Design. **CASE Tools:** Computer-aided software engineering, Introduction to CASE, Building Blocks of CASE, Relevance of CASE tools, High-end and low-end CASE tools, automated support for data dictionaries, DFD, ER diagrams, Integrated Case Environment, CASE workbenches.
Unit: 4	**Coding and Testing:** Choice of Programming languages, Coding standards for Software. User Interface Design: Concepts of Ui, Interface Design Model, Internal and External Design, Evaluation, Interaction and Information Display Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top-Down and Bottom-Up Testing.
Unit: 5	**Configuration Management:** Concepts in Configuration Management, The Configuration Management Process: Planning and Setting up Configuration Management, Perform Configuration Control, Status Monitoring and Audits. **Software Maintenance:** What is software maintenance, Maintenance Process & Models, Reverse Engineering, Software re-engineering, Configuration Management issues and concept,

	Configuration planning & techniques, Software versions and change control process, Documentation.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	R. Pressman, "Software Engineering", 7th Edition, 2010, McGraw-Hill.
2	Yogesh Singh "Software Engineering" , 3rd Edition, 2007, New Age Publications, Delhi.
Reference Books:	
1	W.S. Jawadekar, "Software Engineering", 2008, A Primer, TMH.
2	Shari Pfleeger, "Software Engineering", 2010, Pearson Education.
3	Stephen Schach, "Software Engineering", 2007, TMH.

Course Code	Course Title	Lecture			Semester: VI
BTCS641PCP	Compiler Design LAB	L	T	P	
Version: 1.3	**Date of Approval:** 18th BoS 27-02-2024	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Compiler Design

Course Objectives:

1. To identify tokens by lexical analysis.
2. To design LL parsers and LR parser.
3. To develop syntax directed translation schemes.
4. To develop algorithms to generate code for a target machine.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Apply given grammar specification develop the program for lexical analyzer	PO_3, PO_4, PO_5
CO_2	Implement given parser specification develop the program for top-down and bottom-up parsers	$PO_3, PO_4,$
CO_3	Develop program for syntax directed translation scheme	PO_3, PO_4
CO_4	Develop algorithms to generate code for a target machine	PO_3, PO_4, PO_5

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1			2	2	2							
CO_2			2	2								
CO_3			2	2								
CO_4			2	2	2							

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Section A List of Experiments using Lex and YACC tools:

1. Write a Lex program to find Keyword, Identifier, Constant, Special Characters, Whitespace.
2. Write a Lex program to find and count Vowels and Consonants.
3. Write a Lex program to find and count Upper Case and Lower Case.
4. Write a Lex program to find and count Capital Words and Small Words.
5. Write a Lex program to count the number of Lines, Words, Spaces and Characters.
6. Write a Lex program to recognize given statement is Simple or Compound.
7. Write a Lex and YACC program to recognize valid arithmetic expression (+, -, *, / operators).
8. Write a Lex and YACC program to recognize valid relational expression.
9. Write a Lex and YACC program to recognize declarative statements.
10. Write a Lex and YACC program to implement basic calculator.

Section B List of Experiments using C Programming:

11. Write a C program to read a file and display Number of characters, Number of digits, Number of spaces, Number of lines, Number of special characters, Number of letters.
12. Write a C program display whether the given input is keyword or not.
13. Write a C program to check whether the given string is accepted by given DFA or not.
14. Write a C program to implement Lexical Analyzer.
15. Write a C program to remove left recursion from a given grammar.
16. Write a C program to remove left factoring from given grammar.
17. Write a C program to find FIRST() sets and FOLLOW() sets of as given grammar.
18. Write a C program to derive the predictive parse table.
19. Write a C program to check whether a given string belongs to operator grammar or not.
20. Write a C program to check whether a given string belongs to grammar or not by using predictive parse

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	Principles of compiler design -A.V. Aho .J.D.Ullman; Pearson Education.
2	Modern Compiler Implementation in C- Andrew N. Appel, Cambridge University Press.

Reference Books:

1	lex&yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly

2	Modern Compiler Design- Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, Wiley dreamtech. 3.
3	Engineering a Compiler-Cooper & Linda, Elsevier
4	Compiler Construction, Louden, Thomson.

Course Code	Course Title	Lecture			Semester: VI
BTCS642PCP	Computer Networks LAB	L	T	P	
Version: 1.3	**Date of Approval: 20th BoS 02-03-2026**	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	3 Hrs.

Prerequisite(s): Computer Networks

Course Objectives:

1. To understand the functionalities of various layers of OSI model.
2. To understand the operating System functionalities.
3. To implement Dijkstra 's algorithm to compute the shortest path through a graph.
4. To write a program to break the above DES coding.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Apply the encryption and decryption concepts in Linux environment.	PO_2, PO_3, PO_4
CO_2	Ability to apply appropriate algorithm for the finding of shortest route.	PO_3, PO_4, PO_5
CO_3	Ability to configure the routing table.	PO_4, PO_5
CO_4	Able to apply essential protocols in network design and implementation	PO_3, PO_5, PO_9

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1		2	2	2								
CO_2			2	2	2							
CO_3				2	2							
CO_4			2		2				1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

1. Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP .
2. Implement Dijkstra's algorithm to compute the Shortest path thru a graph.
3. Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm
4. Using RSA algorithm encrypts a text data and Decrypt the same
5. Write TCL Script for connecting two nodes and sending packets in wired network.
6. Write TCL Script for given STAR topology using SFQ on queue at intermediate node & use different colors for packet originated from different nodes.
7. Write TCL Script for given RING topology in wired network using For loop & making topology dynamic.
8. Write TCL Script in wired network for the given topology using TCP connection and sending data through the node.
9. Write TCL Script in wired network for the given topology using UDP connection and sending data through node.

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	Forouzen, "Data Communication and Networks ing", TMH
2	A.S. Tanenbaum, "Computer Networks s", 3rd Edition, Prentice Hall India, 1997.

Reference Books:

1	S. Keshav, "An Engineering Approach on Computer Networks ing", Addison Wesley, 1997
2	W. Stallings, "Data and Computer Communication", Macmillan Press, 1989
3	Introduction to Network Simulator NS2- Open Source

Course Code	Course Title	Lecture			Semester: VI
BTCS641PRP	Project-I	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	0	0	6	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	100
Lab Hours/ Week	:	6	Internal Evaluation	:	50
Credits	:	3	End Semester	:	50
Instruction Mode	:	Practical	Exam Duration	:	-

Prerequisite(s): Programming for Problem Solving & Design and Analysis of Algorithm

Course Objectives:

1. To understand Software requirement specification and designing methodology.
2. To familiarize of the syntax, semantics, data-types and library functions of any programming languages.
3. To apply ER Diagram, DFD, UML for designing the software application.
4. To implement the specified problems.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Applying SRS, techniques	PO_2, PO_3, PO_8, PO_9, PO_{11}
CO_2	Apply Design methods for given SRS	PO_3, PO_5, PO_9, PO_{11}
CO_3	Write the codes as per SRS and designed Framework	PO_3, PO_5
CO_4	Able to implement real world problem into software solution	PO_3, PO_5, PO_9, PO_{11}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1		2	2					2	2		2	
CO_2			2		2				2		2	
CO_3			2		2							
CO_4			2		2				2		2	

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

- Based on real-time/ in-house/ problem specific

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	Real World Software Project for Computer Science and Engineering Students, Varun Gupta and Anh Nguyen-Duc-CRP Press.
2	Computer Science Experiments, Pamela Walker and Elaine Wood
3	Planning and Implementing your Final Year Project -M.Berndtsson,J.Hansson-Springer

Course Code	Course Title	Lecture			Semester: VII
BTCS741PCT	Artificial Intelligence	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Computer Architecture & Organization

Course Objectives:

1. To understand the concept of intelligent human behaviors on a computer.
2. To learn the concept of Artificial intelligence, include: problem solving, reasoning, planning, natural language understanding, computer vision, automatic programming, and machine learning.
3. To learn and possess a firm grounding in the existing techniques and component areas of Artificial Intelligence.
4. To apply this knowledge to the development of Artificial Intelligent Systems and to the exploration of research problems.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the concept of intelligent human behaviors on a computer	PO_1, PO_2
CO_2	Be familiar with techniques for computer-based representation and manipulation of complex information, knowledge, and uncertainty.	PO_2, PO_4
CO_3	Gain awareness of several advanced AI applications and concepts	PO_2, PO_9
CO_4	Apply various machine learning algorithms to solve real-life problem.	PO_3, PO_5, PO_9

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2		2		2								
CO_3		2							1			
CO_4			2		2				1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction**: Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Possessing.
Unit: 2	**Introduction to Search** : Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games, Alpha - Beta pruning.
Unit: 3	**Knowledge Representation** & Reasoning: Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.
Unt: 4	**Machine Learning** : Supervised and unsupervised learning, Decision trees, Statistical learning models, Learning with complete data - Naive Bayes models, Learning with hidden data – EM algorithm, Reinforcement learning.
Unit: 5	**Pattern Recognition** : Introduction, Design principles of pattern recognition system, Statistical Pattern recognition, Parameter estimation methods - Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Classification Techniques – Nearest Neighbor (NN) Rule, Bayes Classifier, Support Vector Machine (SVM), K – means clustering.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Stuart Russell, Peter Norvig, “Artificial Intelligence – A Modern Approach”, Pearson Education.
2	Elaine Rich and Kevin Knight, “Artificial Intelligence”, McGraw-Hill.

Reference Books:

1	E Charniak and D McDermott, “Introduction to Artificial Intelligence”, Pearson Education.
2	Dan W. Patterson, “Artificial Intelligence and Expert Systems”, Prentice Hall of India.

Course Code	Course Title	Lecture			Semester: VII
BTCS742PCT	Machine Learning	L	T	P	
Version: 1.3	**Date of Approval:** 18th BoS 27-02-2024	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Data Mining and Data Ware Housing

Course Objectives:

1. To understand the basic building blocks and general principles that allow one to design machine learning algorithms.
2. To become familiar with specific, widely used machine learning algorithms.
3. To learn methodology and tools to apply machine learning algorithms to real data and evaluate their performance.
4. To provide the concept of various machine learning modelling paradigms.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the basic concept of machine learning.	PO_1, PO_2
CO_2	Analyze a variety of learning algorithms to data.	PO_2, PO_3, PO_5
CO_3	Apply the Neural Networks and its usage in machine learning application.	PO_4
CO_4	Perform evaluation of learning algorithms and model selection.	PO_4, PO_9

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2		2	2		2							
CO_3				2								
CO_4				2					1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction:** Machine Learning, Need of Machine Learning, Application of Machine Learning, Types of Machine Learning, Design cycle of Machine Learning. **Machine Learning Statistic:** Data, Dataset, Features, Data formats: Primary, Secondary, Qualitative, Quantitative; Descriptive Statistic, Inferential Statistic, Measure of Central Tendency, Measure of Dispersion**.**
Unit: 2	**Exploratory Data Analysis:** Data Collection Techniques, Data Cleansing / Preprocessing, Outliers handling, Univariate Analysis, Bi-variate Analysis, Hypothesis: Null-hypothesis, Alternate-hypothesis; Bias-Variance tradeoff. **ML basic Libraries:** Pandas, Numpy, Matplotlib, Seaborn, Scikit-Learn.
Unit: 3	**Supervised-Learning:** *Regression* – Linear Regression, Support Vector Regression (SVR). Best fit line, Residual, cost function, learning rate, Gradient Descent: Global minima, Local minima; Under fitting, Over fitting. *Classification* - Logistic Regression, Sigmoid function, KNN Algorithm.
Unit: 4	**Decision Tree Learning:** Concept of decision tree, Using ID3 and CART algorithm, Picking the Splitting attribute: Entropy, Information Gain. **Ensemble Learning:** Base leaner (weak learner), Bagging (Bootstrap aggregation), Boosting: Ada-Boost, XGboost, Gradient Boosting;
Unit: 5	**Support Vector Machines:** Hyper plane, Support Vectors, Kernal Function: Linear, Polynomial, RBF; Maximum margin linear separator. Bayesian Learning: Bayes rule, Naïve Bayes learning algorithm, Bayes nets and Markov nets. **Clustering :** K-Mean clustring: Centroid, Distance Metric, Elbow method for clustering.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Machine Learning – Tom M. Mitchell, - MGH
2	Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis (CRC)

Reference Books:

1	Machine Learning Methods in the Environmental Sciences, Neural Networks, William W Hsieh, Cambridge Univ Press.
2	Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995

Course Code	Course Title	Lecture			Semester: VII
BTCS743PCT	Introduction to cyber security(CNS)	L	T	P	
Version:	Date of Approval: 16th BoS 17-11-2022	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Pre-requisites: Cyber Security

Course Objectives:

1. Understand the concept of Cybercrime & digital forensic , digital evidence & its role.
2. Interpret & apply various digital forensic models.
3. Interpret & apply various phases of methodology on incident.
4. Interpret & apply digital forensic Tools in real-Time scenario.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO1	Analyze the need for cybercrime investigation and understand The hardware and software components responsible for seekingevidence.	PO1, PO5
CO2	Apply knowledge on the techniques used for collecting evidences.	PO1, PO2, PO3, PO4
CO3	Analyze the evidence through suitable tools.	PO3, PO4, PO5, PO10
CO4	Analyse other sources of evidences	PO2, PO3, PO4

PO1- Engineering Knowledge, **PO2**- Problem analysis, **PO3**- Design/development of solutions, **PO4**- Conduct investigations of complex problems, **PO5**- Modern tool usage, **PO6**- The engineer and society, **PO7**- Environment and sustainability, **PO8**- Ethics, **PO9**- Individual orteam work, **PO10**- Communication, **PO11**- Project management and finance, **PO12**- Life-long Learning.

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2				2							
CO_2	2	3	3	3								
CO_3			3	2	1					3		
CO_4		2	3	2								

3 – High; 2 – Medium; 1 – Low

Detailed Contents:

Unit: 1	Cyber Security Concepts CIA, Risks, Breaches, Threats, Attacks, Exploits. Information Gathering (Social Engineering, Foot Printing & Scanning). **Open Source/ Free/ Trial Tools,** Port Scanners, Network scanners Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, **Overview of Firewalls-** Types of Firewalls, User Management, VPN Security, **Security Protocols:** - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec.
Unit: 2	Infrastructure and Network Security System Security, Server Security, OS Security,Physical Security, Network packet Sniffing, Network Design Simulation. DOS/ DDOS attacks. Asset Management and Audits, Intrusion detection and Prevention Techniques, Network Session Analysis, System Integrity Validation. Internet Security, Cloud Computing & Security, Social Network sites security, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Access control, Open Web Application Security Project (OWASP),
Unit: 3	Malware Explanation of Malware, Types of Malware: Virus, Worms, Trojans, Rootkits, Robots, Adware's, Spywares, Ransom wares, Zombies etc., OS Hardening (Process Management, Memory Management, Task Management, Windows Registry/ services another configuration), Malware Analysis. Open Source/ **Free/ Trial Tools:** Antivirus Protection, Anti Spywares, System tuning tools, Anti Phishing.

Unit: 4	**Security in Evolving Technology:** Biometrics, Mobile Computing and Hardening on android and ios, IOT Security, Web server configuration and Security. Introduction, Basic security for HTTP Applications and Services, Basic Security for Web Services like SOAP, REST etc., Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges.
Unit: 5	Cyber Laws and Forensics Cyber Security Regulations, Roles of International Law, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013.Cyber Forensics, Cyber Evidence, Documentation and Management of Crime Sense, Image Capturing and its importance, Partial Volume Image, Web Attack Investigations, Internet Forensics, Email Crime Investigations.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	William Stallings, "Cryptography and Network Security", Pearson Education/PHI, 2006.
2	V.K. Jain, "Cryptography and Network Security", Khanna Publishing House.
3	Gupta Sarika, "Information and Cyber Security", Khanna Publishing House, Delhi.

Reference Books:

1	Atul Kahate, "Cryptography and Network Security", McGraw Hill.
2	V.K. Pachghare, "Cryptography and Information Security", PHI Learning
3.	Bothra Harsh, "Hacking", Khanna Publishing House, Delhi. Reference Websites http://www.ignou.ac.in/upload/Announcement/programmedetails.pdf 69

Course Code	Course Title	Lecture			Semester: VII
BTCS742PCP	Machine Learning Lab	L	T	P	
Version: 1.2	Date of Approval:	0	0	4	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	50
Credits	:	2	End Semester	:	50
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Statistics, Python Basics

Course Objectives:

1. To understand the basic concepts and techniques of machine learning through python programming.
2. To develop skills of using recent machine learning packages for solving practical problems.
3. To gain experience of doing independent study and research.
4. To design and implement Machine learning Algorithms.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Able to demonstrate python packages	PO_1, PO_2
CO_2	Able to generate and analyze and interpret data using python	PO_2, PO_3
CO_3	Use Python to design and implement classifiers for machine learning applications.	PO_2, PO_3, PO_4
CO_4	Implement an end-to-end machine learning system	PO_2, PO_3, PO_4, PO_5

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2						2				
CO_2			2									
CO_3						2		2				
CO_4			2	2				2	1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

1. Write a Python Program to find the Union and Intersection of two list.
2. Implement a Python Code to map two list into dictionary and create a manual dataset.
3. Using pandas library handle the missing value by applying fillna(), replace() and interpolate().
4. Utilize the pandas library to import dataset from local drive, mounting the drive on jupyter, import dataset from skit-learn and kaggle API.
5. Write a program to handle Categorical data (Encoding techniques).
6. With Pandas, Sklearn Library perform data normalization.
7. Write a program to perform data preprocessing on any data set and save cleaned data into new file.
8. Write a program to illustrate matplot library and draw Bar Graph, Line Graph, Scatter Graph and Histogram on the dataset.
9. Write a program to perform linear regression on:
   i. Create your own dataset.
   ii. Boston housing dataset.
10. Write a program to implement logistic regression on Admission_Predict dataset and understand how logistic regression is different from linear regression.

Examination and Evaluation Pattern: It include both internal evaluation (50 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (50 marks) which is mainly end semester examination.

Text Books:

1	Introduction to Machine Learning, Ethem Alpaydin, MIT Press.
2	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron, O'Reilly Media.

Reference Books:

1	Pattern Recognition and Machine Learning, Christopher M. Bishop, Springer.
2	Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, MIT Press.

Course Code	Course Title	Lecture			Semester: VII
BTCS741PRP	Project-II	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	0	0	12	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	200
Lab Hours/ Week	:	6	Internal Evaluation	:	100
Credits	:	6	End Semester	:	100
Instruction Mode	:	Practical	Exam Duration	:	-

Prerequisite(s): Project-I

Course Objectives:

1. To understand Software requirement specification and designing methodology.
2. Familiarization of the syntax, semantics, data-types and library functions of any programming languages.
3. To apply ER Diagram, DFD, UML for designing the software application.
4. To implement the specified problems.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Applying SRS, techniques	PO_2, PO_3, PO_8, PO_9, PO_{11}
CO_2	Apply Design methods for given SRS	PO_3, PO_5, PO_9, PO_{11}
CO_3	Write the codes as per SRS and designed Framework	PO_3, PO_5
CO_4	Able to implement real world problem into software solution	PO_3, PO_5, PO_9, PO_{11}, PO_{12}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1		2	2					2	2		2	
CO_2			2		2				2		2	
CO_3			2		2							
CO_4			2		2				2		2	2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

- Based on real-time/ in-house/ problem specific

Examination and Evaluation Pattern: It include both internal evaluation (100 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (100 marks) which is mainly end semester examination.

Text Books:

1	Real World Software Project for Computer Science and Engineering Students, Varun Gupta and Anh Nguyen-Duc-CRP Press.
2	Computer Science Experiments, Pamela Walker and Elaine Wood
3	Planning and Implementing your Final Year Project -M.Berndtsson,J.Hansson-Springer

Course Code	Course Title	Lecture			Semester: VIII
BTCS841PRP	Project-III	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	0	0	12	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	30 Hrs.	Maximum Score	:	200
Lab Hours / Week	:	6	Internal Evaluation	:	100
Credits	:	6	End Semester	:	100
Instruction Mode	:	Practical	Exam Duration	:	-

Prerequisite(s): Project-I & Project-II

Course Objectives:

1. To understand Software requirement specification and designing methodology.
2. Familiarization of the syntax, semantics, data-types and library functions of any programming languages.
3. To apply ER Diagram, DFD, UML for designing the software application.
4. To implement the specified problems.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Applying SRS, techniques	$PO_2, PO_3, PO_8, PO_9, PO_{11}$
CO_2	Apply Design methods for given SRS	$PO_3, PO_5, PO_9, PO_{11}$
CO_3	Write the codes as per SRS and designed Framework	PO_3, PO_5
CO_4	Able to implement real world problem into software solution	$PO_3, PO_5, PO_9, PO_{11}, PO_{12}$

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1		2	2					2	2		2	
CO_2			2		2				2		2	
CO_3			2		2							
CO_4			2		2				2		2	2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

- Based on real-time/ in-house/ problem specific

Examination and Evaluation Pattern: It include both internal evaluation (100 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (100 marks) which is mainly end semester examination.

Text Books:

1	Real World Software Project for Computer Science and Engineering Students, Varun Gupta and Anh Nguyen-Duc-CRP Press.
2	Computer Science Experiments, Pamela Walker and Elaine Wood
3	Planning and Implementing your Final Year Project -M.Berndtsson,J.Hansson-Springer

LIST OF PROFESSIONAL ELECTIVES

Course Code	Course Title	Lecture			Semester: V
BTCS540PET	Computer Graphics	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Data Structure & Algorithm and Engineering Mathematics

Course Objectives:

1. To understand the 2D/ 3D geometrical transformation (translation, rotation, scaling).
2. To understand computer graphics techniques (2-D/3-D), focusing on 3D modelling, image synthesis, and rendering.
3. To provide the concept of geometric transformations, geometric algorithms, software systems.
4. To impart the knowledge of 3D object models (surface, volume and implicit), visible surface algorithms, image synthesis, shading and mapping, ray tracing, radiosity, global illumination, photon mapping, and anti-aliasing.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Demonstrate geometrical transformations (2-D/3-D) with the relevant mathematics of computer graphics, e.g., 3D rotations using both vector algebra, geometrical transformations and projections using homogeneous co-ordinations system.	PO_1, PO_2
CO_2	Apply principles and techniques of computer graphics, e.g., the graphics pipeline, and Brenham algorithm for speedy line and circle generation.	PO_3, PO_4
CO_3	Apply computer graphics concepts in the development of computer games, information visualization, and business applications.	PO_3, PO_5
CO_4	Gain the knowledge of 3D object models and apply various visible surface algorithm, shading and mapping etc.	PO_3

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2			2	2								
CO_3			2		2							
CO_4			2									

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Introduction, Application areas of Computer Graphics, overview of graphics systems, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations and input devices. **Output primitives**: Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms. Filled area primitives: Scan line polygon fill algorithm, boundary-fill and flood-fill algorithms
Unit: 2	**2-D geometrical transforms**: Translation, scaling, rotation, other transformations, matrix representations and homogeneous coordinates, transformations between coordinate systems. **2-D viewing**: The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm.
Unit: 3	**3-D object representation:** Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygon rendering methods.
Unit: 4	**3-D Geometric transformations**: Translation, rotation, scaling, reflection and shear transformations, composite transformations. **3-D viewing:** Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.
Unit: 5	**Visible surface detection methods**: Classification, back-face detection, depth-buffer, scan-line, depth sorting, BSP-tree methods, area sub-division and octree methods **Computer animation:** Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Computer Graphics *C version*", Donald Hearn and M.Pauline Baker, Pearson Education.
2	Computer Graphics Principles & practice", second edition in C, Foley, VanDam, Feiner and Hughes, Pearson Education.
Reference Books:	
1	Principles of Computer Graphics, Shalini Govil, Pai, 2005, Springer
2	Computer Graphics, Steven Harrington, TMH

Course Code	Course Title	Lecture			Semester: V
BTCS541PET	Data Mining and Data Warehousing	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Database Management System

Course Objectives:

1. To understand the concept of data mining principles and techniques with data mining as a cutting-edge business intelligence tool.
2. To develop critical thinking, problem solving and decision-making skills in terms of data warehouse and data mining.
3. To learn various schema model and the Star Schema to design a Data Warehouse.
4. To provide the concept of classification and clustering methods.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Analyze and design a data warehouse or data mart to present information needed by the manager and can be utilized for managing clients.	PO_2, PO_3
CO_2	Implement a quality data warehouse or data mart effectively.	PO_3, PO_5
CO_3	Apply the data resources in such a way that it will truly meet management's requirements.	PO_3, PO_4, PO_6
CO_4	Evaluate standards and new technologies to determine their potential impact on your information resource for a large complex data warehouse/data mart.	PO_4, PO_5

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1		2	2									
CO_2			2		2							
CO_3			2	1		1						
CO_4				2	2							

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction:** Fundamentals of Data Mining, Kinds of Patterns can be mined, Technologies Used, Applications and Issues in Data Mining. **Types of Data:** Attribute types, Basic Statistical descriptions of Data, Measuring data Similarity and Dissimilarity. **Data Preprocessing:** Need of Preprocessing, Data Cleaning, Data Integration, Data Reduction, Data Transformation.
Unit: 2	**Data Warehouse and OLAP:** Data Warehouse, Data Warehouse Modeling, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-oriented induction
Unit: 3	**Mining Frequent Patterns, Associations and Correlations:** Market Basket Analysis, Association rule mining, Frequent Item set mining methods, Pattern Evaluation methods, Constraint based frequent pattern mining, Mining Multilevel and Multidimensional patterns
Unit: 4	**Classification:** General approach to classification, Classification by Decision Tree Induction, Bayes Classification methods, Bayesian Belief Networks, Classification by Backpropagation, Lazy Learners, Other Classification methods, Classification using Frequent patterns, Model Evaluation and selection
Unit: 5	**Cluster Analysis:** Basic Clustering methods, Partitioning methods, Density –Based Methods, Grid- based methods, and Evaluation of Clustering, Outlier Analysis and Detection methods. **Data Mining Trends and Research Frontiers:** Mining Complex Data Types, Data Mining Applications, Data Mining Trends

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Han J & Kamber M, "Data Mining: Concepts and Techniques", Harcourt India, Elsevier India, Second Edition.
2	Pang-NingTan. MichaelSteinback,VipinKumar, "Introduction to Data Mining", Pearson Education, 2008.

Reference Books:

1	Margaret H Dunham,S.Sridhar, "Data mining: Introductory and Advanced Topics", Pearson Education, 2008.
2	Humphires,hawkins,Dy, "Data Warehousing: Architecture and Implementation", Pearson Education, 2009.

3	Anahory, Murray, "Data Warehousing in the Real World", PearsonEçiucation, 2008.
4	Kargupta,Joshi,etc., "Data Mining: Next Generation Challenges and Future Directions" Prentice Hall of IndiaPvtLtd, 2007.

Course Code	Course Title	Lecture			Semester: V
BTCS542PET	Signals and Systems	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Analog Electronics Circuits and Digital Electronics.

Course Objectives:

1. To familiarize with basic concept of control systems.
2. To study the concepts and techniques of stability for linear and non-linear control systems.
3. To prove the thorough knowledge of Z transform.
4. To provide the concept of power spectral density.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the basic concept of control systems.	PO_1, PO_2
CO_2	Analyze the stability for linear and non-linear systems.	PO_2
CO_3	Design of linear control systems.	PO_3
CO_4	Application of the most powerful technique of state-space.	PO_3

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2		2	1									
CO_3			1									
CO_4			2									

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Morphology of signals and their classifications. Even and odd functions, orthogonal function, definition of Step, impulse, ramp functions. Other non-sinusoidal signals and wave forms as the sum of standard functions. Fourier series representation of signals.
Unit: 2	Fourier Integral and Fourier transform and its properties. Parsevel's theorem. System representation using differential equations, transfer function, impulse response. Poles and zeros of a system
Unit: 3	Analysis of Linear Time Invariant (LTI) continuous-time system using Laplace Transform. Frequency response of LTI systems, zero input response, forced input response. Stability of LTI system, pole criteria for stability, Routh's stability test.
Unit: 4	Introduction to Z-transform, Inverse Z- transform and their properties, region of convergence. Poles and zeros. Difference equation, transfer function, pulse response. Applications of Z transform for the analysis of discrete-time LTI systems.
Unit: 5	Introduction to probability. Bay's theorem, concept of random variable, probability density and distribution function of a random variable. Introduction to random process. Power spectral density.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Simon Hykin, Barry Van Veen "Signals and System", John Wiley & Sons.
2	Robert A Gabel , "Signal and Linear Systems", John Wiley & Sons.

Reference Books:

1	Henary Stark and John W Woods, "Probability and Random Processes", Pearson Education, New Delhi.
2	Alan V. Oppenheim, "Signals and Systems", Prentice Hall, 2010

Course Code	Course Title	Lecture			Semester: V
BTCS543PET	Behavioral Economics	L	T	P	
Version: 1.2	Date of Approval:	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Basic Microeconomics

Course Objectives:

1. To help students develop a clear understanding of how people actually make economic decisions.
2. To analyze how real-life behavior differs from idealized rational models.
3. To introduce scientific methods and experiments used in behavioral research.
4. To explore practical applications in markets, public policy, and organizations.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO1	Explain how bounded rationality and psychological biases affect economic decisions.	PO1, PO2, PO6, PO8, PO12
CO2	Compare standard models with behavioral models in decisions under risk and over time.	PO1, PO2, PO5, PO12
CO3	Analyze how social norms and preferences influence outcomes in games and real life.	PO2, PO3, PO6, PO8, PO12
CO4	Evaluate behavioral interventions and nudges in different sectors.	PO2-3, PO5-8, PO10, PO12
CO5	Apply behavioral insights to case studies in finance, health, technology, or policy.	PO2-3, PO5-6, PO10, PO12

PO1- Engineering Knowledge, **PO2**- Problem analysis, **PO3**- Design/development of solutions, **PO4**- Conduct investigations of complex problems, **PO5**- Modern tool usage, **PO6**- The engineer and society, **PO7**- Environment and sustainability, **PO8**- Ethics, **PO9**- Individual or team work, **PO10**- Communication, **PO11**- Project management and finance, **PO12**- Life-long Learning

Mapping of course outcomes with program outcomes

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

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit 1	**Introduction to Behavioral Economics** Why behavioral economics? Contrast with classical models, Bounded rationality: anchoring, availability, representativeness, Introduction to Prospect Theory: reference dependence, loss aversion, Endowment effect, status quo bias
Unit 2:	**Risk and Intertemporal Choices** Risk and uncertainty: Expected Utility Theory vs. Prospect Theory, Framing effects, certainty effect, Time inconsistency and discounting: hyperbolic vs exponential discounting, Self-control and commitment devices

Unit 3:	**Social Preferences and Behavioral Game Theory** Altruism, fairness, and reciprocity, Trust and punishment in social dilemmas, Ultimatum and dictator games, Crowd-out effect of monetary incentives
Unit 4	**Choice Architecture and Nudging** Defaults, framing, decoys, and order effects, Libertarian paternalism and ethical debates around nudging, Behavioral public policy: health, savings, environment, Mental accounting and budgeting behavior
Unit 5	**Applications and Real-world Case Studies** Applications in consumer behavior, finance, marketing, Case studies: digital nudging, tax compliance, smart defaults, Behavioral interventions in public services and workplace settings, Experimental design in behavioral economics (basics)

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Behavioral Economics, Edward Cartwright, Routledge.
2	An Introduction to Behavioural Economics, Nick Wilkinson and Matthias Klaes, Macmillan International Higher Education.

Reference Books:

1	Thinking, Fast and Slow, Daniel Kahneman, Farrar, Straus and Giroux.
2	Predictably Irrational, Dan Ariely, HarperCollins.

Course Code	Course Title	Lecture			Semester: V
BTCS544PET	Ad-Hoc and Sensor Network	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Python Programming

Course Objectives:

1. To learn Ad-hoc wireless Internet, MAC protocols for Ad hoc Wireless Networks Issues in Designing a MAC Protocol for Ad hoc Wireless Networks.
2. To understand the Basics of Wireless, Sensors and Applications: The Mica Mote, Sensing and Communication Range, Design Issues, Energy consumption, Clustering of Sensors, Applications Data Retrieval in Sensor Networks.
3. To provide the concept of classification of WSNs, MAC layer, Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.
4. To acquire the concept of operating system in sensors.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand ad hoc wireless Internet, MAC protocols for Ad hoc Wireless Networks Issues	PO_1
CO_2	Analyze Routing Protocol for Ad hoc Wireless Networks, Classifications of Routing Protocols, Transport Layer for Ad Hoc Wireless Networks	PO_2
CO_3	Demonstrate Classification of WSNs, MAC layer, Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.	PO_3, PO_{10}
CO_4	Design and implement the application of operating system in sensors.	PO_3, PO_4, PO_9

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2											
CO_2		2										
CO_3			2							2		
CO_4			2	2					1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Ad Hoc Wireless Networks s:** Introduction, Issues in Ad hoc wireless Networks s, Ad hoc wireless Internet **MAC protocols for Ad hoc Wireless Networks s** Issues in Designing a MAC Protocol for Ad hoc Wireless Networks s, Design Goals for a MAC Protocol for Ad hoc Wireless Networks s, Classifications of the MAC Protocols, Other MAC Protocols.
Unit: 2	**Routing Protocols for Ad Hoc Wireless Networks s** Issues in Designing a Routing Protocol for Ad hoc Wireless Networks s, Classifications of Routing Protocols **Transport Layer for Ad Hoc Wireless Networks s** Issues in Designing a Transport layer protocol for Ad hoc Wireless Networks s, Design goal s of a Transport layer protocol for Ad hoc Wireless Networks s, Classification of Transport layer solutions, TCP over Ad hoc Wireless Networks.
Unit: 3	**Security protocols for Ad hoc Wireless Networks s** Security in Ad hoc Wireless Networks s, Networks Security Requirements, Issues and Challenges in Security Provisioning, Networks Security Attacks, Key Management, Secure Routing in Ad hoc Wireless Networks.
Unit: 4	**Basics of Wireless, Sensors and Applications:** The Mica Mote, Sensing and Communication Range, Design Issues, Energy consumption, Clustering of Sensors, Applications **Data Retrieval in Sensor Networks s:** Classification of WSNs, MAC layer, Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.
Unit: 5	**Sensor Networks Hardware:** Components of Sensor Mote, **Operating System in Sensors–** TinyOS, LA-TinyOS, SOS, RETOS **Imperative Language:** nesC, Dataflow style language: TinyGALS, Node-Level Simulators, ns-2 and its sensor Networks extension, TOSSIM.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Carlos de Morais Cordeiro and Dharma Prakash Agrawal, "Ad Hoc and Sensor Networks: Theory and Applications", Second Edition, World Scientific Publishers, 2011.
Reference Books:	
1	Kazem Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Networks s', A John Wiley & Sons Inc. Publication, 2007.
2	Prasant Mohapatra and Sriramamurtyhy, "Ad Hoc Networks s: Technologies and Protocols", Springer International Edition, 2009.

Course Code	Course Title	Lecture			Semester: VI
BTCS642PET	Advance Python Programming	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Any programming language

Course Objectives:

1. To learn the fundamentals of writing Python programming and core Python scripting elements such as variables and flow control structures.
2. To impart with concept of lists and sequence data and use of Python to read and write files.
3. To deploy the Python standard library for implementing various standard algorithms.
4. To explore Python's object-oriented features for solving various engineering problems.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Read and write the python program for various descriptive statistics on a given dataset.	PO_3, PO_5
CO_2	Implement the list and sequence data and use of Python to read and write files.	PO_3, PO_5
CO_3	Apply Pandas, Matplotlib to visualize the outcomes of given algorithm.	PO_5
CO_4	Write the Python program for solving classification and regression problem using any standard repository (UCI ML Repository/ Kaggle)	PO_3, PO_5, PO_9

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1			3		2							
CO_2			3		2							
CO_3					2							
CO_4			3		2				1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction:** History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator, Input-Output, Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions, If, If- else, Nested if-else, Looping, For, While, Nested loops, Control Statements, Break, Continue, Pass
Unit: 2	**String Manipulation and Lists:** **Strings:** Accessing Strings, Basic Operations, String slices, Function and Methods **Lists:** Introduction, accessing list, Operations, Working with lists, Function and Methods
Unit: 3	**Functions and modules:** Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables, Importing module, Math module, Random module, Packages, Composition **Exception Handling:** Exception, Exception Handling, Except clause, Try ? finally clause, User Defined Exceptions
Unit: 4	**OOPs concept:** Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding **Regular expressions:** Match function, Search function, Matching VS Searching, Modifiers, Patterns **Database:** Introduction, Connections, Executing queries, Transactions, Handling error
Unit: 5	**Networking:** Socket, Socket Module, Methods, Client and server, Internet modules **Multithreading:** Thread, Starting a thread, Threading module, Synchronizing threads, Multithreaded Priority Queue **GUI Programming:** Introduction, Tkinter programming, Tkinter widgets, Sending email

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Sheetal Taneja and Naveen Kumar, "Python Programming - A Modular Approach", Pearson education.
2	Cay S. Horstmann and Rance D. Necaise, "Python for Everyone", Wiley.

Reference Books:

1	Allen Downe, "Learning With Python", Wiley.
2	Jake VanderPlas, "Python Data Science Handbook", O'Reilly' Publisher

Course Code	Course Title	Lecture			Semester: VI
BTCS644PET	Distributed Systems	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Database Management System, Operating System & Computer Networks

Course Objectives:

1. To familiarize the students with the basics of distributed computing systems.
2. To understand the concepts of distributed file systems, shared memory and message passing systems, synchronization and resource management.
3. To learn the concept of inter–process Communication, API for the Internet Protocols, External Data Representation and Marshalling – Client –Server Communication – Group Communication – Case Study.
4. To know the concept of distributed Objects and Remote Invocation – Communication Between Distributed Objects – Remote Procedure Call – Events and Notifications – Java RMI – Case Study.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand Map-Reduce Architecture and Map reduce programming.	PO_1, PO_2
CO_2	Design and develop various algorithms for different environment like Amoeba, Hadoop, HDFS architecture, setting up the Hadoop environment.	PO_3, PO_5
CO_3	Ability to design distributed systems for various real-world applications.	PO_3, PO_5
CO_4	Verify and analyze the time complexity of the algorithms related to distributed computing.	PO_2, PO_4

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2			2		2							
CO_3			2		3							
CO_4		2		2								

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Basic Concepts** Characterization of Distributed Systems – Examples – Resource Sharing and the Web Challenges System Models – Architectural and Fundamental Models – Networks ing and InterNetworks ing Types of Networks s – Networks Principles – Internet Protocols – Case Studies.
Unit: 2	**PROCESSES AND DISTRIBUTED OBJECTS** Inter–process Communication – The API for the Internet Protocols – External Data Representation and Marshalling – Client –Server Communication – Group Communication – Case Study – Distributed Objects and Remote Invocation – Communication Between Distributed Objects – Remote Procedure Call – Events and Notifications – Java RMI – Case Study.
Unit: 3	**OPERATING SYSTEM ISSUES** The OS Layer – Protection – Processes and Threads – Communication and Invocation – OS Architecture – Security – Overview – Cryptographic Algorithms – Digital Signatures – Cryptography Pragmatics – Case Studies – Distributed File Systems – File Service Architecture – Sun Networks File System – The Andrew File System.
Unit: 4	**OPERATING SYSTEM ISSUES** Name Services – Domain Name System – Directory and Discovery Services – Global Name Service – X.500 Directory Service – Clocks – Events and Process States – Synchronizing Physical Clocks – Logical Time And Logical Clocks – Global States – Distributed Debugging – Distributed Mutual Exclusion – Elections – Multicast Communication Related Problems.
Unit: 5	**DISTRIBUTED TRANSACTION PROCESSING** Transactions – Nested Transactions – Locks – Optimistic Concurrency Control – Timestamp Ordering – Comparison – Flat and Nested Distributed Transactions – Atomic Commit Protocols – Concurrency Control in Distributed Transactions – Distributed Deadlocks – Transaction Recovery – Overview of Replication And Distributed Multimedia Systems.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", 3rd Edition, Pearson Education, 2002.
2	Andrew S. Tanenbaum, Maartenvan Steen, Distibuted Systems, "Principles and Pardigms", Pearson Education, 2002
3	John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
Reference Books:	
1	Sape Mullender, "Distributed Systems", 2nd Edition, Addison Wesley, 1993.
2	Albert Fleishman, Distributes Systems, "Software Design and Implementation", Springer, Verlag, 1994.
3	M. L. Liu, "Distributed Computing Principles and Applications", Pearson Education, 2004

Course Code	Course Title	Lecture			Semester: VI
BTCS640PET	Data Science	L	T	P	
Version: 1.3	**Date of Approval:** 18th BoS 27-02-2024	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Mathematics, Statistics

Course Objectives:

1. To make the students to know about understanding of the data operations.
2. To make the student to learn the concept of simple statistical models and the basics of machine learning techniques of regression.
3. To analyze the capability of regression, classification problem.
4. To apply algorithms on Applications of Data Science & Machine learning.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the concepts of data science process, data science toolkit, Types of data, Data collection and management	PO_1, PO_2
CO_2	Demonstrate the concept of simple statistical models and the basics of machine learning techniques of regression.	PO_2
CO_3	Apply the regression and classification problem and create the Databases	PO_3
CO_4	Analyze the data, Applications of Data Science, Technologies for data visualization	PO_3

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2			2									
CO_3			2	1	2							
CO_4			2	1					1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Introduction, Toolboxes: Python, fundamental libraries for data Scientists. Integrated development environment (IDE). Data operations: Reading, selecting, filtering, manipulating, sorting, grouping, rearranging, ranking, and plotting.
Unit: 2	Descriptive statistics, data preparation. Exploratory Data Analysis data summarization, data distribution, measuring asymmetry. Sample and estimated mean, variance and standard score. Statistical Inference frequency approach, variability of estimates, hypothesis testing using confidence intervals, using pvalue.
Unit: 3	Supervised Learning: First step, learning curves, training-validation and test. Learning models generalities, support vector machines, random forest. Examples.
Unit: 4	Regression analysis, Regression: linear regression simple linear regression, multiple & Polynomial regression, Sparse model. Unsupervised learning, clustering, similarity and distances, quality measures of clustering, case study.
Unit: 5	Network Analysis, Graphs, Social Networks, centrality, drawing centrality of Graphs, PageRank, Ego-Networks, community Detection.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Introduction to Data Science a Python approach to concepts, Techniques and Applications, Igual, L;Seghi', S. Springer, ISBN:978-3-319-50016-4

Reference Books:

1	Python Data Analysis, Second Ed., Armando Fandango, Packt Publishing, ISBN: 9781787127487
2	Data Analysis with Python A Modern Approach, David Taieb, Packt Publishing, ISBN-9781789950069

Course Code	Course Title	Lecture			
BTCS641PET	Big Data Analytics	L	T	P	**Semester:** VI
Version:	**Date of Approval: 17th BoS**	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): It is expected that the students have done DBMS, and Programming Course

Course Objectives:

1. To learn the need of Big Data and the various challenges involved and to acquire Knowledge about different analytical architectures.
2. To understand Hadoop Architecture ,ecosystems and acquire knowledge about the NoSQL database.
3. To acquire knowledge about the NewSQL, MongoDB and Cassandra databases.
4. To Apply the processing of Big Data with advanced architectures like Spark.

Course Outcomes (CO):

COs No.	**Statement**	**Mapped Program Outcomes (POs)**
CO_1	Understand the knowledge of Big Data, Data Analytics, challenges and their solutions in Big Data.	PO1
CO_2	Analyze Hadoop Framework and Eco systems.	PO2
CO_3	Analyze MapReduce and Yarn, Work on NoSQL environment. MongoDB and Cassandra.	PO3
CO_4	Apply Big Data using Map-reduce programming in Hadoop and spark framework	PO4

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Course Outcomes	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**	**PO_9**	**PO_{10}**	**PO_{11}**	**PO_{12}**
CO1	3											
CO2		3										
CO3			3									
CO4				3	2							

Detailed Contents:

Unit: 1	Introduction to big data: Data, Characteristics of data and Types of digital data: Unstructured, Semi-structured and Structured - Sources of data. Big Data Evolution - Definition of big data-Characteristics and Need of big data-Challenges of big data. Applications of Big Data, Data Analytics , Types of Data Analytics, Data Analytics Methods and Techniques, Big data analytics, Data Lake , Architecture of Data Lake. Overview of business intelligence.
Unit: 2	Big data technologies and Databases: Hadoop – Requirement of Hadoop Framework - Design principle of Hadoop –Comparison with other system SQL and RDBMS- Hadoop Components – Architecture -Hadoop 1 vs Hadoop 2.
Unit: 3	MapReduce and YARN framework: Introduction to MapReduce , Processing data with Hadoop using MapReduce, Introduction to YARN, Architecture, Managing Resources and Applications

	with Hadoop YARN. Big data technologies and Databases: NoSQL: Introduction to NoSQL - Features and Types- Advantages & Disadvantages -Application of NoSQL.
Unit: 4	New SQL: Overview of New SQL - Comparing SQL, NoSQL and NewSQL. Mongo DB: Introduction – Features – Data types – Mongo DB Query language – CRUD operations – Arrays – Functions: Count – Sort – Limit – Skip – Aggregate – Map Reduce. Cassandra: Introduction – Features – Data types – CQLSH – Key spaces – CRUD operations – Collections – Counter – TTL – Alter commands – Import and Export – Querying System tables.
Unit: 5	Hadoop Frame Work: Map Reduce Programming: I/O formats, Map side join-Reduce Side Join-Secondary Sorting- Pipelining MapReduce jobs , Machine Learning in big Data: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Tom White, “Hadoop: The Definitive Guide”, O˝Reilly, 4th Edition, 2015.
2	Mohammed Guller, “Big Data Analytics with Spark”, Apress, 2015
Reference Books:	
1	Seema Acharya and Subhashini Chellappan, “Big Data and Analytics”, Wiley India Pvt. Ltd., 2016.
2	Mike Frampton, “Mastering Apache Spark”, Packt Publishing, 2015.

Course Code	Course Title	Lecture			Semester: VI
BTCS642PET	Image Processing	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Computer Graphics

Course Objectives:

1. To imparts knowledge in the area of image and image processing.
2. To understand fundamentals of digital image processing.
3. To provide knowledge of the applications of the theories taught in Digital Image Processing.
4. To learn the concept of various segmentation techniques.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand Basics of Image formation and transformation using sampling and quantization	PO_1, PO_2
CO_2	Analyze different types signal processing techniques used for image sharpening and smoothing.	PO_2
CO_3	Perform and apply compression and coding techniques used for image data.	PO_3, PO_5
CO_4	Apply various segmentation techniques.	PO_3, PO_9

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2		2										
CO_3			2		2							
CO_4			2						1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction to Image Processing:** Image formation, image geometry perspective and other transformation, stereo imaging elements of visual perception.Digital Image-sampling and quantization serial & parallel Image processing.
Unit: 2	**Signal Processing:** Signal Processing - Fourier, Walsh-Hadmard discrete cosine and Hotelling transforms and their properties, filters, correlators and convolvers. Image enhancement-Contrast modification, Histogram specification, smoothing, sharpening, frequency domain enhancement, pseudo-colour
Unit: 3	**Image Restoration:** Image Restoration-Constrained and unconstrained restoration Wiener filter , motion blur remover, geometric and radiometric correction Image data compression-Huffman and other codes transform compression, predictive compression two tone Image compression, block coding, run length coding, and contour coding.
Unit: 4	**Segmentation Techniques:** Segmentation Techniques-thresh holding approaches, region growing, relaxation, line and edge detection approaches, edge linking, supervised and unsupervised classification techniques, remotely sensed image analysis and applications.
Unit: 5	**Shape Analysis:** Shape Analysis – Gestalt principles, shape number, moment Fourier and other shape descriptors, Skelton detection, Hough transform, topological and texture analysis, shape matching. Practical Applications – Finger print classification, signature verification, text recognition, map understanding, bio-logical cell classification.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1. Gonzalez and Wood, “Digital Image Processing”, Addison Wesley, 1993.
2. Anil K.Jain, “Fundamental of Image Processing”, Prentice Hall of India.

Reference Books:

1. Rosenfeld and Kak, “Digital Picture Processing” vol.I&vol.II, Academic,1982
2. Ballard and Brown, “Computer Vision”, Prentice Hall, 1982

Course Code	Course Title	Lecture			Semester: VII
BTCS741PET	Soft Computing	L	T	P	
Version: 1.3	**Date of Approval: 20th BoS 02-03-2026**	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Data Mining & Data Ware Housing and Machine Learning

Course Objectives:

1. To familiarize with soft computing techniques and basic concepts.
2. To provide the basic concepts of different methods and tools for processing of uncertainty in intelligent systems, such as, fuzzy models, neural Networks s, probabilistic models, and foundations of it using in real systems.
3. To understand the idea of Neural Networks s, fuzzy logic and use of heuristics based on human experience.
4. To impart the knowledge of biological neurons and their simulation to problem solving.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Identify and describe soft computing techniques and their roles in building intelligent machines.	PO_1, PO_2
CO_2	Recognize the feasibility of applying a soft computing methodology for a particular problem.	PO_2
CO_3	Demonstrate fuzzy logic and reasoning to handle uncertainty and solve engineering problems, genetic algorithms to combinatorial optimization problems.	PO_3, PO_4, PO_9
CO_4	Apply Artificial Neural Networks to solve various classification and regression problems.	PO_3, PO_4

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2		2										
CO_3			2	2					1			
CO_4			2	2								

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Introduction to Soft Computing, Concept of computing systems, "Soft" compiting versus "Hard" Computing, Characteristics of Soft computing, Some applications of Soft computing techniques
Unit: 2	Fuzzy logic: Introduction to Fuzzy logic.,Fuzzy sets and membership functions., Operations on Fuzzy sets., Fuzzy relations, rules, propositions, implications and inferences., Defuzzification techniques. Fuzzy logic controller design., Some applications of Fuzzy logic.
Unit: 3	Genetic Algorithms: Concept of "Genetics" and "Evolution" and its application to proablistic search techniques, Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, etc., Solving single-objective optimization problems using GAs.
Unit: 4	Multi-objective Optimization Problem Solving: Concept of multi-objective optimization problems (MOOPs) and issues of solving them., Multi-Objective Evolutionary Algorithm (MOEA).,Non-Pareto approaches to solve MOOPs, Pareto-based approaches to solve MOOPs, Some applications with MOEAs.
Unit: 5	Artificila Neural Networks: Biological neurons and its working., Simulation of biolgical neurons to problem soloving., Different ANNs architectures., Trainging techniques for ANNs., Applications of ANNs to solve some real life problems.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Fuzzy Logic: A Pratical approach, F. Martin, , Mc neill, and Ellen Thro, AP Professional, 2000.
2	Foundations of Neural Networks, Fuzzy Systems, and Knowldge Engineering, Nikola K. Kasabov, MIT Press, 1998.
3	An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000.

Reference Books:

1	Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010.
2	Genetic Algorithms In Search, Optimization And Machine Learning, David E. Goldberg, Pearson Education, 2002.

Course Code	Course Title	Lecture			
BTCS742PET	WIRELESS SENSOR NETWORKS	L	T	P	**Semester:** VII
Version: 1.2	**Date of Approval:** 16th BoS 17-11-2022	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	70
Credits	:	3	End Semester	:	30
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): No specific requisite.

Course Objectives:

1. To understand the fundamentals of wireless sensor networks and its application to critical real time scenarios.
2. To study the various protocols at various layers and its differences with traditional protocols.
3. To understand the issues pertaining to sensor networks and the challenges involved in managing a sensor network.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO1	Design a wireless sensor network for given sensor data using microcontroller, transceiver, middleware and operating system.	**PO1, PO2**
CO2	Evaluate the performance of schedule based and random Medium Access Control protocols for power consumption, fairness, channel utilization and control packet overhead.	**PO4**
CO3	Evaluate the performance of Geographic routing protocols for power consumption, scalability and latency parameters.	**PO1, PO2,**
CO4	Evaluate the performance of transport control protocols for congestion detection and avoidance, reliability and control packet overhead parameters.	**PO4**

PO1- Engineering Knowledge, **PO2**- Problem analysis, **PO3**- Design/development of solutions, **PO4**- Conduct investigations of complex problems, **PO5**- Modern tool usage, **PO6**- The engineer and society, **PO7**- Environment and sustainability, **PO8**- Ethics, **PO9**- Individual or team work, **PO10**- Communication, **PO11**- Project management and finance,
PO12- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2		3										
CO3				3								
CO4				3								

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction Wireless Networks** Introduction Wireless Networks**,** Protocol Suites and Standards, OSI Model and TCP/IP Protocol Suite, Adhoc Networks, Comparison of Adhoc and Sensor Networks, Applications of Sensor Networks, Challenges and Hurdles in Sensor network design
Unit: 2	Wireless Transmission Technology and Systems Bluetooth; IEEE 802.11a/b/g/n series of wireless LANs; ZigBee; Radio-frequency identification (RFID) Traditional Transport Control Protocols- TCP, UDP; Feasibility of Using TCP or UDP for WSNs, Transport Protocol Design Issues, Existing Transport Control Protocols- CODA (Congestion Detection and Avoidance), ESRT (Event-to-Sink Reliable Transport) Performance of Transport Control Protocols.
Unit: 3	Sensor-node Architecture Hardware components, Energy consumption of sensor nodes, Operating systems and execution environments, Physical layer and transceiver design considerations in Wireless Sensor Networks

Unit: 4	Medium Access Control Protocols for Wireless Sensor Networks Fundamentals of MAC Protocols, Performance Requirements, Types of MAC protocols - Schedule-Based and Random Access-Based Protocols, Sensor-MAC, Zebra-MAC
Unit: 5	Routing Protocols for Wireless Sensor Networks Fundamentals of Routing Protocols, Performance Requirements, Routing Strategies in Wireless Sensor Networks - Flooding and its variants, LEACH, Power-Efficient Gathering in Sensor Information Systems, Directed diffusion, Geographical routing
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Holger Karl, Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley.
2	Kazem Sohraby, Daniel Minoli, Taieb Znati, Wireless Sensor Networks: Technology, Protocols, and Applications, John Wiley.
3	C. S. Raghavendra, Krishna M. Sivalingam, Taieb Znati, Wireless Sensor Networks, Kluwer Academic.
4	Haskar Krishnamachari, Networking Wireless Sensors, Cambridge University Press.
Reference Books:	
1	Raghavendra, Cauligi S, Sivalingam, Krishna M., Zanti Taieb, Wireless Sensor Network, Springer 1/e, 2004 (ISBN: 978, 4020, 7883, 5).
2	Ian F. Akyildiz and Mehmet Can Vuran, Wireless Sensor Networks, John Wiley and Sond Ltd, Publication, 2010

Course Code	Course Title	Lecture			Semester: VII
BTCS743PET	Internet-of-Things	L	T	P	
Version: 1.3	**Date of Approval: 20th BoS 02-03-2026**	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): It is expected that the students have done BTCS711ET and BTCS714PET courses.

Course Objectives:

1. To understand the concepts of Internet of Things and can able to build IoT applications
2. To learn the architecture and applications of IoT.
3. To learn the importance of python for the implementation of IoT.
4. To impart the knowledge of challenges in IoT and their possible solutions.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the impact and challenges posed by IoT networks leading to new architectural models	**PO_1, PO_2**
CO_2	Analyze the role of IoT protocols for efficient network communication	**PO_2, PO_5**
CO_3	Elaborate the need for Data Analytics and Security in IoT	**PO_3, PO_5**
CO_4	Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.	**PO_3, PO_9, PO_{10}**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2		2			1							
CO_3			2		2							
CO_4			2						1	2		

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction to IoT:** Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs **IoT & M2M:** Machine to Machine, Difference between IoT and M2M, Software define Network
Unit: 2	**Network & Communication aspects:** Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination
Unit: 3	**Challenges in IoT:** Design challenges, Development challenges, Security challenges, Other challenges
Unit: 4	**Domain specific applications of IoT:** Home automation, Industry applications, Surveillance applications, Other IoT applications
Unit: 5	**Developing IoTs:** 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 python

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach"
2	Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1

Reference Books:

1	Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice
2	Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications, 2013

Course Code	Course Title	Lecture			Semester: VIII
BTCS840PET	Deep Learning	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Artificial Intelligence and Machine Learning

Course Objectives:

1. To understand the major deep learning algorithms, the problem settings, and their applications to solve real world problems.
2. To learn the foundations of artificial neural networks and their various types.
3. To acquire the knowledge on deep learning concepts.
4. To gain knowledge to apply optimization strategies.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.	PO_1, PO_2
CO_2	Implement deep learning algorithms and solve real-world problems.	PO_3
CO_3	Ability to use an efficient algorithm for Deep models	PO_2, PO_3
CO_4	Apply optimization strategies for large scale applications	PO_3, PO_9

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2			2									
CO_3		2	2									
CO_4			2						1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Introduction: Various paradigms of earning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques.
Unit: 2	Feedforward neural network: Artificial Neural Network, activation function, multi-layer neural network. Training Neural Network: Risk minimization, loss function, backpropagation, regularization, model selection, and optimization.
Unit: 3	Conditional Random Fields: Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy. Deep Learning: Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network.
Unit: 4	Probabilistic Neural Network: Hopfield Net, Boltzman machine, RBMs, Sigmoid net, Autoencoders.
Unit: 5	Deep Learning research: Object recognition, sparse coding, computer vision, natural language processing. Deep Learning Tools: Caffe, Theano, Torch.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016..
2	Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.

Reference Books:

1	Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
2	Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013

Course Code	Course Title	Lecture			
BTCS841PET	Cloud Computing	L	T	P	**Semester:** VIII
Version: 1.2	**Date of Approval: 20th BoS 02-03-2026**	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Distributed System

Course Objectives:

1. To understand the concept of cloud computing fundamentals, issues and challenges of cloud computing, Evolution of Cloud Computing, Applications cloud computing.
2. To learn the characterizes of cloud computing services and models, role of Virtualization, Grids and cluster.
3. To explain Cloud Security Challenges and Risks.
4. To learn the concept of Software-as-a-Service Security, Security Governance, Risk Management, Security Monitoring, Security Architecture Design, Data Security.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand fundamentals of Cloud Computing	**PO_1, PO_2**
CO_2	Demonstrate cloud computing services and models and role of Virtualization, Grids and cluster.	**PO_3**
CO_3	Analyze Cloud Security Challenges and Risks – Software-as-a-Service Security – Security Governance and Risk Management	**PO_3, PO_4**
CO_4	Apply any one Cloud Computing simulation toolkit such as Eucalyptus - Nimbus - Open Nebula, CloudSim for cloud services	**PO_3, PO_5**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2			2									
CO_3			2	2								
CO_4			2		1							

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Cloud Computing Fundamentals:** Cloud Computing definition, Types of cloud, Cloud services: Benefits and challenges of cloud computing, Evolution of Cloud Computing, Applications cloud computing, Business models around Cloud – Major Players in Cloud Computing - Issues in Cloud - Eucalyptus - Nimbus - Open Nebula, CloudSim.
Unit: 2	**Cloud Services and File System** Types of Cloud services: Software as a Service - Platform as a Service – Infrastructure as a Service - Database as a Service- Monitoring as a Service – Communication as services. Service providers- Google App Engine, Amazon EC2, Microsoft Azure, Sales force. Introduction to MapReduce, GFS, HDFS, Hadoop Framework
Unit: 3	**Collaborating With Cloud** Collaborating on Calendars, Schedules and Task Management – Collaborating on Event Management, Contact Management, Project Management – Collaborating on Word Processing ,Databases Storing and Sharing Files- Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Collaborating via Social Networks s – Collaborating via Blogs and Wikis.
Unit: 4	**Virtualization** Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource management – Virtualization for Data-center Automation. **Hardware and Infrastructure** Clients, Security, Networks , Services. Accessing the Cloud – Platforms, Web Applications, Web APIs, Web Browsers. Cloud Storage – Overview, Cloud Storage Providers, Standards – Application, Client, Infrastructure, Service.
Unit: 5	**Security in the Cloud** Security Overview – Cloud Security Challenges and Risks – Software-as-a-Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture

	Design – Data Security – Application Security – Virtual Machine Security - Identity Management and Access Control – Autonomic Security.
Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009. Kumar Saurabh, "Cloud Computing – insights into New -Era Infrastructure", Wiley India,2011.
2	Cloud Computing "A Practical Approach" Anthony T. Velte, Toby J. Velte, Robert Elsenpeter. McGraw-Hill.
Reference Books:	
1	Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2	John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.

Course Code	Course Title	Lecture			Semester: VIII
BTCS842PET	Blockchain Technology	L	T	P	
Version: 1.3	**Date of Approval: 20th BoS 02-03-2026**	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Python Programming

Course Objectives:

1. To understand the concept of the function of Blockchains as a method of securing distributed ledgers
2. To acquire the knowledge of cryptocurrency.
3. To impart the concept of Ethereum framework.
4. To provide the knowledge of Ethereum network and Ethereum Virtual Machine.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Familiarize the functional/operational aspects of cryptocurrency ecosystem.	PO_1, PO_2
CO_2	Understand emerging abstract models for Blockchain Technology.	PO_2
CO_3	Identify major research challenges and technical gaps existing between theory and practice in cryptocurrency.	PO_4, PO_9
CO_4	Analyze the Ethereum network and Ethereum Virtual Machine.	PO_2

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2		2										
CO_3				2					1			
CO_4		2										

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction to Blockchain:** Basics of Blockchain, Distributed Ledger Technology, Types of network, Components of Blockchain or DLT, Ledger: Blocks, Blockchain, PKI and Cryptography: Private Keys, Public Keys, Hashing Digital Signature, Digital Token, Cryptocurrency.
Unit: 2	**Consensus Problem** - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS)
Unit: 3	**Blockchain Working:** Block, Hash, Structure of Blockchain, Distributed, Lifecycle of Blockchain, Smart Contract, Consensus Algorithm, Fault Tolerance, Actors of Blockchain, Blockchain developer, Blockchain operator, Blockchain regulator, Blockchain user, Membership service provider, Building A Small Blockchain Application
Unit: 4	**Introduction to Bitcoin:** Bitcoin, Wallet, Blocks, Merkley Tree, hardness of mining, transaction verifiability, anonymity, forks, double spending, mathematical analysis of properties of Bitcoin.
Unit: 5	**Ethereum** - Ethereum network, Ethereum Virtual Machine (EVM), Wallets for Ethereum, Solidity - Smart Contracts, some attacks on smart contracts, Design and issue Cryptocurrency.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.
2	Arshdeep Bahga and Vijay Madisetti, "Blockchain Application: A Hnads-on Approach".

Reference Books:

1	Xiwei (Sherry) Xu, Ingo Weber and Mark Staples "Architecture for Blockchain Applications", Springer.
2	Andreas Antonopoulos, "Mastering Bitcoin", O'Reilly' Publisher.

Course Code	Course Title	Lecture			Semester: VIII
BTCS843PET	Human Computer Interaction	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Computer Graphics and Image Processing

Course Objectives:

1. To learn the foundations of human computer interaction.
2. To understand the concept of design technologies for individuals and persons with disabilities.
3. To provide the guidelines for user interface.
4. To impart the knowledge of designing web interfaces.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the concept effective dialog for HCI.	PO_1, PO_2
CO_2	Analyze the effective HCI for individuals and persons with disabilities.	PO_2, PO_3
CO_3	Assess the importance of user feedback.	PO_3
CO_4	Able to apply HCI and principles to interaction design	PO_3, PO_9

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2		2	2									
CO_3			2									
CO_4			2						1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	FOUNDATIONS OF HCI The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.
Unit: 2	DESIGN & SOFTWARE PROCESS Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.
Unit: 3	MODELS AND THEORIES Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.
Unit: 4	MOBILE HCI Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.
Unit: 5	WEB INTERFACE DESIGN Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004

Reference Books:

1	Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O"Reilly, 2009.
2	Brian Fling, "Mobile Design and Development", First Edition , O"Reilly Media Inc., 2009

Course Code	Course Title	Lecture			Semester: VIII
BTCS844PET	Natural Language Processing	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): Machine Learning

Course Objectives:

1. To understand the concept of basic NLP problems, tasks and methods.
2. To learn basic programming tools for NLP.
3. To understand some of the problems and solutions of NLP and their relation to linguistics and statistics.
4. To acquire the concept of language generation and discourse analysis.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Demonstrate Regular Expressions and Morphology	PO_1, PO_2
CO_2	Understand syntactic analysis and context free grammars	PO_2
CO_3	Apply the methodology for evaluating NLP systems.	PO_3, PO_5
CO_4	Implement a simple NLP system to solve real life problem	PO_3, PO_4, PO_5, PO_9

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2		2										
CO_3			2		2							
CO_4			2	2	2				1			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	OVERVIEW AND MORPHOLOGY Introduction – Models -and Algorithms - -Regular Expressions Basic Regular Expression Patterns – Finite State Automata. Morphology - Inflectional Morphology - Derivational Morphology. Finite-State Morphological Parsing --Porter Stemmer
Unit: 2	WORD LEVEL AND SYNTACTIC ANALYSIS N-grams Models of Syntax - Counting Words - Unsmoothed N-grams Smoothing- Backoff DeletedInterpolation – Entropy - English Word Classes - Tagsets for English Part of Speech Tagging-Rule Based Part of Speech Tagging - Stochastic Part of Speech Tagging - Transformation-Based Tagging
Unit: 3	CONTEXT FREE GRAMMARS Context Free Grammars for English Syntax- ContextFree Rules and Trees. Sentence- Level Constructions– Agreement – Sub Categorization. Parsing – Top-down – Earley Parsing - feature Structures – ProbabilisticContext-Free Grammars
Unit: 4	SEMANTIC ANALYSIS Representing Meaning - Meaning Structure of Language - First Order Predicate Calculus. Representing Linguistically Relevant Concepts -SyntaxDriven Semantic Analysis - Semantic Attachments -SyntaxDriven Analyzer. Robust Analysis - Lexemes and Their Senses - Internal Struct ure - Word SenseDisambiguation -Information Retrieval
Unit: 5	LANGUAGE GENERATION AND DISCOURSE ANALYSIS Discourse -Reference Resolution - Text Coherence - Discourse Structure – Coherence. Dialog and Conversational Agents - Dialog Acts – Interpret ation -Conversational Agents. Language Generation – Architecture - Surface Realizations - Discourse Planning Machine Translation -Transfer Metaphor–Interlingua – Statistical Approaches

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1 Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2nd Edition, 2008

Reference Books:

1 C. Manning and H. Schutze, "Foundations of Statistical Natural Language Processing", MIT Press. Cambridge, MA:,1999

2	C. Manning and H. Schutze, "Foundations of Statistical Natural Language Processing", MIT Press. Cambridge, MA:,1999

Course Code	Course Title	Lecture			Semester: VI
BTCS641OET	Soft Skill and Interpersonal Communication	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): No specific pre-requisites.

Course Objectives:

1. To learn the concept of building interpersonal skills.
2. To apply the conceptual understanding of communication into everyday practice.
3. To understand the importance of teamwork and group discussions skills.
4. To develop time management and stress management.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the concept of building interpersonal skills.	PO_6
CO_2	Apply the conceptual understanding of communication into everyday practice.	PO_6, PO_{10}
CO_3	Demonstrate the importance of teamwork and group discussions skills.	PO_9, PO_{10}
CO_4	Establish time management and stress management.	PO_{10}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1						2						
CO_2						2				3		
CO_3									2	3		
CO_4										3		

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Fundamentals of Communication:** The Importance of Communication; The Basic Forms of Communication; The Process of Communication; Barriers to Communication; Dealing with Communication Barriers. **Nonverbal Communication:** Characteristics of Nonverbal Communication; Components of Nonverbal Communication.
Unit: 2	**Listening:** Importance of Listening; Barriers to Effective Listening; Approaches to Listening; How to be a Better Listener; What Speakers can do to Ensure Better Listening. **Interpersonal Skills:** Building Positive Relationships; Giving Praise; Dealing with Criticism; Managing Conflict.
Unit: 3	**Negotiations:** Approaches to Negotiation; The Major Elements of Negotiation Preparation; The Situation. **Interviewing:** Interview and Types of Business Interviews; Planning an Interview; Conducting an Interview; The Ethics of Interviewing
Unit: 4	**Interpersonal Skills:** Building Positive Relationships; Giving Praise; Dealing with Criticism; Managing Conflict. **Negotiations:** Approaches to Negotiation; The Major Elements of Negotiation Preparation; The Situation.
Unit: 5	**Interviewing:** Interview and Types of Business Interviews; Planning an Interview; Conducting an Interview; The Ethics of Interviewing. Ethics in engineering practice and research, Introduction to ethical reasoning & Engineering.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Sanjay Kumar and Pushpa Lata, "Communication Skills", Oxford University Press.
2	Krishna Mohan, Meera Banerji, "Developing Communication Skill", McMillan India Ltd.

Reference Books:

1	Simon Sweeney, "English for Business Communication", Cambridge University Press.
2	Caroline & Whitbeck, "Ethics in Engineering Practice and Research", Cambridge University Press.

Course Code	Course Title	Lecture			Semester: VI
BTCS642OET	Human Resource Development and Organizational Behavior	L	T	P	
Version: 1.3	**Date of Approval: 20th BoS 02-03-2026**	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): No specific pre-requisites.

Course Objectives:

1. To learn best by active participation.
2. To familiarize with the theories, concepts, techniques.
3. To acquire the use of case discussions, exercises, games, psychometric testing.
4. To impart into the collaborative learning that emphasized in the form of group exercises, group projects, role-plays.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand Organizational Behaviour	PO_6
CO_2	Improve Personality	PO_6, PO_{10}
CO_3	Build motivation as an individual as well as a team	PO_6, PO_9, PO_{10}
CO_4	Able to analyze various selection techniques in recruitment	PO_6, PO_{10}

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1						2						
CO_2						2				2		
CO_3						2			2	2		
CO_4						2				2		

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Introduction to the course What is Organizational Behaviour (OB) and Human Resource Management (HRM) Difference between corporates and development organizations OB and HRM and Sustainable development OB and HRM: contribution and linkages with sustainability Importance of OB and HRM for sustainable development practitioners
Unit: 2	Knowing and Managing Yourself Individual Behaviour: MARS model of individual behaviour Values: Values across cultures (Hofstede's framework); Personality: Big five model; MBTI; Use of personality tests; Personality attributes influencing OB Emotions: Understanding emotions; Emotional labour; Emotional Intelligence Attitudes: Attitudes v/s values; Job Satisfaction; Organizational Commitment Perception: Factors influencing perception; 3 3 Perceptual errors; Self-fulfilling prophecy; Know yourself: Johari window
Unit: 3	Motivation in the workplace What is motivation; Early theories of motivation; Contemporary theories of motivation; Designing motivating jobs: JCM model; motivation of social workers. Work Teams v/s groups; Why teams; A model of Team effectiveness: Context, Composition, Work design, Process; Virtual teams; Turning individuals into team players
Unit: 4	Communication What is communication; Organizational communication: Formal networks and Grapevine; Electronic communications; Barriers to effective communication; non- verbal communication; Improving Interpersonal communication: Empathy and Active listening
Unit: 5	Job Analysis Job description; Job Specification; Job Evaluation 2 1 8 Recruitment, Selection, Orientation Sources of recruitment: Internal and external; Steps in selection process; Socialization and Induction; NGO recruitment

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1. McShane, S.L. and Von Glinow, M.A., Organizational Behaviour, New Delhi, Tata McGrawHill Publishing company ltd.
2. P. Jyothi, P. and Venkatesh, D.N., Human Resource Management, New Delhi, Oxford University Press

Reference Books:

1. Denhardt, R.B., Denhardt, J.V., and Aristigueta, M.P. (2009), Managing Human Behaviour in Public and Non-Profit Organizations, Second edition. California, Sage Publications.

2	Pynes, J.E. (2004). Human Resources Management for Public and Nonprofit Organizations, Second Edition. San Francisco, CA: Jossey- Bass Publishers.

Course Code	Course Title	Lecture			Semester: VI
BTCS643OET	Cyber Law and Cyber Security	L	T	P	
Version: 1.3	**Date of Approval: 20th BoS 02-03-2026**	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): No specific pre-requisites.

Course Objectives:

1. To create the basic clarity and understanding of cyberlaws and cyber security laws to the professionals learning the ethical hacking programme.
2. To emphasize on the activities leading to infringement of individual or organizational privacy.
3. To provide the awareness of vulnerabilities in software.
4. To understand the concept of intrusion detection and prevention.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand of cyberlaws and cyber security laws	PO_1, PO_2
CO_2	Awareness for prevention of cyber crimes	PO_6, PO_8, PO_{12}
CO_3	Demonstrate cyber security vulnerabilities and cyber security safeguards	PO_5, PO_8
CO_4	Able to secure web applications	PO_8, PO_9

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	2	2										
CO_2						2	3					2
CO_3					2			2				
CO_4								2	2			

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction:** Cyber law, Need for Cyber Law, Cyber Jurisprudence at International and Indian Level, Issues of jurisdiction in cyberspace, Types of jurisdiction, The Test evolved - Minimum Contacts Theory - Sliding Scale Theory - Effects Test and International targeting, Jurisdiction under IT Act, 2000.
Unit: 2	**Cyber Crimes& Legal Framework** Cyber Crimes against Individuals, Institution and State , Hacking , Digital Forgery ,Cyber Stalking/Harassment, Cyber Pornography, Identity Theft & Fraud , Cyber Terrorism .,Cyber Defamation ,Right to Privacy and Data Protection on Internet - Concept of privacy. Threat to privacy on internet - Self-regulation approach to privacy - Ingredients to decide confidentiality of information - Breach of sensitive personal information and confidentiality under IT Act and penalties for the same. - Right of Interception under IT Act. , Different offences under IT Act, 2000.
Unit: 3	**Overview of Cyber Security, Internet Governance** – Challenges and Constraints, Cyber Threats:- Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace.
Unit: 4	**Cyber Security Vulnerabilities and Cyber Security Safeguards:** vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management.
Unit: 5	**Securing Web Application, Services and Servers:** Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges. Intrusion Detection and Prevention, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection Systems

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:	
1	Karnika Seth, Computers, Internet and New Technology Laws, Lexis NexisButterworthsWadhwa Nagpur.
2	Chris Reed & John Angel, Computer Law, OUP, New York, (2007).
Reference Books:	
1	JonthanRosenoer, Cyber Law, Springer, New York, (1997).
2	SudhirNaib, The Information Technology Act, 2005: A Handbook, OUP, New York, (2011)
3	S. R. Bhansali, Information Technology Act, 2000, University Book House Pvt. Ltd., Jaipur (2003).

Course Code	Course Title	Lecture			Semester: VI
BTCS644OET	Comparative Study of Modern Indian Languages	L	T	P	
Version: 1.3	**Date of Approval: 20th BoS 02-03-2026**	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): No specific pre-requisites.

Course Objectives:

1. To introduce students to the evolution and classification of Indian languages.
2. To compare the structural aspects such as phonology, morphology, and syntax of major Indian languages.
3. To study the cultural and literary characteristics of Modern Indian Languages.
4. To understand the linguistic diversity, multilingualism, and societal role of language in India.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the historical development and classification of Indian languages	**PO6, PO8, PO12**
CO_2	Analyze and compare linguistic structures of selected Indian languages	**PO1, PO2, PO10**
CO_3	Examine multilingualism, language identity, and sociolinguistic challenges	**PO6, PO9, PO10**
CO_4	Appreciate the literary and cultural richness of major Indian languages	**PO6, PO8, PO12**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1						2		2				2
CO_2	2	2								2		
CO_3						2		2	2	2		2
CO_4						2						

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction to Indian Languages** Definition and Scope of Modern Indian Languages – Classification of Indian Languages: Indo-Aryan, Dravidian, Tibeto-Burman, Austro-Asiatic – Historical Development – Language Families and Their Characteristics – Constitutional Provisions Related to Languages – Role of Language in National Integration.
Unit: 2	**Phonology and Morphology** Phonological Features of Selected Indian Languages (Hindi, Tamil, Bengali, Telugu) – Syllabic Structure – Consonant and Vowel Systems – Morphological Differences: Word Formation, Inflection, Derivation – Influence of Sanskrit and Persian – Script Systems and Orthography.
Unit: 3	**Syntax and Semantics** Sentence Structure and Word Order Patterns – Case Markers, Postpositions, and Agreement Systems – Semantics and Meaning – Common Idioms and Proverbs – Issues in Translation and Transliteration – Lexical Borrowing and Hybridization.
Unit: 4	**Multilingualism and Sociolinguistic Aspects** Language and Identity – Bilingualism and Multilingualism – Code-Switching and Code-Mixing – Language Planning and Policy in India – Language in Education – Language and Media – Technology and Indian Languages (Unicode, Input Tools, Speech Processing).
Unit: 5	**Literary and Cultural Traditions** Overview of Literary Evolution in Major Indian Languages – Classical and Modern Literature – Comparative Study of Selected Literary Texts – Folk Traditions and Oral Narratives – Language in Cinema and Popular Culture – Role of Language in Cultural Expression and Exchange.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:	
1	*A History of Indian Literature*, Sisir Kumar Das, Sahitya Akademi.
2	L*anguage and Society in India*, Braj B. Kachru, Cambridge University Press
Reference Books:	
1	*The Languages of India*, George Cardona and Dhanesh Jain, Routledge.
2	*Comparative Dravidian Linguistics: Current Perspectives*, Bhadriraju Krishnamurti, Oxford University Press.

Course Code	Course Title	Lecture			Semester: VI
BTCS645OET	Biology (Basic Science Course)	L	T	P	
Version: 1.3	**Date of Approval: 20th BoS 02-03-2026**	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): No specific pre-requisites.

Course Objectives:

1. To introduce the basics of biology such as cell structure and functions.
2. To learn the concepts of inheritance & evolution.
3. To understand basic concepts of genetics.
4. To introduce microbiology concepts.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the basics of Diversity of life	PO_7
CO_2	Gain knowledge of Metabolism and Bioenergetics	PO_7, PO_{12}
CO_3	Explore the concept of Genetics and cell Biology	PO_7, PO_{12}
CO_4	Analyze biology as a science, outlining the diversity, organization and fundamental principles of living systems.	PO_7, PO_{12}

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1							2					
CO_2							2					2
CO_3							2					2
CO_4							2					2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Basics: Diversity of life, prokaryotes and eukaryotes, basic cell constituents and macromolecules.
Unit: 2	Biochemistry: Metabolism (Catabolism and Anabolism) and Bioenergetics
Unit: 3	Genetics: Basic principles of Mendel, molecular genetics, structure and function of genes and chromosomes, Transcription and Translation, gene expression and regulation
Unit: 4	Cell Biology: Macromolecules, membranes, organelles, cytoskeleton, signaling, cell division, differentiation, motility.
Unit: 5	Microbiology: host-microbe interactions, physiology, ecology, diversity, and virology

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Biology: N. Campbell and J. Reece (2005) 7th edition, Pearson, Benjamin,Cummings
2	The Biological Chemistry of the Elements: J.J.R.F. da Silva, R.J.P. Williams (2001) 2ndedition, Oxford UniversityPress

Reference Books:

1	Biology: P.H. Raven, G.B. Johnson, J.B. Losos and S.R. Singer (2005) 7th edition, McGraw Hill
2	Molecular Biology of the Cell: B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts and P. Walter (2007) 5th edition, GarlandScience.

Course Code	Course Title	Lecture			Semester: VI
BTCS646OET	Managerial Economics and Financial Analysis	L	T	P	
Version: 1.3	**Date of Approval: 20th BoS 02-03-2026**	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): No specific pre-requisites.

Course Objectives:

1. To introduce students to the structural, functional, and cultural aspects of Modern Indian Languages (MILs).
2. To understand the evolution and linguistic features of selected Indian languages.
3. To analyse similarities and differences among Indian languages through phonology, morphology, syntax, and semantics.
4. To promote appreciation for linguistic diversity and the role of language in society and identity

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the historical development and classification of Indian languages	**PO6, PO8, PO12**
CO_2	Analyze linguistic structures (phonology, morphology, syntax) of Indian languages	**PO1, PO2, PO10**
CO_3	Examine language diversity, multilingualism, and sociolinguistic issues	**PO6, PO9, PO10**
CO_4	Compare literary, cultural, and functional aspects of major Indian languages	**PO6, PO8, PO12**

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1						2		2				2
CO_2	2	2								2		
CO_3						2			2	2		
CO_4						2		2				2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction to Managerial Economics** Definition, Nature and Scope of Managerial Economics – Demand Analysis: Determinants of Demand – Demand Function – Law of Demand – Elasticity of Demand – Types – Demand Forecasting and Methods – Supply Analysis: Law of Supply – Elasticity of Supply.
Unit: 2	**Production and Cost Analysis** Production Function – Law of Variable Proportions – Isoquants and Isocosts – Economies of Scale – Cost Concepts – Cost-Output Relationship – Short-run and Long-run Cost Curves – Break-even Analysis (BEA).
Unit: 3	**Market Structures and Pricing** Market Structures: Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly – Pricing Methods and Strategies – Price-Output Determination in Different Market Structures – Business Cycles – Features and Phases.
Unit: 4	**Introduction to Financial Accounting** Accounting Principles – Journal, Ledger, Trial Balance – Final Accounts with Adjustments – Depreciation: Straight Line Method and Diminishing Balance Method.
Unit: 5	**Financial Analysis and Capital Budgeting** Financial Statement Analysis – Ratio Analysis – Liquidity Ratios, Profitability Ratios, Solvency Ratios – Funds Flow and Cash Flow Statements – Capital Budgeting Techniques: Payback Period, Net Present Value (NPV), Internal Rate of Return (IRR).

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	*Managerial Economics and Financial Analysis*, Dr. N. Appa Rao and Dr. P. Vijay Kumar, Cengage Learning.

2	*Managerial Economics and Financial Analysis*, Prof. S. A. Siddiqui and A. S. Siddiqui, New Age International Publishers.
Reference Books:	
1	*Managerial Economics*, Varshney & Maheshwari, Sultan Chand & Sons.
2	*Financial Accounting*, T.S. Grewal, S. Chand Publications.

Course Code	Course Title	Lecture			Semester: VIII
BTCS841OET	Intellectual Property Rights	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): No specific pre-requisites/ awareness of Cyber Law and Cyber Security is desirable.

Course Objectives:

1. To understand the fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.
2. To learn all aspects of the IPR Acts with case studies to demonstrate the application of the legal concepts in science, engineering, technology and creative design.
3. To acquire the knowledge of copyright act and rights of trademark.
4. To provide the concept of geographical indication and their protection.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the basic concepts of Intellectual property, laws	PO_6, PO_8
CO_2	Demonstrate about licensing regime associated with each kind of intellectual property	PO_6, PO_8
CO_3	Understand the knowledge of copyright act and rights of trademark.	PO_6, PO_8
CO_4	Analyze all aspects of the IPR Acts with case studies	PO_6, PO_8

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1						2		2				
CO_2						2		2				
CO_3						2		2				
CO_4						2		2				

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	OVERVIEW OF INTELLECTUAL PROPERTY introduction and the need for intellectual property right (IPR) IPR in India – Genesis and Development IPR in abroad Some important examples of IPR 5 PATENTS: Meaning,Criteria for obtaining patents Novelty Inventive step. Utility Non patentable inventions. Procedure for registration , Term of patent , Rights of patentee. Basic concept of Compulsory license and Government use of patent Infringement of patents and remedies in case of infringement
Unit: 2	COPYRIGHT: What is copyright, Copyright Act; What is covered by copyright? How long does copyright last? Why protect copyright? RELATED RIGHTS What are related rights? Distinction between related rights and copyright? Rights covered by copyright? TRADEMARKS: What is a trademark? Rights of trademark? What kind of signs can be used as trademarks? types of trademark function does a trademark perform How is a trademark protected? How is a trademark registered? How long is a registered trademark protected for ? How extensive is trademark protection? What are well-known marks and how are they protected? Domain name and how does it relate to trademarks?
Unit: 3	GEOGRAPHICAL INDICATIONS: What is a geographical indication? How is a geographical indication protected? Why protect geographical indications? INDUSTRIAL DESIGNS:What is an industrial design? How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?
Unit: 4	ENFORCEMENT OF INTELLECTUAL PROPERTY RIGHTS Infringement of intellectual property rights Enforcement Measures EMERGING ISSUES
Unit: 5	INTELLECTUAL PROPERTY Overview of Biotechnology and Intellectual Property, Biotechnology Research and Intellectual Property Rights Management Licensing and Enforcing Intellectual Property

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	T. M Murray and M.J. Mehlman,Encyclopedia of Ethical, Legal and Policy issues in Biotechnology, John Wiley & Sons 2000

2	Lionel Bently & Brad Sherman, Intellectual Property Law, Oxford. P. Narayanan, Intellectual Property Law, Eastern Law House
Reference Books:	
1	Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2	Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tate McGraw Hill Publishing company ltd.

Course Code	Course Title	Lecture			
BTCS842OET	Computational Finance	L	T	P	**Semester:** VIII
Version: 1.3	**Date of Approval: 20th BoS 02-03-2026**	3	0	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): No specific pre-requisites.

Course Objectives:

1. To introduce the role of computational tools and quantitative models in finance.
2. To understand stochastic processes, time series, and simulation methods in financial modeling.
3. To explore risk assessment, option pricing, and portfolio optimization.
4. To implement real-world financial algorithms using Python or R.

Course Outcomes (CO):

COs No.	Statement	Mapped POs
CO1	Understand the mathematical and statistical foundations of financial models.	PO1, PO2
CO2	Apply time series analysis and stochastic calculus in modeling financial data.	PO2, PO3
CO3	Implement computational algorithms for pricing derivatives and assessing risk.	PO3, PO5
CO4	Design, simulate and evaluate financial strategies using programming tools.	PO3, PO5, PO12

PO_1- Engineering Knowledge, **PO_2**- Problem analysis, **PO_3**- Design/development of solutions, **PO_4**- Conduct investigations of complex problems, **PO_5**- Modern tool usage, **PO_6**- The engineer and society, **PO_7**- Environment and sustainability, **PO_8**- Ethics, **PO_9**- Individual or team work, **PO_{10}**- Communication, **PO_{11}**- Project management and finance, **PO_{12}**- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1	3	2										
CO_2	2	3	2									
CO_3		2	3	2	2							
CO_4			2	2	3				1	2		2

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	**Introduction to Computational Finance** Overview of Financial Systems – Role of Computational Methods in Finance – Financial Markets and Instruments – Time Value of Money – Introduction to Financial Statements – Introduction to Python/R for Financial Applications – Data Sources: Quandl, Yahoo Finance, NSE APIs.
Unit: 2	**Probability & Stochastic Processes in Finance** Random Variables – Normal, Log-Normal Distributions – Expected Value, Variance – Monte Carlo Simulations – Brownian Motion – Geometric Brownian Motion – Introduction to Ito's Lemma – Stochastic Differential Equations (SDEs) – Binomial Trees.
Unit: 3	**Time Series Analysis** Introduction to Time Series – AR, MA, ARIMA, ARCH, GARCH Models – Stationarity – Forecasting – Volatility Modeling – Applications in Stock Price Prediction – Implementation using Python (Statsmodels, scikit-learn). .
Unit: 4	**Derivatives and Option Pricing Models** Options: Calls, Puts, Payoffs – Futures and Forwards – Black-Scholes Model – Greeks (Delta, Gamma, Vega, Theta, Rho) – Binomial and Trinomial Pricing – Hedging Strategies – Volatility Smile – Real-Time Options Data.
Unit: 5	**Portfolio Theory and Risk Management** Modern Portfolio Theory – Risk-Return Tradeoff – Markowitz Model – Capital Asset Pricing Model (CAPM) – Efficient Frontier – Value at Risk (VaR) – Expected Shortfall – Sharpe Ratio – Backtesting – Financial Stress Testing.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.	
Text Books:	
1	R. U. Seydel, Tools for Computational Finance, 5th Ed., Springer, 2012.
2	P. Glasserman, Monte Carlo Methods in Financial Engineering, Springer, 2004.
Reference Books:	
1	Y.-l. Zhu, X. Wu, I-L. Chern and Z.-z. Sun, Derivative Securities and Difference Methods, 2nd Ed., Springer, 2013.
2	D. Higham, Introduction to Financial Option Valuation: Mathematics, Stochastics and Computation, Cambridge University Press, 2004.

Course Code	Course Title	Lecture			Semester: VIII
BTCS843OET	Values & Ethics	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): No specific pre-requisites.

Course Objectives:

1. To help students to understand values.
2. To introduce the concepts related to values.
3. To understand the problem of Sustenance of value.
4. To facilitate the students to understand the views of Pt. Madan Mohan Malviya and Mahatma Gandhi.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Able to understand the importance of values in real life	PO_6
CO_2	Demonstrate the concepts related to values	PO_7,
CO_3	Analyze the problem of Sustenance of value	PO_2, PO_8
CO_4	Explore the views of Pt. Madan Mohan Malviya and Mahatma Gandhi.	PO_6, PO_8

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1						2						
CO_2							2					
CO_3		2						3				
CO_4						2		3				

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Definition and classification of values: Extrinsic values, Universal and Situational values, Physical, Environmental, Sensuous, Economic, Social, Aesthetic, Moral and Religious values.
Unit: 2	Concepts related to values: Purusartha, Virtue, Right, duty, justice, Equality, Love and Good
Unit: 3	Egoism, Altruism and universalism. The Ideal of Sarvodaya and Vasudhaiva Kutumbakam
Unit: 4	The Problem of Sustenance of value in the process of Social, Political and Technological changes.
Unit: 5	The Problem of hierarchy of values and their choice, The views of Pt. Madan Mohan Malviya and Mahatma Gandhi.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Little, William, An Introduction of Ethics , allied Publisher, Indian Reprint 1955
2	William, K Frankena, Ethics , Prentice Hall of India, 1988

Reference Books:

1	Dr. Awadesh Pradhan , Mahamana ke Vichara. , B.H.U., Vanarasi-2007

Course Code	Course Title	Lecture			Semester: VIII
BTCS844OET	Economic Policies in India	L	T	P	
Version: 1.3	Date of Approval: 20th BoS 02-03-2026	3	0	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	45 Hrs.	Maximum Score	:	100
Periods/ Week	:	3	Internal Evaluation	:	30
Credits	:	3	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Prerequisite(s): No specific pre-requisites.

Course Objectives:

1. To understand the development strategies in India.
2. To acquire the knowledge of Economic reforms since 1991.
3. To learn growth policies.
4. To analyze Indian Economy with other countries.

Course Outcomes (CO):

COs No.	Statement	Mapped Program Outcomes (POs)
CO_1	Understand the development strategies in India	PO_6
CO_2	Gain the knowledge of Economic reforms since 1991	PO_6
CO_3	Demonstrate growth policies	PO_6, PO_9
CO_4	Analyze Indian Economy with other countries	PO_6

PO_1- Engineering Knowledge, PO_2- Problem analysis, PO_3- Design/development of solutions, PO_4- Conduct investigations of complex problems, PO_5- Modern tool usage, PO_6- The engineer and society, PO_7- Environment and sustainability, PO_8- Ethics, PO_9- Individual or team work, PO_{10}- Communication, PO_{11}- Project management and finance, PO_{12}- Life-long Learning

Mapping of course outcomes with program outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO_{12}
CO_1						2						
CO_2						2						
CO_3						2			1			
CO_4						2						

1 – Reasonable; 2 – Significant; 3 – Strong

Detailed Contents:

Unit: 1	Development Strategies in India: Planning in India, Objectives, Strategies and Evaluation.
Unit: 2	Economic reforms since 1991 and its impact.
Unit: 3	Economic Development and Growth Policies.
Unit: 4	Agriculture and Industrial Sectors of the Indian economy.
Unit: 5	Current challenges facing Indian Economy, Development experience of India- a comparison with other countries.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1. Karl E. Case and Ray C. Fair, Principles of Economics, Pearson Education Inc., 8th Edition, 2007.
2. N. Gregory Mankiw, Economics: Principles and Applications, India edition by South Western, a part of Cengage Learning, Cengage Learning India Private Limited, 4th edition, 2007.

Reference Books:

1. Joseph E. Stiglitz and Carl E. Walsh, Economics, W.W. Norton & Company, Inc., New York, International Student Edition, 4th Edition, 2007.