COURSE CURRICULUM

B.Tech. Computer Science & Engineering

Batch:2025-2029
Academic Year: 2025-26
Updated on: July, 2025

GSFC University

School of Science, Vigyan Bhavan, P. O. Fertilizernagar, Vadodara - 391750, Gujarat, India

Vision

- GSFCU strives to be the best compact boutique institution with a futuristic approach, encouraging student centric culture and sharpened focus on developing industry ready & employable students with all-round development.

Mission

- Establish an institution, which promotes creativity and innovation.
- Develop unique quality standards for academic excellence and pedagogical innovations.
- Remain agile through a learning ecosystem with flexible processes & systems.
- Holistic growth for industry readiness.

No.	Programme Outcomes (POs)	Blooms' Taxonomy Domain	Blooms' Taxonomy SubDomain
PO1	Engineering Knowledge: Apply the knowledge of Mathematics, Basic Sciences, Engineering Fundamentals and an Engineering specialization to solve the complex engineering problems	Cognitive Domain	Apply
PO2	Problem Analysis: Identify, Formulate, Review Research Literature and Analyze the complex engineering problems and give solutions related to domain & allied industries.	Cognitive Domain	Analyse
PO3	Design/ development of solutions: Design and formulate solutions for the Domain Specific engineering problems to solve both industrial & social related problems.	Cognitive Domain	Create
PO4	Conduct investigations of complex problems: Design & conduct experiments, analyze and interpret the resulting data to solve Domain specific Engineering problems	Cognitive Domain	Analyse
PO5	Modern tool usage: Create, Select and Apply appropriate techniques, resources and modern engineering & IT Tools including prediction and modeling to complex Engineering Activities with an understanding of the limitations.	Cognitive Domain	Evaluate

PO6	The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and their consequent responsibilities relevant to professional engineering practice.	Cognitive Domain	Apply
PO7	Environment and sustainability: Understand the impact of the professional Engineering Solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.	Cognitive Domain	Understand
PO8	Ethics: Apply Ethical principles and commit to professional Ethics and responsibilities and enhance their commitment towards best engineering practices	Cognitive Domain	Apply
PO9	Individual and team work: Function effectively as a member or a leader in diverse teams, and be competent to carry out multidisciplinary tasks.	Cognitive Domain	Create
PO10	Communication: Communicate effectively in both verbal & non-verbal and able to comprehend & write effective reports.	Cognitive Domain	Remember
PO11	Project management and finance: Understand the engineering and management principles to manage the multidisciplinary projects in whatever position they are employed.	Cognitive Domain	Apply
PO12	Life-long learning: Recognize the need of self education and life-long learning process in order to keep abreast with the ongoing developments in the field of engineering.	Cognitive Domain	Understand

No.	**Programme Specific Outcomes (PSOs)**	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy SubDomain**
PSO1	Preparing the students who can design, implement and evaluate computing-based solutions for industrial and societal requirements by laying a strong foundation of core courses in Computer Science & Engineering.	Cognitive Domain	Apply
PSO2	To prepare the world class software professionals who can apply the knowledge in the allied sectors like Finance, Medicine, Agriculture, Science and others.	Cognitive Domain	Create

PSO3	Making students industry ready by offering hands-on experience from industry experts and working on real industrial problems.	Cognitive Domain	Analyse

Mapping of POs & PSOs

No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	P8O	PO9	PO10	PO11	PO12
PSO1	3	3	3	2	3	1	2	2	1	1	2	1
PSO2	2	2	3	3	1	2	1	1	2	2	3	2
PSO3	2	1	2	1	3	1	0	3	2	3	3	1
Avg	**2.33**	**2.00**	**2.67**	**2.00**	**2.33**	**1.33**	**1.00**	**2.00**	**1.67**	**2.00**	**2.67**	**1.33**

1: Slight (Low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Definition of Credit

1 Hour. Lecture (L) per week	**01 Credit**
1 Hour Tutorial (T) per week	**01 Credit**
4 Hours Practical (P) per week	**02 Credit**
2 Hours Practical (P) per week	**01 Credit**
1 Hour Practical (P) per week	**0.5 Credit**
3 Hours Experiential learning	**01 Credit**

Course Code Definitions

Lecture	**L**
Tutorial	**T**
Practical	**P**
Basic Science Courses	**BSC**
Engineering Science Courses	**ESC**
Humanities and Social Sciences includingManagement courses	**HSMC**
Professional Core Courses / Major (Core)	**PCC**
Professional Elective Courses / Minor Stream	**PEC**
Open Elective Courses	**OEC**
Laboratory Course	**LC**
Mandatory Courses	**MC**
Non - Credit Courses	**NC**
Project (Experiential Learning)	**PROJ**
Experiential Learning ex. Internship, Industrial Visit, Field Visit, etc.	**EL**
Multidisciplinary Courses	**MDC**
Ability Enhancement Course	**AEC**
Skill Enhancement Course	**SCE**
Value Added Courses	**VAC**

Structure of Undergraduate Programme

Sr. No.	Category	Credit Breakup
1.	Humanities & Social Sciences Courses	14
2.	Basic Science Courses.	12
3.	Engineering Science Courses.	15
4.	Professional Core Courses	68
5.	Professional Elective Courses	36
6.	Open Elective Courses	02
7.	Project Work, Seminar & Internship	30
Total		**177**

Category - Wise Courses

Humanities & Social Sciences Courses

1. Number of Humanities & Social Science Courses: 7
2. Credits: 14

Sr. No.	Course Code	Course Name	Sem	Teaching Scheme (Hours / week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1.	AECC101	Fundamentals of English	I	2	0	0	2	2	0	0	2
2.	SECC101	Foundation Course	I	0	0	0	4	0	0	0	4
3.	AECC201	Communication Skills in English	II	2	0	0	2	2	0	0	2
4.	AECC301	Entrepreneurship Development	III	2	0	0	2	2	0	0	2

5.	AECC401	Environmental Studies	IV	2	0	0	2	2	0	0	2
6.	AECC502	Indian Constitution	V	2	0	0	2	2	0	0	2
7.	AECC601	Disaster Risk Management	VI	2	0	0	2	2	0	0	2
Total				**12**	**0**	**0**	**16**	**12**	**0**	**0**	**16**

Note
L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

Basic Science Course

1. Number of Basic Science Course: 3
2. Credits: 12

Sr. No.	Course Code	Course Name	Sem	Teaching Scheme (Hours / week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1.	BTMA103	Mathematics - I	I	3	0	1	4	3	0	1	2
2.	BTPY105	Engineering Physics	I	3	2	0	5	3	1	0	4
3.	BTPY105	Mathematics - II	II	3	0	1	4	3	0	1	2
Total				**9**	**2**	**2**	**13**	**9**	**1**	**2**	**12**

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Engineering Science Course

1. Number of Professional Core Courses: 5
2. Credits: 15

Sr. No.	Course Code	Course Name	Sem	Teaching Scheme (Hours / week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1.	BTEC101	Basics of Electrical & Electronics	I	3	2	0	5	3	1	0	4
2.	BTCS104	Computer Programming - I	I	3	2	0	5	3	1	0	4
3.	BTCS106	ICT Workshop	I	0	2	0	2	0	1	0	1
4.	BTFS108	Fundamentals in Fire and Environment, Health, Safety	I	2	0	0	2	2	0	0	2
5.	BTCS205	Digital Electronics	II	3	2	0	5	3	1	0	4
Total				**11**	**8**	**0**	**19**	**11**	**4**	**0**	**15**

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Professional Core Courses

1. Number of Professional Core Courses: 17
2. Credits: 68

Sr. No.	Course Code	Course Name	Sem	Teaching Scheme (Hours / week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1.	BTCS20	Object Oriented Programming with C++	II	3	2	0	5	3	1	0	4
2.	BTCS202	Data Structures	II	3	2	0	5	3	1	0	4
3.	BTCS203	Web Technologies	II	3	2	0	5	3	1	0	4
4.	BTCS301	Discrete Mathematics	III	3	0	1	4	3	0	1	4
5.	BTCS302	Object Oriented Programming with JAVA	III	3	2	0	5	3	1	0	4
6.	BTCS303	Operating System	III	3	2	0	5	3	1	0	4
7.	BTCS304	Computer Organization	III	3	0	1	4	3	0	1	4
8.	BTCS409	Numerical Methods in Computer Science & Engineering	IV	3	0	1	4	3	0	1	4
9.	BTCS402	Computer Networks	IV	3	2	0	5	3	1	0	4
10.	BTCS403	Microprocessor & Interfacing	IV	3	2	0	5	3	1	0	4
11.	BTCS404	Database Management Systems	IV	3	2	0	5	3	1	0	4

12.	BTCS501	Design and Analysis of Algorithms	V	3	2	0	5	3	1	0	4
13.	BTCS502	Software Engineering	V	3	2	0	5	3	1	0	4
14.	BTCS503	Advanced Web Technologies	V	3	2	0	5	3	1	0	4
15.	BTCS602	Theory of Computation	VI	3	0	1	4	3	0	1	4
16.	BTCS603	Advanced Java Technology	Vi	3	2	0	5	3	1	0	4
17.	BTCS702	Mobile Application Development	VII	2	4	0	6	2	2	0	4
Total				**50**	**28**	**4**	**82**	**50**	**14**	**4**	**68**

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Professional Elective Courses

1. Number of Professional Elective Course: 9
2. Credits: 36

Sr. No.	Course Code	Course Name	Sem	Teaching Scheme (Hours / week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1.	BTCS305	Specialized Track Elective - I - Python Programming	III	3	2	0	5	3	1	0	4
2.	BTCS405	Specialized Track Elective - I - Fundamentals of AI & ML	IV	3	2	0	5	3	1	0	4

	BTCS406	Specialized Track Elective - II - Fundamentals of IoT								
	BTCS408	Specialized Track Elective - III - Fundamentals of Cyber Security								
3.	BTCS504	Specialized Track Elective - I - Data Science for Engineers	V	3	2	0	5	3	1	0	4
	BTCS505	Specialized Track Elective - II - IoT Architecture & Protocols								
	BTCS507	Specialized Track Elective - III - Network security & access control								
4.	BTCS604	Specialized Track Elective I - Deep Learning	VI	3	2	0	5	3	1	0	4
	BTCS606	Specialized Track Elective - I - Big Data Architecture & Programming								
5.	BTCS605	Specialized Track Elective - II - IoT Network, Signal & Signal processing	VI	3	2	0	5	3	1	0	4
	BTCS607	Specialized Track Elective - II - Data Analytics for IoT								
6.	BTCS608	Specialized Track Elective - III - Platform & Application security principles	VI	3	2	0	5	3	1	0	4

	BTCS609	Specialized Track Elective - III - Wireless & Mobile Device security principles									
7.	BTCS703	Specialized Track Elective - I - Natural Language Processing	VII	3	2	0	5	3	1	0	4
	BTCS705	Specialized Track Elective - I Machine Learning for Intelligent Systems									
8.	BTCS704	Specialized Track Elective - II - Fundamentals of Robotics & Automation	VII	3	2	0	5	3	1	0	4
	BTCS706	Specialized Track Elective - II - Industry 4.0 & Application Areas									
9.	BTCS707	Specialized Track Elective III - Vulnerability & Risk Management	VII	3	2	0	5	3	1	0	4
	BTCS708	Specialized Track Elective - III - Digital forensic, Investigation & response									
Total				**27**	**18**	**0**	**45**	**27**	**9**	**0**	**36**

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Open Elective Courses

1. Number of Open Elective Courses: 01
2. Credits: 02

Sr. No.	Course Code	Course Name	Sem	Teaching Scheme (Hours / week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1.	NOC01	NPTEL Elective	v	2	0	0	2	2	0	0	2
Total				**2**	**0**	**0**	**2**	**2**	**0**	**0**	**2**

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Project Work, Seminar and Internship In Industry Or Elsewhere

1. Number of Project Work, Seminar And Internship In Industry Or Elsewhere: 10
2. Credits: 30

Sr. No.	Course Code	Course Name	Sem	Teaching Scheme (Hours / week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1.	BTCS208	Industrial Internship	II	0	0	0	0	0	0	0	2
2.	BTCS306	Industrial Internship	III	0	0	0	0	0	0	0	2
3.	BTCS407	Industrial Internship	IV	0	0	0	0	0	0	0	2
4.	BTCS506	Industrial Internship	V	0	0	0	0	0	0	0	2
5.	BTCS610	Minor Project - I	VI	0	6	0	6	0	3	0	3
6.	BTCS611	Industrial Internship	VI	0	0	0	0	0	0	0	2
7.	BTCS709	Minor Project - II	VII	0	6	0	6	0	3	0	3
8.	BTCS710	Industrial Internship	VII	0	0	0	0	0	0	0	2
9.	BTCS801	Major Project	VIII	0	30	0	30	0	15	0	15
Total				**0**	**42**	**0**	**42**	**0**	**21**	**0**	**33**

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Ability Enhancement Courses

1. Number of Ability Enhancement Courses: 7
2. Credits: 14

Sr. No.	Course Code	Course Name	Sem	Teaching Scheme (Hours / week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1.	AECC101	Fundamentals of English	I	2	0	0	2	2	0	0	2
2.	VACC101	Foundation Course	I	0	0	0	4	0	0	0	4
3.	AECC201	Communication Skills in English	II	2	0	0	2	2	0	0	2
4.	AECC301	Entrepreneurship Development	III	2	0	0	2	2	0	0	2
5.	AECC401	Environmental Studies	IV	2	0	0	2	2	0	0	2
6.	AECC502	Indian Constitution	V	2	0	0	2	2	0	0	2
7.	AECC601	Disaster Risk Management	VI	2	0	0	2	2	0	0	2
Total				**12**	**0**	**0**	**16**	**12**	**0**	**0**	**16**

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Skill Enhancement Compulsory / Elective Courses

1. Number of Skill Enhancement Courses: 6
2. Credits: 16

Sr. No.	Course Code	Course Name	Sem	Teaching Scheme (Hours / week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1.											
2.											
Total											

Note

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Value Added Courses

1. Number of Skill Enhancement Courses: 2
2. Credits: 2

Sr. No.	Course Code	Course Name	Sem	Teaching Scheme (Hours / week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1.	VACC101	Foundation Course	I	0	0	0	4	0	0	0	4
Total				0	0	0	4	0	0	0	2

Note

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Research Project / Dissertation (Must for the research students)

1. Number of Skill Enhancement Courses: 6
2. Credits: 16

Sr. No.	Course Code	Course Name	Sem	Teaching Scheme (Hours / week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1.											
Total											

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About the Program

Augmenting cutting edge skills is the core determination of GSFC University. To supplement and nourish these skills, strong industrial support is a vital agent. Students at GSFC University receive a unique opportunity in the form of hands - on training at industries besides the classroom learning that empower them for their career development in multiple ways. The Computer Science Engineering program at GSFC University emphasizes on providing core fundamental knowledge along with practical and hands-on experience and an exposure to entrepreneurship & research.

This program focuses on Holistic development of the students by participating in the co - curricular and extra - curricular activities organized through different Student Managed Clubs and Student Chapters Continuous Grooming of students by Developing Soft Skills, Preparing for Placements, Preparing for Competitive Exams by arranging special sessions and through Foundation Course & Bridge Course.

Computer Science & Engineering is continuously evolving and adapting to new developments in science and technology. The knowledge of the emerging technology is essential for any Computer Engineer in addition to the fundamental subjects of classical Computer Science Engineering.

To impart the cutting edge knowledge Computer Science & Engineering program has revamped and offers three specializations in:

1. Data science, Artificial intelligence and Machine Learning
2. IOT and Automation
3. Cyber Security

Teaching Scheme

Semester – I B.Tech Computer Science & Engineering

Sr. No.	Course Code	Course Name	Teaching Scheme (Hours / week)				Teaching Credit			
			L	P	T	Total	L	P	T	Total
1.	BTEC101	Basics of Electrical & Electronics	3	2	0	5	3	2	0	5
2.	BTMA103	Mathematics – I	3	0	1	4	3	0	1	4
3.	BTCS104	Computer Programming	3	2	0	5	3	2	0	5
4.	BTPY105	Engineering Physics	3	2	0	5	3	2	0	5
5.	BTCS106	ICT Workshop	0	2	0	2	0	2	0	2
6.	BTFS108	Fundamentals in Fire & Environment, Health, Safety	2	0	0	2	2	0	0	2
7.	AECC101	Fundamentals of English	2	0	0	2	2	0	0	2
8.	VACC101	Foundation Course	0	0	0	0	0	0	0	0
Total			**16**	**8**	**1**	**25**	**16**	**8**	**1**	**25**

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Sr. No.	Course Code	Course Name	Teaching Scheme (Hours / week) Teaching Credit					
			Theory MS Marks	Theory CEC Marks	Theory ES Marks	Theory Marks	Practical Marks	Total Marks
1.	BTEC101	Basics of Electrical & Electronics	20	40	40	100	50	150
2.	BTMA103	Mathematics – I	20	40	40	100	0	100
3.	BTCS104	Computer Programming	20	40	40	100	50	150
4.	BTPY105	Engineering Physics	20	40	40	100	50	150
5.	BTCS106	ICT Workshop	0	0	0	0	50	50
6.	BTFS108	Fundamentals in Fire & Environment, Health, Safety	0	0	0	0	0	P/F
7.	AECC101	Fundamentals of English	20	40	40	100	0	100
8.	VACC101	Foundation Course	0	0	0	0	100	100
Total			**100**	**200**	**200**	**500**	**300**	**800**

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Course Code BTEC101	Course Name Basic of Electrical & Electronics	Semester I

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	NIL
Course Category	Engineering Science
Course focus	Skill development
Rationale	Basic electrical and electronics knowledge is essential for understanding modern technology, from everyday applications to career opportunities. It provides a foundation for working with computers, telecommunications, renewable energy, and more. It promotes safety by teaching proper handling of electricity and hazard awareness. This knowledge enables DIY projects, repairs, and problem-solving skills. It also contributes to environmental sustainability by understanding energy consumption and designing efficient systems.
Course Revision / Approval Date	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Emphasize the fundamental concepts and overview of Electrical Engineering & Electronics. **2.** Imparting fundamental knowledge on electronic components **3.** To provide brief idea about electrical machines **4.** To be aware about communication engineering concepts **5.** To gain knowledge about test equipment of electrical and electronics.

Course Content	Weightage	Contact Hours
Unit 1: Electrical Engineering Study of voltage, current, power & energy. Application of Ohm's law, Kirchhoff's law, Lenz law. Electromagnetic induction through the working of a transformer.	**20%**	**10**
Unit 2: Concept of 1 - Phase, 3 - Phase AC supply. Introduction of terms like RMS value, average value. Familiarity with components like resistors,capacitors, diodes, LED's, their application, uses, industrial specification. Introduction to component data sheets.	**25%**	**10**
Unit 3: Electrical Machines Understanding the construction, type, principle of operation of various motors like DC, Stepper, Servo,AC. Introduction to the concepts of motor selection and sizing.	**25%**	**10**
Unit 4: Electronics Engineering Introduction of electronic components like diodes, LED's, transistors, O Amps, Gates Industrial specification & data sheets of the components. Characteristics and usage of the components. Signals: Analog and Digital. Introduction to industrial data acquisition.	**20%**	**10**
Unit 5: Test Equipment Introduction to Multimeter and Oscilloscope.	**10%**	**05**

List Of Practical	Weightage	Contact Hours
Practical 1: Symbols of Electrical & Electronics equipment, Basics of Electrical safety & Study of Electrical Safety rules	**20%**	**03**
Practical 2: Patch cords, Digital Multimeter (DMM), Familiarization with Digital multimeter (DMM).	**20%**	**03**
Practical 3: Measurement of AC Voltage at 230 V AC Mains plug, Measurement of DC Voltage for cell phone battery of 3.8 V DC, Measurement of Resistance of Current coil & Potential coil of Energy meter, Measurement of Continuity of any wire / fuse.	**20%**	**03**
Practical 4: Study the basics of phase control transformers and verify its turn - ratio, Familiarization with Digital Storage Oscilloscope (DSO).	**20%**	**03**
Practical 5: Understand the construction & working of energy meter, Load Test on 1 Phase AC CSCR Type AC Motor, Load Test on DC Shunt Motor..	**20%**	**03**

Instructional Method and Pedagogy

Teaching basic electrical and electronics, a combination of instructional methods and pedagogies can be employed to enhance learning. A hands - on approach, such as laboratory experiments, allows students to directly engage with circuits and electronic components, reinforcing theoretical concepts.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Apply** the concepts of limits continuity and derivatives to solve problems.	Cognitive	Apply
CO2	**Determine** convergence or divergence of sequences and series.	Cognitive	Determine
CO3	**Use** Taylor and MacLaurin series to represent functions. Solve application problems.	Cognitive	Apply
CO4	**Understand** functions of several variables, limits, continuity, partial derivatives. Identify and solve some system of linear equations.	Cognitive	Understand
CO5	**To deal** with functions of several variables that is essential in most branches of engineering. The essential tool of matrices and linear algebra in a comprehensive manner.	Cognitive	Apply

Learning Resources	
1.	**Textbook** **1.**
2.	**Reference Books** **1.** Thomas, G.B., Finney, R.L., Calculus and Analytic Geometry, 9th Ed.,Wesley / Narosa, (1998).
3.	**Journals & Periodicals** **1.** Journal of Electrical Engineering and Electronics **2.** IET Power Electronics **3.** International Journal of Electronics **4.** IEEE Transactions on Education.
4.	**Other Electronic Resources** **1.** www.electronicsclub.info **2.** www.circuitlab.com

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Apply** the concepts of limits continuity and derivatives to solve problems.
2.	**Determine** convergence or divergence of sequences and series.
3.	**Use** Taylor and MacLaurin series to represent functions. Solve application problems.
4.	**Understand** functions of several variables, limits, continuity, partial derivatives. Identify and solve some system of linear equations.
5.	**To deal** with functions of several variables that is essential in most branches of engineering. The essential tool of matrices and linear algebra in a comprehensive manner.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	0	0	2	0	0	1	0	0	3
CO2	3	0	0	0	0	1	0	0	2	0	0	3
CO3	3	0	0	0	0	1	0	0	2	0	0	3
CO4	3	0	0	0	0	2	0	0	2	0	0	3
CO5	3	0	0	0	0	1	0	0	1	0	0	3

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	2	0	0
CO2	0	3	0
CO3	0	2	0
CO4	0	0	1
CO5	0	0	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS103	Course Name Mathematics - I	Semester I

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	0	1	4	3	0	1	3

Course Prerequisites	Differentiation and Integration (Basic calculus), Trigonometry.
Course Category	Basic Science
Course focus	Skill Development
Rationale	Mathematics is essential for everyday life, providing practical applications and problem - solving skills. It forms the foundation for science, technology, engineering, and mathematics (STEM) fields. Learning mathematics enhances cognitive development, including critical thinking and analytical skills.
Course Revision / Approval Date	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To introduce the concept of linear system of equations, stochastic process, neural network, non- linear and combinational optimization. **2.** Provide an understanding of statistical concepts. **3.** Understand the matrix and vectors. **4.** Computations for implementing various numerical linear algebra algorithms. **5.** Learn about the Recurrence Relation.

Course Content	Weightage	Contact Hours
Unit 1: Review of limits, continuity, and differentiability of function of single variable; indeterminate forms & Hospitals Rule.	**20%**	**07**
Unit 2: Sequences and series, Tests for convergence of series (nth term, Comparison, limit comparison, Ratio, Root, Integral, Geometric series, Alternating series), Power Series, Taylor Series, Maclaurin's Series.	**20%**	**10**
Unit 3: Partial Derivatives Limit and continuity of functions of two variables, chain rule, total derivatives, Taylor's series expansion of function of two variables.	**20%**	**10**
Unit 4: Applications of Partial Derivatives Maxima and minima, Lagrange multipliers, errors and approximation, implicit functions, tangent plane and normal to a surface.	**20%**	**08**
Unit 5: Recurrence Relations Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving Inhomogeneous Recurrence Relations	**20%**	**10**

List Of Practical Tutorial	Weightage	Contact Hours
Practical 1: **A.** Limits, Continuity, Differentiability of one variable functions. **B.** Limits, Continuity, Differentiability of two variable functions.	**20%**	**03**
Practical 2: **A.** Partial Derivatives: Total Derivatives, Composite functions. **B.** Application of Partial Derivatives: Maxima – Minima of functions, Taylor's Series.	**20%**	**03**
Practical 3: **A.** Application of Partial Derivatives: Tangent Plane Normal line, Error approximation. **B.** Matrices: Rank and Inverse of matrix.	**20%**	**03**
Practical 4: **A.** Matrices: Solution of System of linear equations. **B.** Eigenvalues and Eigenvectors of a matrix.	**20%**	**03**
Practical 5: **A.** Convergence and Divergence of Sequence. **B.** Convergence and Divergence of Series.	**20%**	**03**

Instructional Method and Pedagogy

For engineering mathematics, an effective instructional method involves a combination of problem-based learning, active learning, and technology integration. Engage students in solving real-world engineering problems, promoting critical thinking and application of mathematical concepts. Utilise visualisations, demonstrations, and mathematical software to enhance understanding.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Apply** the concepts of limits, continuity and derivatives to solve problems.	Cognitive	Apply
CO2	**Determine** convergence or divergence of sequences and series.	Cognitive	Determine
CO3	**Use** Taylor and MacLaurin series to represent functions. Solve application problems.	Cognitive	Apply
CO4	**Understand** functions of several variables, limits, continuity, partial derivatives. Identify and solve some system of linear equations.	Cognitive	Understand
CO5	**To deal** with functions of several variables that is essential in most branches of engineering. The essential tool of matrices and linear algebra in a comprehensive manner.	Cognitive	Apply

Learning Resources	
1.	**Reference Books** **1.** Thomas, G.B., Finney, R.LCalculus and Analytic Geometry, 9th Ed.,Wesley / Narosa, (1998)..
2.	**Journals & Periodicals** **1.** Journal of Optimization Theory and Applications. **2.** Journal of Mathematical Modelling and Algorithms. **3.** SIAM Journal on Applied Mathematics. **4.** Mathematical Problems in Engineering.
3.	**Other Electronic Resources** **1.** www.onlinemathlearning.com **2.** www.mathway.com

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Apply** the concepts of limits, continuity and derivatives to solve problems.
2.	**Determine** convergence or divergence of sequences and series.
3.	**Use** Taylor and MacLaurin series to represent functions. Solve application problems.
4.	**Understand** functions of several variables, limits, continuity, partial derivatives. Identify and solve some system of linear equations.
5.	**To deal** with functions of several variables that is essential in most branches of engineering. The essential tool of matrices and linear algebra in a comprehensive manner.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	1	1	0	0	0	0	1	0	2
CO2	2	1	1	0	0	0	0	0	0	1	0	0
CO3	2	1	2	1	0	0	0	0	0	1	0	1
CO4	3	2	2	2	1	0	0	0	0	1	0	2
CO5	2	2	3	3	1	0	0	0	0	1	0	2

Mapping of PSOs & Cos

	PSO1	PSO2	PSO3
CO1	0	2	2
CO2	0	0	1
CO3	0	0	0
CO4	0	2	2
CO5	0	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS104	Course Name Computer Programming I	Semester I

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	NIL
Course Category	Engineering Science
Course focus	Skill development
Rationale	Learning C programming is essential due to its versatility, efficiency, and portability. It provides low - level control and high - level abstraction, making it suitable for a wide range of applications. C offers access to system - level functions, enabling interaction with hardware and development of performance - critical software.
Course Revision / Approval Date	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To provide the basics of programming components. **2.** To develop logics for arrays and strings which will help them to create applications in C. **3.** To familiarise students with functions and pointers. **4.** To give a brief idea about structures in c programming. **5.** To gain knowledge about file handling using c language.

Course Content	Weightage	Contact Hours
Unit 1: Introduction Introduction to programming paradigms, structure of a C program, data types, storage classes, constants, enumeration constants, keywords, operators with precedence and associativity, expressions, input/output statements, assignment statements, decision-making statements, and control structures.	**20%**	**09**
Unit 2: Arrays & Strings Array declaration, initialization, 1D & 2D arrays, matrix operations (add, scale, determinant, transpose), string operations (length, compare, concatenate, copy), sorting (bubble), and searching (linear, binary).	**20%**	**09**
Unit 3: Functions & Pointers Function prototype, definition, call; built-in functions (string, math), recursion; pointers and pointer operators, pointer arithmetic, arrays and pointers, array of pointers, parameter passing (by value and by reference).	**20%**	**09**
Unit 4: Structures Structure: Nested structures, Pointer and Structures, Array of structures, Self - referential structures, typedef, Dynamic memory allocation: malloc, calloc, realloc, free().	**20%**	**09**
Unit 5: File Processing Files and file handling operations, types of file processing: Sequential access, Random access, Sequential access file, Command line argument.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: 1. Write a program to print “Hello GSFC University”. 2. Write a program to perform basic arithmetic operations (sum, area, interest, temperature conversion). 3. Write a program to swap two numbers (with and without a third variable). 4. Write a program to check even/odd, leap year, and greatest of three numbers. 5. Write a program to reverse a number and check if it's prime. 6. Write a program to print first 15 natural numbers, patterns, Fibonacci series, and factorial. 7. Write a program using switch to display student percentage and arithmetic operations.	**20%**	**06**
Practical 2: 1. Write a program to input 10 elements and display their sum, average, and maximum. 2. Write a program to display a matrix and perform addition, subtraction, and multiplication of two matrices.	**20%**	**06**
Practical 3: 1. Write a program to find factorial and display table of a using functions. 2. Write a program to demonstrate call by value and call by reference. 3. Write a program to find the largest of two numbers and return multiple values from a function. 4. Write a program to pass an array to a function. 5. Write a program to declare and use pointers, including & and * operators. 6. Write a program to add numbers using pointers and store/display array elements using a pointer.	**20%**	**06**

Practical 4: 1. Write a program to declare and use structures (student info, distances). 2. Write a program to use nested structures and pointers with structures. 3. Write a program to handle an array of structures for storing multiple student records.	**20%**	**06**
Practical 5: 1. Write a program to create a file and store information. 2. Write a program to read contents from a file. 3. Write a program to append content at the end of file.	**20%**	**06**

Instructional Method and Pedagogy:
Teaching will be conducted through interactive lectures and practical lab sessions. Emphasis will be on hands-on programming, real-life problem-solving, and continuous practice.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	Gain basic **understanding** of basic components of programming language.	Cognitive	Understand
CO2	**Understand** any other programming language with the knowledge of array & string.	Cognitive	Understand
CO3	**Apply** function concepts in real time applications.	Cognitive	Apply
CO4	**Analyse** working of structure in C or other programming languages.	Cognitive	Analyse
CO5	Students will be able to **develop** applications using C Programming.	Cognitive	Apply

Learning Resources	
1.	**Textbook** 1. "The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie 2. "C Programming Absolute Beginner's Guide" by Greg Perry & Dean

	Miller.
2.	**Reference Books** 1. Thomas, G.B., Finney, R.L., Calculus and Analytic Geometry, 9th Ed.,Wesley / Narosa, (1998).
3.	**Journals & Periodicals** 1. ACM Transactions on Programming Languages and Systems. 2. IEEE Transactions on Software Engineering.
4.	**Other Electronic Resources** 1. https://www.gnu.org/software/libc/manual/ 2. https://www.learn-c.org/

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	**Course Outcomes**
1.	Gain basic **understanding** of basic components of programming language.

2.	**Understand** any other programming language with the knowledge of array & string.
3.	**Apply** function concepts in real time applications.
4.	**Analyse** working of structure in C or other programming languages.
5.	Students will be able to **develop** applications using C Programming.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	0	0	1	3	0	0	0	0	0	0	2
CO2	1	0	1	1	3	0	0	0	0	0	0	2
CO3	1	0	1	1	3	0	0	0	0	0	0	2
CO4	1	0	2	1	3	0	0	0	2	1	0	2
CO5	1	2	3	1	3	0	1	0	3	2	0	2

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	1	3
CO2	1	2	3
CO3	1	2	3
CO4	1	2	3
CO5	3	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTPY105	Course Name Engineering Physics	Semester I

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	NIL
Course Category	Engineering Science
Course focus	Skill development
Rationale	Engineering physics combines the principles of physics and engineering, bridging the gap between theory and practical applications. It equips students with problem solving skills, a deep understanding of scientific principles, and the ability to apply them to engineering challenges.
Course Revision / Approval Date	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To familiarise with the basics of Noise, Vibrations and Oscillations. **2.** To inculcate fundamental knowledge of Electromagnetism and its engineering applications. **3.** To develop basic understanding for different applications of optical phenomena. **4.** To embrace optical technologies and understand their functioning. **5.** To familiarise with introductory quantum physics and its importance.

Course Content	Weightage	Contact Hours
Unit 1: Noise and Vibrations Concept of Noise and its sources. Noise Terminology. Definition of Harshness, acceptable levels and perception. Sources of Vibrations. Simple harmonic motion. Damped harmonic oscillator and its energy decay, Quality factor. Forced harmonic oscillator and its steady - state motion. Power absorbed by the oscillator. Resonance. Analogy between electrical and mechanical oscillations. Mathematical modeling of vibrations.	**25%**	**12**
Unit 2: Electromagnetism Laws of Electrostatics. Polarisation and corresponding classification of materials Magnetization and corresponding classification of materials, Permeability and susceptibility. Hysteresis Maxwell's equations. Continuity equation.	**20%**	**09**
Unit 3: Modern Optics - I Superposition of waves and Interference. Concept of Diffraction and types of Diffraction. Fraunhofer diffraction of single and multiple slits. Types and applications of Diffraction gratings. Bragg's law.	**20%**	**09**
Unit 4: Modern Optics – II Concept of Polarization and types of Polarization. Polarization using reflection, double refraction, and scattering. Optical activity. Concept of Lasers, working and different types of Lasers, safety aspects, using lasers as sensors.	**15%**	**07**
Unit 5: Quantum Physics Black body radiation and concept of Photons, Photoelectric effect, de Broglie hypothesis, wave particle duality, Interpretation of wave - function, Uncertainty relations, Schrodinger's wave - equation, Particle in a box.	**20%**	**08**

List Of Practical	Weightage	Contact Hours
Practical 1: **A.** To determine the frequency of vibrations on a string using Melde's experiment. **B.** To determine the frequency of the A.C. mains source using a Sonometer.	**20%**	**8**
Practical 2: **A.** To determine magnetic hysteresis Properties of ferromagnetic materials. **B.** To find the horizontal component of earth's magnetic field using a tangent galvanometer. **C.** To determine the magnetic dipole moment of a bar magnet and horizontal intensity of a bar magnet and horizontal intensity of earth's magnetic field using a deflection magnetometer.	**20%**	**6**
Practical 3: **A.** To determine the wavelength of Monochromatic source using diffraction gratings. **B.** To determine the dispersive power of a grating. (8) To determine wavelength of light using Newton's rings setup. **C.** To determine refractive index of liquids using Newton's Ring (Virtual Lab).	**20%**	**8**
Practical 4 A. To determine the specific rotation of sugar using a polarimeter (using setup / virtual lab).	**20%**	**4**
Practical 5: **A.** To determine Planck's constant using photoelectric effect setup. **B.** To determine the work function of the given material using photoelectric effect setup.	**20%**	**4**

Instructional Method and Pedagogy

The pedagogy should emphasize the integration of theory and practical applications, promote active learning through interactive discussions and collaborative projects, and provide opportunities for students to explore and analyze complex engineering systems.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understanding** of the basic knowledge of harmonic motions.	Cognitive	Understand
CO2	Conceptualization of different electric and magnetic properties of materials.	Cognitive	Analyze
CO3	**Understanding** different engineering applications of optical fundamentals.	Cognitive	Understand
CO4	**Conceptualization** of construction & working of lasers.	Cognitive	Analyze
CO5	**To embrace** the concept of quantum physics & have a basic understanding of its principles.	Cognitive	Apply

Learning Resources	
1.	**Textbook** **1.**
2.	**Reference Books** **1.** Textbook of Engineering Physics by Dr. P. S. Aithal and Dr. H. J. Ravindra, ACME Learning **2.** Engineering Physics by S K Nayak and K.P. Bhuvana, Tata McGraw-Hill Education.
3.	**Journals & Periodicals** **1.** IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control **2.** Journal of Magnetism and Magnetic Materials.

4.	**Other Electronic Resources** 1. phet.colorado.edu 2. openstax.org

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Understanding** of the basic knowledge of harmonic motions.
2.	Conceptualization of different electric and magnetic properties of materials.
3.	**Understanding** different engineering applications of optical fundamentals.
4.	**Conceptualization** of construction & working of lasers.
5.	**To embrace** the concept of quantum physics & have a basic understanding of its principles.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	0	0	1	3	0	0	0	0	0	0	2
CO2	1	0	1	1	3	0	0	0	0	0	0	2
CO3	1	0	1	1	3	0	0	0	0	0	0	2
CO4	1	0	2	1	3	0	0	0	2	1	0	2
CO5	1	2	3	1	3	0	1	0	3	2	0	2

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	1	3
CO2	1	2	3
CO3	1	2	3
CO4	1	2	3
CO5	3	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS106	Course Name ICT Workshop	Semester I

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
0	2	0	2	0	1	0	1

Course Prerequisites	NIL
Course Category	Engineering Science
Course focus	Skill development
Rationale	The rationale for the ICT subject is to equip individuals with the necessary skills and knowledge to thrive in the digital age.
Course Revision / Approval Date	2/8/2022
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To aware students about the basics of computer hardware. **2.** To brief about troubleshooting and operating systems. **3.** To provide an advanced knowledge about advanced functionalities of an Excel. **4.** To give basic knowledge of Cyber Security. **5.** To make students understand about various tools and technologies.

Course Content	Weightage	Contact Hours
Unit 1: Overview of Computer Hardware Introduction to hardware peripherals and its generations. Use and features of upgraded hardwares in recent computers/laptops. SMPS: Working, output connectors, UPS and Stabilizer Assembling and disassembling a computer.	**20%**	**09**
Unit 2: Troubleshooting and Operating System Hardware troubleshooting and repairing, Software troubleshooting and dealing with various error messages. Installation of operating system - windows and Linux . Multiple operating system installation in single system (Dual Boot). bootable mass storage devices.	**20%**	**09**
Unit 3: Advanced Features of an Excel Advanced features of Excel / Google Sheet: Cell referencing, Hyperlink, Count and countif LOOKUP / VLOOKUP, Split cells, freeze panes, group and outline, Sorting, Conditional formatting, Pivot Tables, Interactive Buttons, Importing Data, Data Protection, Data Validation	**20%**	**09**
Unit 4: Introduction of Tools & Technologies Introduction to Google Office Tools - Docs, Forms, slides,sites Introduction to Designing Tools, Latex, Online cloud platforms Introduction to AI, ML & DS Tools, IoT & Automation Tools	**20%**	**09**
Unit 5: Cyber Awareness Introduction to Cyber security Tools, Cyber Hygiene: viruses on the internet and installation of antivirus software. Customization of the browsers to block pop ups, block active x downloads to avoid viruses and/or worms..	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: **A.** Computer Assemble & Disassemble.	**20%**	**06**
Practical 2: **A.** Installation of Virtual Machine. **B.** Installation of Operating System (Windows 10,11 & Linux).	**20%**	**06**
Practical 3: **A.** Auto fill out Invoice. **B.** Auto fill out the Marksheet.	**20%**	**06**
Practical 4: **A.** Make ICT workshop Google Slider PPT.	**20%**	**06**
Practical 5: **A.** Installation of Security Tools.	**20%**	**06**

Instructional Method and Pedagogy

The instructional methods and pedagogies for teaching ICT involve a combination of theoretical knowledge and practical application.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	Upon completion of this laboratory course, students will be able to **read & use** a manufacturing drawing as a definition for the manufacturing of a part.	Cognitive	Understand
CO2	**Able to fabricate** components with their own.	Cognitive	Analyze
CO3	**Understand** the practical difficulties encountered in industries during any assembly work.	Cognitive	Understand
CO4	Will also get practical knowledge of the dimensional.	Cognitive	Apply
CO5	Accuracies and dimensional tolerances possible with different manufacturing processes.	Cognitive	Apply

Learning Resources	
1.	**Textbook** **1.**
2.	**Reference Books** **1.** Singh, D.K., Fundamentals of Manufacturing Engineering, Ane Books Pvt. Ltd, New Delhi, 2nd Edition, (2009). **2.** Raghuwanshi, B.S., Course in Workshop Technology, DhanpatRai& Sons, New Delhi, (1991). **3.** Schey, J.A., Introduction to Manufacturing Process, 3rd.Edition, McGraw Hill, (2000).
3.	**Journals & Periodicals** **1.** Journal of Information Technology. **2.** ACM Transactions on Computer - Human Interaction. **3.** Journal of Computer - Mediated Communication".

4.	**Other Electronic Resources** **1.** Online Professional Development Courses **a.** Websites like LinkedIn Learning, Udemy, and Coursera offer online courses specifically designed for professional development in ICT.

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	**Course Outcomes**
1.	Upon completion of this laboratory course, students will be able to **read & use** a manufacturing drawing as a definition for the manufacturing of a part.
2.	**Able to fabricate** components with their own.
3.	**Understand** the practical difficulties encountered in industries during any assembly work.
4.	Will also get practical knowledge of the dimensional.
5.	Accuracies and dimensional tolerances possible with different manufacturing processes.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	0	2	2	2	0	2	2	2	2
CO2	1	2	1	0	2	0	0	0	2	2	2	2
CO3	1	0	1	2	2	1	0	0	2	0	2	3
CO4	1	2	2	0	2	2	2	0	2	0	2	3
CO5	1	2	0	2	2	0	0	0	2	2	2	3

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	0	1	1
CO2	0	1	1
CO3	0	1	1
CO4	0	1	1
CO5	0	1	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTFS108	Course Name Fundamentals of Fire, Safety, Health & Environmental	Semester I

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
2	0	0	2	2	0	0	2

Course Prerequisites	NIL
Course Category	Engineering Science
Course focus	Employability
Rationale	The rationale behind fire and environmental safety as a subject is to educate individuals and communities about the risks associated with fire and other environmental hazards, and to promote strategies and practices that minimize those risks.
Course Revision / Approval Date	19/8/2019

Course Objectives (As per Blooms' Taxonomy)	To enable students to: **1.** Understand the fire, safety, health and environment challenges in the built and industrial environment and approaches to addressing the same. **2.** Become aware of important past incidents causing major loss of life & property and damage to the environment, and their impact with respect to safety legislation and environment. **3.** History and current role of Fire & EHS related legislation and role of agencies involved with implementation. **4.** Understand approaches for addressing fire and EHS challenges in the industrial environment. **5.** Become familiar with current fire & safety engineering and management concepts and practices followed in the industry.

Course Content	Weightage	Contact Hours
Unit 1: Challenges to safety in the built environment, types of hazards likely to cause harm (fire, burns, electric shock, falls), natural disasters, fatalities involving hazardous environments. Important Case studies involving major incidents and their subsequent effect on safety outlook. Approach to addressing Fire & EHS challenges at organization and national level.	**20%**	**08**
Unit 2: The concept of industrial safety, health and environment - need, nature and importance. Focus on Human resource, and the concept of importance of 'man' as the central theme in safety. Concept of accident prevention, occupational health and environmental protection. Problems of Industrial safety, occupational health and environmental pollution and the modern concept of SHE.	**20%**	**05**

Unit 3: History and role of building codes and safety legislation, concept of safety versus risk, enforcement of codes and standards, role of government agencies and emergency services in enforcing legislation, government framework and infrastructure involved in safety legislation enforcement. Role of code enforcement, plan review and approval, record keeping, public education.	**20%**	**04**
Unit 4: Industrial Fire & Safety management concepts – hazard identification and risk assessment, risk reduction and control methods. Design aspects such as segregation and separation, fire resisting construction, emergency exit arrangements, access for emergency agencies, fire protection systems, safe operational practices, maintenance and upkeep of systems, planning for emergency response. Design approaches for fire and safety, NFPA fire safety concepts tree.	**20%**	**05**
Unit 5: Environmental Pollution Air Pollution Sources and effects of air pollution, NAAQS Basic principles of air pollution control devices Global effects of air pollution, Air Pollution due to automobiles, photochemical smog. Water Pollution: Sources and effects, Effluent standards Domestic and Industrial wastewater and treatment principles, Land pollution:- Solid waste, solid waste management by land filling, composting. Social Issues and the environment, from unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, watershed management, resettlement and rehabilitation of people; its problems and concerns.	**10%**	**08**

Instructional Method and Pedagogy

The instructional method and pedagogy of the fire and safety subject typically involve a combination of theoretical knowledge, practical training, and hands-on exercises.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	Students will **understand** the fire and EHS challenges faced in the built and industrial environment, and the current approaches taken to address the same.	Cognitive	Understand

CO2	Students will **learn** about major incidents which affected industrial and societal attitudes towards safety.	Cognitive	Learn
CO3	Students will become **familiar** with the history and development of fire & safety legislation, their current form and role of different agencies involved in their implementation.	Cognitive	Familiar
CO4	Students will be **able to explain** the different design approaches for addressing the fire & life safety challenges inbuilt and industrial environments.	Cognitive	Analyze
CO5	Students will become aware of the different engineering and management concepts **applied** for addressing fire and safety risks in industrial scenarios.	Cognitive	Apply

Learning Resources	
1.	**Reference Books** **1.** Cheunisinoff Graffia, Environmental Health & Safety Management, Reprint Jaico Publishing House. **2.** Tarafdar, Industrial Safety Management.
2.	**Journals & Periodicals** **1.** International Journal of Environmental Research and Public Health. **2.** Journal of Occupational and Environmental Hygiene.
3.	**Other Electronic Resources** **1.** OSHA, NFPA, EPA Provides information on environmental regulations, guidelines, and resources.

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	Students will **understand** the fire and EHS challenges faced in the built and industrial environment, and the current approaches taken to address the same.
2.	Students will **learn** about major incidents which affected industrial and societal attitudes towards safety.
3.	Students will become **familiar** with the history and development of fire & safety legislation, their current form and role of different agencies involved in their implementation.
4.	Students will be **able to explain** the different design approaches for addressing the fire & life safety challenges inbuilt and industrial environments.
5.	Students will become aware of the different engineering and management concepts **applied** for addressing fire and safety risks in industrial scenarios.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	1	3	2	2	2	2	1	1	2
CO2	1	3	2	3	2	2	1	1	2	1	2	2
CO3	3	1	0	1	3	2	2	1	2	1	1	2
CO4	3	1	0	1	3	2	2	1	2	1	2	2
CO5	3	1	0	1	3	2	2	1	2	1	2	2

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	2	1	1
CO2	2	2	1
CO3	1	1	0
CO4	1	2	0
CO5	0	2	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

c++

Teaching Scheme

Semester – II B.Tech Computer Science & Engineering

Sr. No.	Course Code	Course Name	Teaching Scheme (Hours / week)				Teaching Credit			
			L	P	T	Total	L	P	T	Total
1.	BTCS201	Object oriented Programming with C++	3	2	0	5	3	2	0	5
2.	BTCS202	Data Structures	3	2	0	5	3	2	0	5
3.	BTCS203	Web Technologies	3	2	0	5	3	2	0	5
4.	BTCS204	Mathematics - II	3	0	1	4	3	0	1	4
5.	BTCS205	Digital Electronics	3	2	0	5	3	2	0	5
6.	AECC201	Communication Skills in English	2	0	0	2	2	0	0	2
7.	BTCS206	Industrial Internship	0	0	0	0	0	2	0	2
Total			**17**	**8**	**1**	**26**	**17**	**10**	**1**	**28**

Note
L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

Sr. No.	Course Code	Course Name	Teaching Scheme (Hours / week) Teaching Credit					
			Theory MS Marks	Theory CEC Marks	Theory ES Marks	Theory Marks	Practical Marks	Total Marks
1.	BTCS201	Object oriented Programming with C++	20	40	40	100	50	150
2.	BTCS202	Data Structures	20	40	40	100	50	150
3.	BTCS203	Web Technologies	20	40	40	100	50	150
4.	BTCS204	Mathematics - II	20	40	40	100	0	100
5.	BTCS205	Digital Electronics	20	40	40	100	50	150
6.	AECC201	Communication Skills in English	20	40	40	100	0	100
7.	BTCS206	Industrial Internship	0	0	0	0	100	100
Total			**120**	**240**	**240**	**600**	**300**	**900**

Note
L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

Course Code BTCS201	Course Name Object Oriented Programming With C++	Semester II

Teaching Scheme (Hours)				Teaching Credit			
Lecture	**Practical**	**Tutorial**	**Total**	**Lecture**	**Practical**	**Tutorial**	**Credits**
3	2	0	5	3	1	0	4

Course Prerequisites	C Programming
Course Category	Mandatory courses
Course focus	Skill development
Rationale	OOP with C++ is locally relevant as it enhances code organization, reusability, and data security. Nationally, OOP is significant for the software industry, promoting scalability, code maintenance, and employment opportunities. Internationally, OOP in C++ enables collaboration, interoperability with diverse systems, and utilization of popular frameworks and libraries. OOP in C++ empowers developers at all levels to build modular, efficient, and robust software systems, contributing to local development projects, national software initiatives, and global software ecosystems.
Course Revision / Approval Date	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Be aware about the basics of OOP for every OOP based programming language. **2.** Be familiar with class and object with function. **3.** Understand working and importance of constructor and destructor. **4.** Get a brief idea about inheritance. **5.** Get an overview of file handling and templates.

Course Content	Weightage	Contact Hours
Unit 1: Principles of OOP: Programming Paradigms, Basic concepts, Benefits of OOP, Applications of OOP. Introduction to C++, History of C++, Basic data types, Derived data types, Symbolic constants.Dynamic initialization, Type modifiers, Type Casting, Operator and control statements, Input and Output statements in C++.	**20%**	**09**
Unit 2: Classes and objects, class specification, member function specification, scope resolution operator, Access qualifiers, Instance creation, Member functions. Function prototyping, Function components, and Passing parameters,Inline functions, Default arguments.	**20%**	**09**
Unit 3: Array of objects, pointers to objects, this pointer, Dynamic allocation operators, Dynamic objects. Constructors,Type of Constructor, static class members and static objects. Operator overloading, friend function, stream operator overloading, data conversion.	**20%**	**09**
Unit 4: Inheritance, Defining derived classes, Single inheritance, protected data with private inheritance, multiple inheritance, multi-level inheritance, hierarchical inheritance, hybrid inheritance, multipath inheritance, Constructors in derived and base class, Abstract classes, virtual function and dynamic polymorphism, virtual destructor. Exception Handling.	**20%**	**09**
Unit 5: Streams in C++, Stream classes, Formatted and Unformatted data, manipulators, file streams, file pointer manipulation, file open and close. Templates, Template functions and Template classes.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: **A.** Write a program to demonstrate simple C++ structure with help of COUT and CIN. **B.** Write a program to demonstrate cascading I/O. **C.** Explain the use of namespace in C++ with proper examples. **D.** Write a different program to demonstrate control statements available in C++. **E.** Write a different program to demonstrate loops available in C++.	**20%**	**04**
Practical 2: **A.** Write a program to demonstrate scope resolution operators and reference variables in C++. **B.** Write a program to demonstrate implicit type casting and explicit type casting in C++. **C.** Write a program to demonstrate const keyword and #define. **D.** Write a program to demonstrate different types of user defined function and Function call **E.** Write a program to demonstrate class and object creation. Define a member function inside the class and outside the class. **F.** Write a program to show the working of different access specifiers . **G.** What do you understand about the Inline function? How can you create an Inline function?	**20%**	**06**
Practical 3: **A.** Why do an array of objects require? Demonstrate an array of objects with proper examples. **B.** Write a program to demonstrate concepts and different types of constructors. **C.** Write difference between Constructor overloading and overriding. Also apply the concept with proper examples. **D.** Write a program to demonstrate friend function. 5. Write a program to demonstrate the concept of copy constructor and static class member.	**20%**	**06**

Practical 4: **A.** Write a program to demonstrate different type of inheritances. **B.** Write a program to demonstrate the concept of polymorphism and exception handling. **C.** Explain the behavior of the constructor in derived class using examples.	**20%**	**08**
Practical 5: **A.** Perform following operation of file management Count characters & spaces: **a.** Append to a file. **b.** Copy contents & change case. **c.** Merge two files. **d.** Count characters, words & lines. **e.** Arrange records in descending order. **f.** Add & read contents of file. **g.** Create a file to store employee details. **h.** Display content of file.	**20%**	**04**

Instructional Method and Pedagogy Visual Aids & Demonstrations, Hands-On Approach, Active Learning Strategies, Real - World Examples, Project - Based Learning, Continuous Assessment

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** object - oriented programming features in C++.	Cognitive	Understand
CO2	**Implement** computer programs to solve real world problems based on object-oriented principles.	Cognitive	Apply
CO3	**Understand** the concept of Array, pointers and Polymorphism.	Cognitive	Understand
CO4	**Analyze** the concept of inheritance and exception handling.	Cognitive	Analyse
CO5	**Develop** the applications using object oriented programming with C++.	Cognitive	Create

Learning Resources	
1.	**Textbook** **1.**
2.	**Reference Books** **1.** Barbara E. Moo, JoséeLajoie, Stanley B.Lippman, C++ Primer, 5th Edition. **2.** Tony Gaddis, Starting Out with C++ - From Control Structures through Objects. **3.** Andrew Koenig Accelerated C++: Practical Programming by Example, 1st Edition. **4.** E Balagurusamy, Object-Oriented Programming with C++, Seventh edition. **5.** YashwantKanetkar, Let US C++, 2nd Edition.
3.	**Video Tutorial** 1. https://www.studytonight.com/courses/cpp-video-tutorial/
4.	**NPTEL MOOC** 1. https://nptel.ac.in/courses/106/101/106101208/

<table>
<tr><th colspan="2">Evaluation Scheme</th><th>Total Marks
150</th></tr>
<tr><td>Mid semester Marks</td><td colspan="2">20</td></tr>
<tr><td>End Semester Marks</td><td colspan="2">40</td></tr>
<tr><td rowspan="5">Practical Marks</td><td>Attendance</td><td>5 marks</td></tr>
<tr><td>Practical Exam</td><td>20 marks</td></tr>
<tr><td>Viva</td><td>10 marks</td></tr>
<tr><td>Journal</td><td>10 marks</td></tr>
<tr><td>Discipline</td><td>5 marks</td></tr>
<tr><td rowspan="4">Continuous Evaluation Marks</td><td>Attendance</td><td>5 marks</td></tr>
<tr><td>MCQs</td><td>10 marks</td></tr>
<tr><td>Open Book Assignment</td><td>15 marks</td></tr>
<tr><td>Article Review</td><td>10 marks</td></tr>
</table>

Sr. No.	Course Outcomes
1.	**Understand** object - oriented programming features in C++.
2.	**Implement** computer programs to solve real world problems based on object-oriented principles.
3.	**Understand** the concept of Array, pointers and Polymorphism.
4.	**Analyze** the concept of inheritance and exception handling.
5.	**Develop** the applications using object oriented programming with C++.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	0	0	1	3	0	0	0	0	1	0	2
CO2	1	0	1	1	3	0	0	0	0	1	0	2
CO3	1	0	1	1	3	0	0	0	0	1	0	2
CO4	1	0	2	1	3	0	0	0	2	1	0	2
CO5	1	2	3	1	3	0	1	0	3	1	0	2

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	2	3
CO2	1	1	1
CO3	1	1	2
CO4	1	2	1
CO5	3	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS202	Course Name Data Structures	Semester II

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits

3	2	0	5	3	1	0	4

Course Prerequisites	NIL
Course Category	Mandatory courses
Course focus	Employability
Rationale	Data structures and algorithms play a crucial role in both local and global contexts. At a local level, efficient data structures and algorithms enable faster processing, retrieval, and storage of information, leading to improved performance of local systems, applications, and databases. Nationally, they contribute to the development of advanced infrastructure, optimizing resource allocation, and enabling the efficient functioning of critical sectors like healthcare, transportation, and finance. Internationally, data structures and algorithms drive global technological advancements, facilitating seamless communication, secure data exchange, and collaborative research. Their relevance lies in enabling innovation, scalability, and problem - solving, benefiting individuals, communities, and societies at various levels.
Course Revision / Approval Date	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable students to: **1.** To get an idea about data and how it is stored in memory structure. **2.** To inform students about arrays and stack used in different programming languages. **3.** Familiarize with sorting and searching techniques **4.** Understand about tree and graph structures. **5.** Elaborate testing approach with data structure.

Course Content	Weightage	Contact Hours

Unit 1: Introduction to Data Structures and Algorithms: Arrays and Strings, Algorithm Development, Complexity analysis, Recursion.	**20%**	**09**
Unit 2: Linear Data Structures: Stacks: Operations and Applications, Queues: Operations and Applications, Circular Queues: Operations and Applications, Links Lists: Operation – Creations, insertion, Deletion, Circular Lists, Doubly Linked.	**20%**	**09**
Unit 3: Sorting & Searching: Insertion Sort, Merge Sort, Quick Sort, Binary Search, Linear Search, Selection Sort	**20%**	**09**
Unit 4: Non Linear Data Structures: Graphs I: Representation and Traversal, Representation: Matrix, Adjacency list, Traversal: Depth First Search, Breadth First Search, Graphs II: Basic Algorithms, Minimum Spanning Tree, Shortest Path, All pairs Shortest Path, Transitive Closer, Binary Trees, Representation, Operations: Insert, Delete, Traversal: Preorder, In order, Postured, Heap Sort, Method and Complexity, Priority Queue, Search Trees, AVl - trees, B tree, External Search.	**20%**	**09**
Unit 5: Hashing Techniques, String algorithms: Hashing Techniques, Pattern Matching, Text Editor	**10%**	**04**

List Of Practical	Weightage	Contact Hours
Practical 1: Introduction to dynamic memory allocation. DMA functions malloc(), calloc(), free() etc.	**20%**	**03**

Practical 2: **A.** Implement a program for stack that performs the following operation using an array. **a.** PUSH **b.** POP **c.** PEEP **d.** CHANGE **e.** DISPLAY **B.** Implement a program to convert infix notation to postfix notation using stack. **C.** Write a program to implement QUEUE using arrays that performs following operations: **a.** INSERT **b.** DELETE **c.** DISPLAY **D.** Write a program to implement Circular Queue using arrays that performs following operations: **a.** INSERT **b.** DELETE **c.** DISPLAY	**20%**	**03**
Practical 3: A. Write a menu driven program to implement following operations on singly linked lists. **d.** Insert a node at the front of the linked list. **e.** Insert a node at the end of the linked list. **f.** Delete a first node of a linked list g. Delete a node after Specified position. B. Write a program to implement stack using linked list	**20%**	**03**
Practical 4: **A.** Write a program to implement linear search. **B.** Write a Program to implement Binary Search. **C.** Write a program to implement, Bubble sort, Merge sort, Quick sort. **D.** Write a program to create binary search tree**.**	**20%**	**03**

Practical 5: **A.** Write a program to implement hashing using Linear Probe.	**20%**	**03**

Instructional Method and Pedagogy(Max. 100 words) Visual Aids & Demonstrations, Hands - On Approach, Active Learning Strategies, Real - World Examples, Project - Based Learning, Continuous Assessment.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** and use the process of abstraction using a programming language such as C++.	Cognitive	Understand
CO2	**Analyze** step by step and develop algorithms to solve real world problems.	Cognitive	Analyze
CO3	**Implement** various data structures viz. Stacks, Queues, Linked Lists, Trees and Graphs	Cognitive	Apply
CO4	**Understand** various searching and sorting techniques.	Cognitive	Understand
CO5	**Identify** the appropriate data structure to design efficient algorithms for the given application.	Cognitive	Analyse

Learning Resources	
1.	**Reference Books** 1. ReemaThareja, Data Structures Using C, 2nd Edition. 2. Horowitz, SartajSahni, Fundamentals Of Data Structures in C++, 2nd Edition. 3. Yashwant Kanetkar, Data Structure Through C, 2nd Edition. 4. Jean- Paul Tremblay & Paul Sorenson, An Introduction to Data Structures with Application, 2nd edition. 5. NarasimhaKarumanchi, Data Structures and Algorithms Made Easy: a. Data Structures and Algorithmic Puzzles, 5th Edition.
2.	**Video Tutorial**

	1. https://www.youtube.com/playlist?list=PL2_aWCzGMAwI3W_JlcBbTwiQS sOTa6P
3.	**NPTEL MOOC** 1. https://nptel.ac.in/courses/106/102/106102064/

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	**Course Outcomes**
1.	**Understand** and use the process of abstraction using a programming language such as C++.
2.	**Analyze** step by step and develop algorithms to solve real world problems.
3.	**Implement** various data structures viz. Stacks, Queues, Linked Lists, Trees and Graphs
4.	**Understand** various searching and sorting techniques.
5.	**Identify** the appropriate data structure to design efficient algorithms for the given application.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	0	0	0	0	0	0	0	0	0	0
CO2	1	3	0	0	0	0	3	0	0	0	0	2
CO3	1	0	0	0	3	0	0	0	0	0	0	2
CO4	0	0	0	0	3	0	0	0	0	0	0	0
CO5	0	2	3	0	3	0	3	0	0	0	0	2

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	0	1	1
CO2	0	2	1
CO3	0	3	3
CO4	0	2	3
CO5	0	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS203	Course Name Web Technologies	Semester II

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Basic Programming
Course Category	Mandatory courses
Course focus	Skill development
Rationale	Web technology plays a significant role in both local and global contexts. At a local level, web technology enables businesses and individuals to create an online presence, reach local customers, and provide essential services. It facilitates local communication, e commerce, and community engagement. Nationally, web technology drives digital transformation supporting economic growth, government services, and education. It enables efficient information sharing, e governance, and online learning platforms. Internationally, web technology connects people globally, transcending geographical boundaries. The relevance of web technology lies in its ability to empower individuals, connect societies, and foster inclusive and interconnected digital ecosystems at various levels.
Course Revision / Approval Date	24/1/2022

Course Objectives (As per Blooms' Taxonomy)	To enable students to: **1.** Provide a brief idea about html for web page development. **2.** Be aware about CSS - to design web page 3. Elaborate working of JavaScript. **3.** Understand how Jquery can enhance the look and feel of a webpage. **4.** Familiarize students with components and working of bootstrap.

Course Content	Weightage	Contact Hours
Unit 1: Introduction, Elements, Tags, Formatting, Links, Font, Images, Tables,WebForms, Form Elements, Formatting Form Attributes, Form Input Types, Media Elements, Canvas, SVG, CSS3 Introduction, Borders, Backgrounds, Text Effects, Text, Transitions, Animations, Multiple Columns, Transforms.	**20%**	**09**
Unit 2: Introduction, Operators, Function and Object, Methods, Conditional Statement & Looping Statement, Event Types.	**20%**	**09**
Unit 3: Introduction, Retrieving Page Content, Manipulating Page Content, Working with Events, JQuery Animations and Effects, Using the jQuery UI PlugIns.	**20%**	**09**
Unit 4: Introduction, Bootstrap Grid, Bootstrap Components Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Using XML with application. Transforming XML using XSL and XSLT.	**20%**	**09**

Unit 5: Introduction to PHP, Operators and Variables, Control Structures, Looping and Error handling,Iterables, PHP functions, String Functions, Array Functions, Mathematical Functions,Graphics Library (GD Support),Superglobals, Date and Time Functions, Misc. Function,Include, File handling, Object Oriented Features of PHP, Classes and Objects, Constructors, Destructor, Serialization, Inheritance, Abstract Class, Interface,Trait, namespace.	**10%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: **A.** Write a program to create a HTML page, which has properly aligned paragraphs with images, and displays a list of items in different styles. **B.** Display various text formatting tags available in HTML. (i.e.<h1>,<b>,<u> etc…), special characters. **C.** Create a HTML file which displays 3 images at LEFT, RIGHT and CENTER respectively in the browser. **D.** Demonstrate following attributes using CSS Color and background Font, Text, Border, Margin, hyperlinks and list. **E.** Demonstrate use of external style sheets.	**20%**	**03**
Practical 2: **A.** To create an html page to explain the use of various predefined functions in an array & Date object in JavaScript. **B.** Write a Program to show use of alert, confirm and prompt box. **C.** Write JavaScript to perform the following operations: **a.** To find the highest from given three values. **b.** To calculate the factorial of n. **c.** To calculate a sum of 1 to n. **d.** To check whether the given number is palindrome or not. **D.** Write a Java Script program to print current date & time.	**20%**	**03**

Practical 3: **A.** Develop the jQuery Program with the scripting tag. **B.** Develop the jQuery Program with the event methods.	**20%**	**03**
Practical 4: **A.** Create a CD Catalogue Table in XML and display it using XSL Style Sheet.	**20%**	**03**
Practical 5: **A.** Write a PHP script for Looping Structures. **B.** Write a PHP script for Switch Case statements. **C.** Write a PHP script for Class, objects and inheritance. **D.** Write a PHP script for Constructor and destructor.	**20%**	**03**

Instructional Method and Pedagogy: (Max. 100 words)

Visual Aids and Demonstrations, Hands-On Approach, Active Learning Strategies, Real - World Examples, Project - Based Learning, Continuous Assessment.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** the importance and need of client side scripting.	Cognitive	Understand
CO2	**Analyze** and Develop static and dynamic web applications.	Cognitive	Analyse
CO3	**Develop** responsive websites.	Cognitive	Create
CO4	**Apply** the jquery to enhance the creative web page.	Cognitive	Apply
CO5	**Apply** Bootstrap in real time web application development.	Cognitive	Apply

Learning Resources	
1.	**Reference Books:** **1.** Eric Freeman, HTML5 Black Book, Dreamtech Press, Head First HTML5 Programming. **2.** Jake Spurlock, Bootstrap, O'Reilly Media.

2.	**Electronic Platform** **1.** HTML, CSS, JAVASCRIPT https://www.youtube.com/playlist?list=PL41lfR6DnOruqMacTfff1zrEcqtmm7Fv **2.** JQuery https://www.youtube.com/playlist?list=PLZdjW012sjggLnRyanevMkgu51xehoQr **3.** Bootstrap https://www.youtube.com/watch?v=aTLRdrRQyN4

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Understand** the importance and need of client side scripting.
2.	**Analyze** and Develop static and dynamic web applications.
3.	**Develop** responsive websites.
4.	**Apply** the jquery to enhance the creative web page.
5.	**Apply** Bootstrap in real time web application development.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	0	0	1	3	0	0	0	0	1	0	2
CO2	1	0	1	1	3	0	0	0	0	1	0	2
CO3	1	0	1	1	3	0	0	0	0	1	0	2
CO4	1	0	2	1	3	0	0	0	2	1	0	2
CO5	1	2	3	1	3	0	1	0	3	1	0	2

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	2	3
CO2	1	1	1
CO3	1	1	2
CO4	1	2	1
CO5	3	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS204	Course Name Mathematics II	Semester II

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	0	1	4	3	0	1	4

Course Prerequisites	NIL
Course Category	Basic Science Courses / Engineering Science Courses / Mandatory courses.
Course focus	
Rationale	Mathematics - II is essential at the local, national, & international levels due to its wide - ranging applications and benefits. Locally, it enables individuals to understand & solve everyday problems involving finance, measurements, and data analysis. Nationally, it provides the foundation for scientific and technological advancements, economic growth, and informed decision - making. Internationally, mathematics facilitates collaboration, innovation, and problem-solving on a global scale, contributing to advancements in various fields, including engineering, computer science, finance, and healthcare. Mathematics - II empowers individuals and societies to navigate the complexities of the modern world and fosters critical thinking, logical reasoning, and quantitative literacy, which are indispensable skills in today's interconnected and data-driven global landscape.
Course Revision / Approval Date	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Aware students about probability. **2.** Give a brief idea about distributions in mathematics. **3.** To give a brief idea about Statistical methodology.

Course Content	Weightage	Contact Hours
Unit 1: Probability Random Experiment; Sample space; Random Events; Probability of events. Axiomatic definition of probability; Frequency Definition of probability; Finite sample spaces and equiprobable measure as special cases; Probability of Non-disjoint events (Theorems). Counting techniques applied to probability problems; Conditional probability; General Multiplication Theorem; Independent events; Bayes' theorem and related problems. 10L Random variables (discrete and continuous); Probability mass function; Probability density function and distribution function.	**20%**	**09**
Unit 2: Distributions Binomial, Poisson, Uniform, Exponential, Normal. Expectation and Variance (t and χ 2 excluded); Transformation of random variables (One variable); shev by chev inequality (statement) and problems.	**33%**	**15**
Unit 3: Statistical Methods Classification of data, Frequency tables – exclusive & inclusive, relative percentage and cumulative distribution table, visualization of data, various measures of central tendency, measure of dispersion, skewness, their interpretation and comparative applications. Frequency distributions, Data analysis, Expectations and moments, Correlation and regression, Trend analysis, Seasonal effects, Cyclical Fluctuation, Moving average, MSE, Predictions. Non-parametric statistics. Computer-based resampling techniques. Confidence intervals and statistical significance.	**34%**	**16**

Instructional Method and Pedagogy Visual Aids, Active Learning Strategies, Real-World Examples, Continuous Assessment.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** the terminologies of basic probability, two types of random variables and their probability functions observe and analyze the behavior of various discrete and continuous probability distributions.	Cognitive	Understand
CO2	**Understand** the central tendency, correlation and correlation coefficient and also regression.	Cognitive	Understand
CO3	**Apply** the statistics for testing the significance of the given large and small sample data and use time series analysis for predictions.	Cognitive	Apply

Learning Resources	
1.	**Textbook** 1.
2.	**Reference Books:** 1. W. Navidi, Statistics for Engineers and Scientists, McGraw Hill. 2. Miller & Freund's Probability and Statistics for Engineers – By Richard A Johnson., PHI. 3. Mood, Graybill and Boes, Introduction to the theory of Statistics, 3rd Edition, McGraw Hill, 1974. 4. Sharma, Business Statistics, 2nd Edition, Pearson Education, 2007. 5. Orris, Basic Statistics Using Excel and MegaStat, McGraw Hill. 2006. 6. Spiegel, Schiller and Srinivasan, Schaum's Outline of Probability and Statistics, McGraw – Hill. 7. Hogg, Mckeain and Craig, Introduction to Mathematical Statistics, 7th edition.

Evaluation Scheme		Total Marks 100
Mid semester Marks	20	
End Semester Marks	40	
Continuous Evaluation Marks	Attendance	5 marks

	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Understand** the terminologies of basic probability, two types of random variables and their probability functions observe and analyze the behavior of various discrete and continuous probability distributions.
2.	**Understand** the central tendency, correlation and correlation coefficient and also regression.
3.	**Apply** the statistics for testing the significance of the given large and small sample data and use time series analysis for predictions.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	3	0	0	0	1	0	1	0	1
CO2	1	2	1	1	0	0	0	1	0	1	0	1
CO3	3	0	1	2	0	0	0	1	0	1	0	1

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	0	3
CO2	1	0	3
CO3	1	0	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS205	Course Name Digital Electronics	Semester II

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Basics of electronics
Course Category	Basic Science Courses / Engineering Science Courses / Mandatory courses
Course focus	Skill development
Rationale	Digital Electronics holds significant relevance at the local, national, and international levels due to its pervasive impact on modern technology and communication systems. Locally, understanding digital electronics enables individuals to operate and troubleshoot common consumer devices, such as smartphones, computers, and home appliances. Nationally, it is the backbone of various industries, including telecommunications, manufacturing, and information technology, driving economic growth and innovation. Internationally, digital electronics facilitates global connectivity, data exchange, and collaboration, enabling seamless communication and integration across borders. Proficiency in digital electronics empowers individuals and nations to adapt to the rapidly evolving digital landscape, leverage emerging technologies, and contribute to the advancement of society in the digital age.
Course Revision / Approval Date	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To inform students about the number system. **2.** To familiar students with Boolean algebra. **3.** To make students understand about combinational circuits. **4.** To elaborate sequential circuits. **5.** To provide knowledge about memory devices.

Course Content	Weightage	Contact Hours
Unit 1: Data and number systems, Binary representation, Codes and their conversions: BCD, Octal, Hexadecimal, ASCII, EBDIC, Gray, Signed binary number representation with 1's and 2's complement methods.	**20%**	**09**
Unit 2: Binary arithmetic Boolean algebra, Venn diagram, logic gates and circuits, Minimization of logic expressions by algebraic method, Kmap method and Quine McCluskey method.	**20%**	**09**
Unit 3: Combinational circuits- adder, subtractor, encoder, decoder, comparator,multiplexer, demultiplexer, parity generator, etc Design of combinational circuits Programming logic devices and gate arrays.	**20%**	**09**
Unit 4: Sequential Circuits- Flip Flops, various types of Registers and counters and their design, Irregular counter, State table and state transition diagram, sequential circuits design methodology.	**20%**	**09**
Unit 5: Memory devices- ROM, RAM, EPROM, EEPROM, etc Different types of A/D and D/A conversion techniques Different Logic families- TTL, ECL, MOS and CMOS, their operation, design and specifications.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: **A.** Study of Digital Number System & Its Significance. **B.** Study of Logic Gates (Buffer, AND, OR, NOT EXOR, EXNOR, NAND & NOR). **C.** Study of Adder circuits.	**25%**	**06**
Practical 2: **A.** Study of Subtrator circuit. **B.** Study of Parity Bit Generator. **C.** Study of Sequential logic & Flip Flops.	**25%**	**06**
Practical 3: **A.** Study of CMOS Technology & Its Significance in Digital Electronics.	**25%**	**06**
Practical 4: **A.** Project Canvas.	**25%**	**06**

Instructional Method and Pedagogy
Visual Aids and Demonstrations, Hands-On Approach, Active Learning Strategies, Real-World Examples, Project-Based Learning, Continuous Assessment.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** the number system.	Cognitive	Understand
CO2	**Apply** Boolean algebra for K-maps.	Cognitive	Apply
CO3	**Analyze** Combinational circuits.	Cognitive	Analyse
CO4	**Understand** working of sequential circuits.	Cognitive	Understand
CO5	**Comprehend** understanding of memory structure.	Cognitive	Understand

Learning Resources	
1.	**Textbook** **1.**
2.	**Reference Books** **1.** Morris Mano, Digital Logic and Computer Design **2.** Anandkumar, Fundamental of Digital Circuits **3.** R. P. Jain, Digital Electronics
3.	**Video Reference** **1.** https://www.youtube.com/playlist?list=PLBlnK6fEyqRjMH3mWf6kwqiTbT 98eAOm
4.	**NPTEL MOOC** **1.** https://nptel.ac.in/courses/117106086/

<table>
<tr><th colspan="2">Evaluation Scheme</th><th>Total Marks
150</th></tr>
<tr><td>Mid semester Marks</td><td colspan="2">20</td></tr>
<tr><td>End Semester Marks</td><td colspan="2">40</td></tr>
<tr><td rowspan="5">Practical Marks</td><td>Attendance</td><td>5 marks</td></tr>
<tr><td>Practical Exam</td><td>20 marks</td></tr>
<tr><td>Viva</td><td>10 marks</td></tr>
<tr><td>Journal</td><td>10 marks</td></tr>
<tr><td>Discipline</td><td>5 marks</td></tr>
<tr><td rowspan="4">Continuous Evaluation Marks</td><td>Attendance</td><td>5 marks</td></tr>
<tr><td>MCQs</td><td>10 marks</td></tr>
<tr><td>Open Book Assignment</td><td>15 marks</td></tr>
<tr><td>Article Review</td><td>10 marks</td></tr>
</table>

Sr. No.	Course Outcomes
1.	**Understand** the number system.
2.	**Apply** Boolean algebra for K-maps.
3.	**Analyze** Combinational circuits.
4.	**Understand** working of sequential circuits.
5.	**Comprehend** understanding of memory structure.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	1	0	0	0	0	0	1	1	2
CO2	3	1	0	2	0	0	0	0	0	1	1	1
CO3	3	2	1	1	0	0	0	0	0	2	1	3
CO4	3	0	0	1	0	0	0	0	0	0	1	2
CO5	3	1	3	1	0	0	0	0	0	2	1	2

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	2	3	2
CO2	2	3	1
CO3	1	2	1
CO4	2	1	1
CO5	1	1	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Teaching Scheme

Semester – III B.Tech Computer Science & Engineering

Sr. No.	Course Code	Course Name	Teaching Scheme (Hours / week)				Teaching Credit			
			L	P	T	Total	L	P	T	Total
1.	BTCS301	Discrete Mathematics	3	0	1	4	3	0	1	4
2.	BTCS302	Object Oriented Programming With JAVA	3	2	0	5	3	1	0	4
3.	BTCS303	Operating System	3	2	0	5	3	1	0	4
4.	BTCS304	Computer Organization	3	0	1	4	3	0	1	4
5.	BTCS305	Specialized Track Elective - I - Python Programming	3	2	0	5	3	1	0	4
6.	AECC301	Entrepreneurship Development	2	0	0	2	2	0	0	2
7.	BTCS306	Industrial Internship	0	0	0	0	0	2	0	2
Total			**17**	**6**	**2**	**25**	**17**	**5**	**2**	**24**

Note
L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

Sr. No.	Course Code	Course Name	Teaching Scheme (Hours / week) Teaching Credit					
			Theory MS Marks	Theory CEC Marks	Theory ES Marks	Theory Marks	Practical Marks	Total Marks
8.	BTCS301	Discrete Mathematics	20	40	40	100	0	100
9.	BTCS302	Object Oriented Programming With JAVA	20	40	40	100	50	150
10.	BTCS303	Operating System	20	40	40	100	50	150
11.	BTCS304	Computer Organization	20	40	40	100	0	100
12.	BTCS305	Specialized Track Elective - I - Python Programming	20	40	40	100	50	150
13.	AECC301	Entrepreneurship Development	20	40	40	100	0	100
14.	BTCS306	Industrial Internship	0	0	0	0	100	100
Total			**120**	**240**	**240**	**600**	**250**	**850**

Note
L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

Course Code BTCS301	Course Name Discrete Mathematics	Semester III

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	0	0	45	3	1	0	4

Course Prerequisites	Basic Mathematics
Course Category	Professional Subjects - Core (PC)
Course focus	Skill development
Rationale	The subject focuses on developing students' understanding of fundamental concepts in set theory, graph theory, and recurrence relations. This knowledge equips students with essential tools for problem-solving, data modeling, and analysis, which are applicable in various fields including computer science, engineering, and operations research.
Course Revision / Approval Date	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To help students to gain the basics of set theory. **2.** To provide depth knowledge about propositional calculus. **3.** To make students familiar with recursion and recurrence relation. **4.** To inculcate understanding of algebraic structure. **5.** To educate students about graphs and functions.

Course Content	Weightage	Contact Hours
Unit 1: introduction to set theory, Set Operations, Algebra of sets, Duality, Finite & Infinite sets, Classes of sets, Power Sets, Multi sets, Cartesian Product, Representation of relations, Types of relation, Equivalence relations and partitions Partial ordering relations & lattices, Function & its types, Composition of function and relations, Cardinality & inverse relations.	**20%**	**09**
Unit 2: Propositional Calculus Basic Operations: AND(^), OR(v), NOT(~), Truth value of a compound statement, propositions, tautologies, contradictions.	**20%**	**09**
Unit 3: Recursion and RecurrenceRelation: Polynomials and their evaluation, Sequences, Introduction to AP, GP & AG series, partial fractions, linear recurrence relation with constant coefficients, Homogeneous solutions, Particular solutions, Total solution of recurrence relation using generating.	**20%**	**09**
Unit 4: Algebraic Structures Definition and examples of a monoid, Semigroup, Groups and rings, Homomorphism, Isomorphism and Automorphism, Subgroups and Normal subgroups, Cyclic groups, Integral domain and fields, Cosets, Lagrange's theorem.	**20%**	**09**
Unit 5: Graphs And Trees Introduction to graphs, Directed and Undirected graphs, Homomorphic and Isomorphic graphs, Subgraphs, Cut points and Bridges, Multigraph and Weighted graph, Paths and circuits, Shortest path in weighted graphs, Eurelian path and circuits, Hamilton paths and circuits, Planar graphs, Euler's formula, Trees, Spanning trees, Binary trees and its.	**20%**	**09**

Instructional Method and Pedagogy
Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** the concept of sets.	Cognitive	Understand
CO2	**Analyze** use of propositional theory in real time scenarios.	Cognitive	Analyze
CO3	**Apply** recurrence relations in other applications.	Cognitive	Apply
CO4	**Apply** generation of functions in algebraic structures.	Cognitive	Apply
CO5	**Comprehend** the use of graph theory in other domains.	Cognitive	Understand

Learning Resources	
1.	**Textbook** **1.**
2.	**Reference Books:** **1.** "Discrete Mathematics and Its Applications", by Kenneth H. Rosen, Tata McGraw Hill, 6th edition, ISBN: 0072880082© 2007 2. "Elements of Discrete Mathematics", by C. L. Liu, Tata McGraw Hill Education Private Limited, 3rd edition,2008. **2.** "Elements of Discrete Mathematics", by C. L. Liu, Tata McGraw Hill Education Private Limited, 3rd edition,2008. **3.** Jean Paul Trembley, R Manohar, "Discrete Mathematical Structures with Application to Computer Science", Tata McGraw Hill, 1997. **4.** R.P. Grimaldi, "Discrete and Combinatorial Mathematics", Addison Wesley, 2003. **5.** B. Kolman, R.C. Busby, and S.C. Ross, "Discrete Mathematical Structures", PHI Publications, 2010.

	6. Johnson Bough R., "Discrete Mathematics", 5th Edition, PEA, 2001. **7.** Ronald Graham, Donald Knuth and Oren Patashik, "Concrete Mathematics: A Foundation for Computer Science", Addison- Wesley, 1989. **8.** Judith L. Gersting, "Mathematical Structures for Computer Science", Computer Science Press, 2001. **9.** A. Chtewynd and P. Diggle, "Discrete Mathematics", (Modular Mathematics series), Edward Arnold, London, 1995.
3.	**Journals & Periodicals** **1.**
4.	**Other Electronic Resources** **1.**

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Understand** the concept of sets.
2.	**Analyze** use of propositional theory in real time scenarios.
3.	**Apply** recurrence relations in other applications.
4.	**Apply** generation of functions in algebraic structures.
5.	**Comprehend** the use of graph theory in other domains.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	0	0	0	0	0	0	0	0	0	0
CO2	1	3	1	0	0	0	0	0	0	0	0	0
CO3	3	1	1	0	0	0	0	0	0	0	0	0
CO4	3	2	1	0	0	0	0	0	0	0	0	0
CO5	1	1	3	0	0	0	0	0	0	0	0	0

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	0	3
CO2	1	0	3
CO3	1	0	3
CO4	1	0	3
CO5	1	0	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS302	Course Name Object Oriented Programming With Java	Semester III

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	0	2	45	3	0	2	4

Course Prerequisites	Basic Java Programming
Course Category	Professional Subjects - Core (PC)
Course focus	Employability
Rationale	The Java programming syllabus aims to provide students with a strong foundation in programming using the Java language. It covers topics such as variables, data types, control structures, functions, arrays, pointers, and file handling. This equips students with the skills to develop efficient and reliable software solutions in Java for various applications. Java's strong OOP design helps students grasp core concepts like encapsulation, inheritance, and polymorphism, while its structured syntax encourages good coding habits. Java's widespread industry use, extensive libraries, strong error handling, and rich community support make it practical for real-world applications. Java lays a solid foundation for learning advanced topics and transitioning to other languages, preparing students for both academic and professional success.
Course Revision / Approval Date	30/5/2025

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To make students familiar with the basics of java programming. **2.** To give brief knowledge about constructor and inbuilt function. **3.** To make students understand about inheritance and different packages. **4.** To inculcate students about To make students understand about inheritance and different packages layout handling and other GUI based commands. **5.** To aware students about advanced technologies of Java Programming.

Course Content	Weightage	Contact Hours
Unit 1: Basics of Java Basics of JAVA & Introduction to OOP Paradigm 1. **Features of Java**- Byte Code and Java Virtual Machine, JDK 2. **Data types**- Integers, Floating point, characters, Boolean, Type conversion and casting 3. **Operators**- Arithmetic operators, Bit wise operators, Relational Operators, Boolean Logical operators, Assignment Operator, Operator Precedence 4. **Control Statements** – If , else, nested if, if-else ladders, Switch 5. **Looping Statements** -while, do-while, for, for-each 6. **Jump Statements**- break, continue. 7. **Scope and Life Time of Variables** 8. **OOP Paradigm**– 6 features of OOP, Class, fields ,methods, declaring objects, new operator, Assigning object reference variables 9. **The main class, Command line arguments, finalize method** 10. **A Stack Class**	**20%**	**09**

Unit 2: Polymorphism, Inheritance & Interfaces Polymorphism, Inheritance & Interfaces 1. **Polymorphism-** Method overloading, Constructors and its overloading 2. **Uses of this keyword and static keyword** 3. **Nested classes and Inner classes** 4. **Inheritance-** Types of Inheritance, Constructors in Inheritance 5. **Uses of super keyword** 6. **Access modifiers** –public, private, protected and no access modifier 7. **Runtime Polymorphism-**Method Overriding, dynamic method dispatch, abstract classes 8. **Uses of final keyword** 9. **Interfaces**– defining an interface, implementing interfaces, features of interfaces, difference between classes, interfaces and abstract classes 10. **A Stack Interface**	**20%**	**09**
Unit 3: Package, Exception handling, Multithreaded Programming 1. **Packages-** Defining a package, Access protection importing packages 2. **Exception handling-** defining exceptions, errors, Hierarchy of Exception class & Builtin Exceptions 3. **Keywords used for Exception Handling-** try, catch, finally, throw, throws 4. **try with multiple catch & Nested try-catch** 5. **User-defined/Custom Exceptions** 6. **Multithreading -** Defining thread & multi-threading in Java, Java Thread lifecycle, Java Thread Model 7. **Creation of Threads-** thread class, Runnable interface, main thread, creating single Multithreading 8. **Methods -**start(),run(),stop(), Isalive ( ) and join ( ) 9. **Thread – Priorities, Synchronization** 10. **Interthread communications, Deadlock.**	**20%**	**09**

Unit 4: I/O Programming & Collection Classes 1. **I/O Programming-** Introduction to Stream, Byte Stream, Character Stream, Readers and Writers 2. **String handling-** String class, StringBuffer, Use of Wrapper Class 3. **File Handling-**File Class, File InputStream, File Output Stream, InputStreamReader, inputStreamWriter, FileReader, FileWriter, Bufferedreader 4. **Network Programming-** Introduction to Java Networking, Java Networking classes, Socket API & Programming 5. **Collection Framework-** Collection Interfaces& Classes, List, AbstractList, ArrayList, LinkedList, Enumeration, Vector, Properties 6. **Understanding Singleton Classes and Java Reflection API** 7. **Lambda Expressions-** Functional Interfaces, Lambda Expression Fundamentals, Passing Lambda Expressions as Arguments, Block Lambda Expressions	**20%**	**09**
Unit 5: Introducing GUI Programming with JavaFX 1. **Event Handling-** Event Handling Mechanisms, The Delegation Event Model, Event Classes, Event Classes, Anonymous Inner Classes 2. **AWT-** Windows fundamentals, AWT Classes,Working with Frame Window, Introduction to Graphics, creating a windowed program 3. **Swings-** Two key features of swing, MVC ,Components and Containers, A simple swing application 4. **JavaFX-** FX Basics, the FX Skeleton, FX- controls, menus, events **Creating a Main Menu Application in JavaFX**.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: Write Program on **A.** Working of control structures. **B.** Loop execution with array and string. **C.** Demonstrate working of overloading. **D.** Usage of Math class	**08%**	**02**

Practical 2: Write Program on **A.** Different array operations. **B.** Use string class for various string manipulations.	**08%**	**02**
Practical 3: Write Program on **A.** Demonstrate working of class and objects. **B.** Working with different types of constructors.	**10%**	**02**
Practical 4: Write Program on **A.** Show the importance of modifiers with different classes.	**08%**	**02**
Practical 5: Write Program on **A.** Usage of this keyword. **B.** Demonstrate simple inheritance.	**08%**	**02**
Practical 6: Write Program on **A.** Working of overriding. **B.** Polymorphism execution with dynamic binding.	**08%**	**02**
Practical 7: Write Program on **A.** Usage of abstract class. **B.** Working of casting objects.	**08%**	**02**
Practical 8: Write Program on **A.** Show use of interface. **B.** Demonstrate try catch finally.	**10%**	**02**
Practical 9: Write Program on **A.** Working of Input output. **B.** Demonstrate file handling.	**8%**	**02**

Practical 10: Write Program on **A.** Usage of thread. **B.** Create a JavaFx application to display "Hello World" messages.	**08%**	**02**
Practical 11: Create a tic-tac-toe board in which a cell may be X, O, or empty. Randomly decide what to display at each cell. The X and O are images in the files X.gif & O.gif.	**08%**	**02**
Practical 12: Create a GUI application to move a circle up, down, left or right using arrow keys.	**08%**	**02**

Instructional Method and Pedagogy

Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** the concept of sets.	Cognitive	Understand
CO2	**Analyze** use of propositional theory in real time Scenario.	Cognitive	Analyse
CO3	**Apply** recurrence relations in other applications.	Cognitive	Apply
CO4	**Apply** generation of functions in algebraic structures.	Cognitive	Apply
CO5	**Comprehend** the use of graph theory in other domains.	Cognitive	Comprehend

Learning Resources	
1.	**Textbook** **1.** The Complete Reference, Java 2 (Fourth Edition), Herbert Schild, TMH. 4 Java Programming, D. S. Malik, Cengage Learning.

2.	**Reference Books** **1.** Introduction to Java Programming (Comprehensive Version), Daniel Liang, Seventh Edition, Pearson. **2.** Programming in Java, Sachin Malhotra Saurabh Chaudhary, Oxford **3.** Murach’s Beginning Java 2, Doug Lowe, Joel Murach and Andrea Steelman, SPD. **4.** Core Java Volume-I Fundamentals, Eight Edition, Horstmann & Cornell, Pearson Education.
3.	**Journals & Periodicals** **1.**
4.	**Other Electronic Resources** 1. http://nptel.ac.in

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Understand** the concept of sets.
2.	**Analyze** use of propositional theory in real time Scenario.
3.	**Apply** recurrence relations in other applications.
4.	**Apply** generation of functions in algebraic structures.
5.	**Comprehend** the use of graph theory in other domains.

Mapping of POs & COs

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

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	3	3
CO2	1	3	3
CO3	1	3	3
CO4	1	3	3
CO5	1	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS303	Course Name Operating System	Semester III

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	45	3	2	0	4

Course Prerequisites	Basic Computer Knowledge
Course Category	Professional Subjects - Core (PC)
Course focus	Skill development
Rationale	The course offers students the opportunity to grasp the concepts behind human - computer interfaces present in computer systems, as well as the fundamental principles and functioning of operating systems. Additionally, students will gain practical experience and a strong working knowledge of working in DOS and Windows environments. The primary objective is to develop proficiency in utilizing different operating systems upon completion of this course. During instruction, the teachers are expected to prioritize the understanding of operating system concepts, principles, features, & practical applications.
Course Revision / Approval Date	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To educate students about different operating systems. **2.** To make students understand about basic functions of memory and process handling. **3.** To provide brief idea about process synchronization **4.** To elaborate understanding of memory management. **5.** To gain knowledge about inter - process communication.

Course Content	Weightage	Contact Hours
Unit 1: Introduction Basics of Operating Systems: Definition – Generations of Operating systems – Types of Operating Systems, OS Service, System Calls, OS structure: Layered, Monolithic, Microkernel Operating Systems Process Management Processes: Definition, Process Relationship, Process states, Process State transitions, Process Control Block, Context switching – Threads & Types of threads.	**15%**	**07**
Unit 2: Process Scheduling Definition, Scheduling objectives,Types of Schedulers, Scheduling criteria, Scheduling algorithms: Preemptive & Non, preemptive, Multiprocessor scheduling: Types, Overview -Performance evaluation of the scheduling.	**25%**	**11**
Unit 3: Inter process Communication Race Conditions, Critical Section, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem etc. Deadlocks: Deadlock Prevention, Deadlock Avoidance(banker's algorithm), Deadlock detection and Recovery.	**15%**	**07**
Unit 4: Memory Management Basic Memory Management Definition, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition – Internal and External fragmentation and Compaction, Paging: Principle of operation – Page allocation – Hardware support for paging – Protection and sharing – Disadvantages of paging.	**25%**	**11**

Unit 5: Virtual Memory Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault Working Set, Dirty page / Dirty bit Demand paging (Concepts only) – Page Replacement policies: Optimal (OPT), First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU) Unix / Linux Operating System Development Of Unix / Linux, Role and Function OF Kernel, System Calls, Elementary Linux command & Shell Programming, Directory Structure, System Administration Case study.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: Basic Linux commands.	**10%**	**02**
Practical 2: Write a program on the working of the following algorithm. **A.** FCFS **B.** SJF	**08%**	**02**
Practical 3: Write a programming on working of Round Robin algorithm.	**08%**	**02**
Practical 4: Basic shell scripting.	**08%**	**02**
Practical 5: Advance shell scripting.	**08%**	**02**
Practical 6: Demonstrate paging Working of page replacement algorithms.	**08%**	**02**
Practical 7: Demonstrate paging algorithms.	**08%**	**02**

Practical 8: Working of Page replacement algorithms.	**08%**	**02**
Practical 9: Demonstrate Process Deadlock algorithms.	**08%**	**02**
Practical 10: Demonstrate Producer consumer Problem.	**08%**	**02**
Practical 11: Demonstrate Lock for inter process communication.	**08%**	**02**
Practical 12: Demonstrate Semaphore.	**10%**	**02**

Instructional Method and Pedagogy

Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** basic technical differences between different operating systems	Cognitive	Understand
CO2	**Analyze** how the command line argument works.	Cognitive	Analyze
CO3	**Able** to handle different processes at the same time.	Cognitive	Able
CO4	**Apply** memory management in real time applications.	Cognitive	Apply
CO5	**Comprehend** scheduling of different processes based on priority.	Cognitive	Comprehend

Learning Resources	
1.	**Textbook** 1. Operating Systems Concepts – Silberschatz, Galvin, Wiley Publications (2008).
2.	**Reference Books:** 1. Modern Operating Systems - Andrew S. Tenenbaum, Pearson Education Asia / PHI (2005). 2. UNIX System Programming Using C++, by Terrence Chan: Prentice Hall India, 1999. 3. Advanced Programming in UNIX Environment, by W. Richard Stevens: 2nd Ed, Pearson Education, 2005. 4. Operating Systems – William Stallings, Pearson Education Asia (2002).
3.	**Journals & Periodicals** 1. Journal of Systems and Software 2. ACM Transactions on Computer Systems (TOCS) 3. ACM Operating Systems Review (OSR)
4.	**Other Electronic Resources** 1. https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/ 2. https://pages.cs.wisc.edu/~remzi/OSTEP/

	3. https://nptel.ac.in/courses/106108101

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	**Course Outcomes**
1.	**Understand** basic technical differences between different operating systems
2.	**Analyze** how the command line argument works.
3.	**Able** to handle different processes at the same time.
4.	**Apply** memory management in real time applications.
5.	**Comprehend** scheduling of different processes based on priority.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	0	0	1	0	0	0	1	1	0	0	1	2
CO2	1	2	0	3	1	0	0	1	1	0	2	2
CO3	1	1	1	2	1	0	0	1	2	0	1	2
CO4	1	1	2	3	2	0	0	1	2	0	2	2
CO5	3	2	3	1	2	0	0	1	2	0	2	2

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	0	1	1
CO2	2	2	1
CO3	1	2	2
CO4	1	1	3
CO5	1	3	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS304	Course Name Computer Organization	Semester III

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	0	1	45	3	0	1	4

Course Prerequisites	Basic Computer Knowledge
Course Category	Professional Subjects - Core (PC)
Course focus	Skill development
Rationale	The COA syllabus provides a comprehensive understanding of computer systems, covering components, memory organization, hardware - software interaction, ISA, pipelining, caching, data representation, and arithmetic. It equips students with the knowledge to analyze, design, and optimize computer systems, bridging the gap between theory and practical application.
Course Revision / Approval Date	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To understand the basic organization of computers. **2.** To gain knowledge about machine instructions. **3.** To aware students about representation of information. **4.** To give a brief idea about different memory technologies. **5.** To familiar students about input output processes.

Course Content	Weightage	Contact Hours
Unit 1: Basic organization of computers, Block level description of the functional units as related to the execution of a program; Fetch, decode and execute cycle.	**20%**	**09**
Unit 2: Machine instructions, Instruction set architectures, Assembly language programming, addressing modes, instruction cycles, registers and storage, addressing modes; discussions about RISC versus CISC architectures; Inside a CPU.	**20%**	**09**
Unit 3: Information representation, Floating point representation (IEEE 754), computer arithmetic and their implementation; Fixed-Point Arithmetic: Addition, Subtraction, Multiplication and Division, Arithmetic Logic Units control and data path, data path components, design of ALU and data path, controller design; Hardwired and Micro programmed Control.	**20%**	**09**
Unit 4: Memory Technology, static and dynamic memory, Random Access and Serial Access Memories, Cache memory and Memory Hierarchy, Address Mapping Cache updating schemes, Virtual memory and memory management unit.	**20%**	**09**
Unit 5: Test Equipment I/O subsystems: Input-Output devices such as Disk, CD-ROM, Printer etc.; Interfacing with IO devices, keyboard and display interfaces; Basic concepts Bus Control, ReadWrite operations, programmed IO, Concept of handshaking, Polled and Interrupt-driven I/O, DMA data transfer; Pipeline Processing, Instruction and Arithmetic Pipeline, Pipeline hazards and their resolution, Parallel Processing.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: **A.** Explain the functioning of the Control Unit with a proper Diagram. **B.** Describe in detail the different types of Basic Registers available in a computer. **C.** Describe Instruction Format in detail. Explain different types of Instructions with proper instruction formats.	**20%**	**02**
Practical 2: **A.** Consider a processor with 64 registers & an instruction set of size 12. Each instruction has 5 distinct fields: Opcode: 1, Source Registers: 2, Destination register: 1 identifier & a 12 bit immediate value. Each instruction must be stored in memory in a byte aligned fashion. If a program has 100 instructions, the amount of memory (in Bytes) consumed by the program text is? **B.** A processor can support a max memory of 4GB where the memory is word addressable(a word = 2 bytes). **C.** The size of the address bus of the processor is at least bits. **D.** What is the difference between a direct and an indirect address instruction? How many references to memory are needed for each type of instruction to bring an operand into a processor register? **E.** The following control inputs are active in the bus system shown in Fig. For each case, specify the register transfer that-will be executed during the next dock transition	**20%**	**04**

	St	S1	S0	LD of	
	Register	Memory	Adder		
	1	1	1		
	IR 1	Read 1	0		
	PC 1	— 0	0		
	DR 0	Write 0	0		
	AC	—	Add		

F. The following register transfers are to be executed in the system of Fig. H. For each transfer, specify:

- **a.** the binary value that must be applied to bus select inputs S,.S,
- **b.** the register whose I.D cont:tol input must be active (if any);
- **c.** A memory read or write operation (if needed);
- **d.** The operation in the adder and logic circuit (if any).
  - **i.** A.R -PC
  - **ii.** R -MIARI
  - **iii.** M(AR)-TR
  - **iv.** AC-DR, DR-AC (done simultaneously)

Practical 3:

A. Perform the arithmetic operations below with binary numbers and with negative numbers$ In signed-2"s complement. Use seven bits to accommodate each number together with its sign. In each cue, determine if there is an overflow by checking the carries Into and out of the sign bit position:

- **a.** (+35) + (+40)
- **b.** (-35) + (-40)
- **c.** (-35) - (+40)

B. Perform the operation (-9) + (- 6) = - 15 with binary numbers in signed-1' s complement representation using only five bits to represent each number (including the sign).

- **a.** Show that the overflow detection procedure of checking the inequality of the last two carries fails in this case.
- **b.** Suggest a modified procedure for detecting an

30% **06**

overflow when signed-I's complement numbers are used. **C.** Show the contents of registers E, A, Q, and SC (as in Table 10 - 2) during the process of multiplication of two binary numbers, 11111 (multiplicand) and 10101 (multiplier). The signs are not included. **D.** Show the contents of registers E, A, Q, and SC (as in Fig. 10-12) during the process of division of (a) 10100011 by 1011; (b) 00001111 by 0011. (Use a dividend of eight bits.). **E.** Show the step-by-step multiplication process using the Booth algorithm (as in Table 10-3) when the following binary numbers are multiplied. Assume 5-bit registers that hold signed numbers. The multiplicand in both cases is + 15. **a.** (+ 15) x (+ 13) **b.** (+ 15) X (- 13)		
Practical 4: **A.** **a.** How many 128 x 8 RAMchop are needed to provide a memory capacity of 2048 bytes? **b.** How many tines of the address bus must be used to access 2048 bytes of memory? **c.** How many oJ these times will be common 10 all chips? **d.** How many lines must be decoded for chip select? Specify the size or the decoders. **B.** A computer uses RAM chips or 1024 x I capacity. **a.** How many chips are needed, and how should their address tines be connected to provide a memory capacity of 1024 bytes? **b.** How many clips are needed to provide a memory capacity of 16k bytes? Explain In words how the chips are connected t0 the address bus. **C.** A digital computer has a memory unit of 64K X 16 and	**30%**	**04**

a cache memory of 1K words. The cache uses direct mapping with a block size of four words. **a.** How many bits are there in the tag,index,block& word fields of the address format? **b.** How many bits are there in each word of cache, and how are they divided into functions? Include a valid bit. **c.** How many blocks can the cache accommodate? **D.** An address space is specified by 24 bits and the corresponding memory space by 16 bits. **a.** How many words are there in the address space? **b.** How many words are there in the memory space? **c.** If a page consists of 2K words, how many pages and blocks are there in the system? **E.** The logical address space in a computer system consists of 128 segments. Each segment can have upto 32 pages of 4K words in each. Physical memory consists of 4K blocks of 4K words in each. Formulate the logical and physical address formats.		

Instructional Method and Pedagogy

Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** how fetch - decode & execute cycle works.	Cognitive	Understand
CO2	**Analyze the inside** mechanism of a computer.	Cognitive	Analyze
CO3	**Apply** different information representation in intermediate code generation.	Cognitive	Apply
CO4	**Able** to manage memory for different purposes.	Cognitive	Able

CO5	**Comprehend** input output organization of computers with different storage devices.	Cognitive	Comprehend

Learning Resources	
1.	**Textbook** **1.**
2.	**Reference Books:** **1.** Computer Organization by V. Carl Hamacher, Safwat G. Zaky and Zvonko G. Vranesic, McGraw-Hill series (2002). **2.** Computer Organization and Design, by David Patterson and John Hennessey, " Elsevier. 2008. **3.** Computer System Architecture by Mano, M.M.,, Prentice Hall of India, New Delhi, 1992. **4.** Computer Systems Design and Architecture (2nd Edition) by Vincent P. Heuring and Harry F. Jordan (Dec 6, 2003). **5.** Computer Architecture & Organization, by Hayes, J.P.1998, McGraw - Hill.
3.	**Journals & Periodicals** **1.**
4.	**Other Electronic Resources** **1.**

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Understand** how fetch - decode & execute cycle works.
2.	**Analyze the inside** mechanism of a computer.
3.	**Apply** different information representation in intermediate code generation.
4.	**Able** to manage memory for different purposes.
5.	**Comprehend** input output organization of computers with different storage devices.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	1	1	1	0	0	0	1
CO2	1	2	1	2	1	1	1	1	0	0	0	1
CO3	1	2	1	2	1	1	0	1	0	0	1	1
CO4	1	2	1	2	1	1	0	1	0	0	0	1
CO5	1	3	1	2	1	1	0	1	0	0	1	1

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	0	1	2
CO2	0	1	2
CO3	0	1	2
CO4	0	1	2
CO5	0	1	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS305	Course Name Python Programing	Semester III

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	45	3	1	0	4

Course Prerequisites	Introduction to Programming
Course Category	Professional Subjects — Electives (PE)
Course focus	Employability
Rationale	The Python syllabus aims to provide students with a strong foundation in programming using Python. It covers topics such as variables, data types, control structures, functions, file handling, object - oriented programming, and libraries. This equips students with the skills to develop applications, analyze data, and automate tasks using Python.
Course Revision / Approval Date	30/5/2025
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To inculcate students about main control structures of the programming language. **2.** To provide depth knowledge about List, Tuple & Dictionaries. **3.** To make students aware about python utility and useof various types of functions. **4.** To provide knowlege on various python libraries for AI/ML, Cyber and IoT domains. **5.** To make students aware on OOP concepts in python, Django framework and Web API framework.

<table>
<tr><th>Course Content</th><th>Weightage</th><th>Contact Hours</th></tr>
<tr><td>Unit 1: Introduction & Control Statements

1. Installation and Working with Python
2. Essentials of a Python program
3. Program Structure of Python
4. Basic Syntax, Variables and Identifiers, Built- In Data Types. Variable definition
5. Operators And Expressions, Constants And Literals
6. Basic Input / output Statement, Conditions, Relational, Operators
7. Decision Making : If-Else, Nested If-Else Statement
8. Looping Statements: While loop, Do-while, For loop, Nested loops
9. Looping Control Statements: Break, Continue and pass Statements</td><td>20%</td><td>09</td></tr>
<tr><td>Unit 2: Python Data Types

1. Arrays – One dimensional and multidimensional array, Array processing.
2. String Manipulation - accessing Strings, Basic Operations, String slices and Function and Methods,
3. Lists: Introduction, accessing list, Operations, Working with lists, Function and Methods.
4. Tuple: Introduction, accessing tuples, Operations.
5. Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties.</td><td>20%</td><td>09</td></tr>
<tr><td>Unit 3: Functions in python

1. Dates and Time: Basic date and time classes, Different time formats, Converting between formats, Formatting dates and times, Parsing date / time information,
2. Binary Data: What is Binary Data, Binary vs. text,
3. Using the Struct module. Defining a function,
4. Python Built-in Functions, Calling a function, Types of functions, Function Arguments, Default Argument, Anonymous functions,
5. Global and local variables, Custom Functions vs. Standard Functions, Refactoring, Making Functions Reusable, Functions as Data.</td><td>20%</td><td>09</td></tr>
</table>

Unit 4: Python Library Overview **1.** Introduction to Tinker **2.** An Introduction to various libraries used for AI & ML, IoT & Cyber Security. **3.** Reading from a file – Writing to a file – Other Operations on Files. **4.** GUI Programming: Tkinter and its widgets – Overview of other GUIs.	**20%**	**09**
Unit 5: OOP Concepts & Introduction to Django & Web API **1.** OOP Concepts Classes and Objects - Oriented Programming, Abstract Data Types and Classes, Inheritance, Encapsulation and Information Hiding **2.** Introduction to Django. **3.** Introduction to Web application Framework in python.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: **1.** Demonstrate installation of python **2.** Working of variables and identifiers with simple programs **3.** Create different variables to show **4.** Different types of data, operators and expressions. **5.** Demonstrate working of constants. **6.** Usage of input output statements.	**20%**	**02**
Practical 2: **1.** Demonstrate practical based on conditional statements. **2.** Working of decision statements. **3.** Show replacement of switch statements. **4.** Demonstrate working of different loops. **5.** Usage of break, continue and pass. **6.** Show working of array. **7.** Show different string manipulations.	**20%**	**02**

Practical 3: **1.** Demonstrate List and accessing of list. **2.** Working of tuples. **3.** Show working of dictionaries.	**20%**	**02**
Practical 4: **1.** Demonstrate date and time functions. **2.** Working of conversion of different date format manipulations. **3.** Create functions and its types.	**20%**	**02**
Practical 5: **1.** Demonstrate working of above libraries for real time AI/ML, Cyber & IOT applications.	**20%**	**02**

Instructional Method and Pedagogy

Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	Able to **understand** the basics of python programming, concepts of loops and control structures for different purposes.	Cognitive	Understand
CO2	**Understand** the concepts of working of list, tuples & dictionaries.	Cognitive	Understand
CO3	**Comprehend** about working of python Utilty like date time and functions.	Cognitive	Comprehend
CO4	**Design** python application with the use of various python libraries.	Cognitive	Design
CO5	**Apply** in development of application using django and OOP framework.	Cognitive	Apply

Learning Resources	
1.	**Textbook** **1.** John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India. **2.** R. NageswaraRao, “Core Python Programming”, dreamtech Reference Books.
2.	**Reference Books** **1.** Wesley J. Chun. “Core Python Programming - Second Edition”, Prentice Hall. **2.** Kenneth A. Lambert, “Fundamentals of Python – First Programs”, CENGAGE Publication. **3.** Luke Sneeringer, “Professional Python”, Wrox.

Evaluation Scheme		**Total Marks** **150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	Able to **understand** the basics of python programming, concepts of loops and control structures for different purposes.
2.	**Understand** the concepts of working of list, tuples & dictionaries.
3.	**Comprehend** about working of python Utilty like date time and functions.
4.	**Design** python application with the use of various python libraries.
5.	**Apply** in development of application using django and OOP framework.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	0	0	1	3	0	0	0	0	0	0	2
CO2	1	0	1	1	3	0	0	0	0	0	0	2
CO3	1	0	1	1	3	0	0	0	0	0	0	2
CO4	1	0	2	1	3	0	0	0	2	1	0	2
CO5	1	2	3	1	3	0	1	0	3	2	0	2

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	2	3
CO2	1	2	3
CO3	1	2	3
CO4	1	2	3
CO5	1	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Teaching Scheme

Semester – IV B.Tech Computer Science & Engineering

Sr. No.	Course Code	Course Name	Teaching Scheme (Hours / week)				Teaching Credit			
			L	P	T	Total	L	P	T	Total
1.	BTCS409	Numerical Methods in Computer Science and Engineering	3	0	1	4	3	0	1	4
2.	BTCS402	Computer Networks	3	2	0	5	3	1	0	4
3.	BTCS403	Microprocessor & Interfacing	3	2	0	5	3	1	0	4
4.	BTCS404	Database Management Systems	3	2	0	5	3	1	0	4
5.	BTCS405	Specialized Track Elective - I - Fundamentals of AI & ML	3	2	0	5	3	1	0	4
6.	BTCS406	Specialized Track Elective - I - Fundamentals of IoT								
7.	BTCS408	Specialized Track Elective - I - Fundamentals of Cyber Security								
8.	AECC401	Environmental Studies	2	0	0	2	2	0	0	2
9.	BTCS407	Industrial Internship	0	0	0	0	0	2	0	2
Total			17	8	1	26	17	6	1	24

Note

L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

Sr. No.	Course Code	Course Name	Teaching Scheme (Hours / week) Teaching Credit					
			Theory MS Marks	Theory CEC Marks	Theory ES Marks	Theory Marks	Practical Marks	Total Marks
1.	BTCS409	Numerical Methods in Computer Science and Engineering	20	40	40	100	0	100
2.	BTCS402	Computer Networks	20	40	40	100	50	150
3.	BTCS403	Microprocessor & Interfacing	20	40	40	100	50	150
4.	BTCS404	Database Management Systems	20	40	40	100	50	150
5.	BTCS405	Specialized Track Elective - I - Fundamentals of AI & ML	20	40	40	100	50	150
6.	BTCS406	Specialized Track Elective - I - Fundamentals of IoT						
7.	BTCS408	Specialized Track Elective - I - Fundamentals of Cyber Security						
8.	AECC401	Environmental Studies	20	40	40	100	0	100
9.	BTCS407	Industrial Internship	0	0	0	0	100	100
Total			**120**	**240**	**240**	**600**	**300**	**900**

Note
L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

Course Code BTCS409	Course Name Methods In Computer Science Engineering	Semester IV

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	0	1	4	3	0	1	4

Course Prerequisites	Basic Mathematics
Course Category	Professional core courses
Course focus	Skill development
Rationale	Mathematics provides a logical framework for precise reasoning, problem-solving, and communication. Its universal language and rigorous methods facilitate scientific research, technological advancement, and practical applications in various fields. Mathematics cultivates critical thinking, intellectual development, and the ability to analyse complex systems. It uncovers patterns, structures, and relationships, revealing the inherent beauty and elegance of the subject. As a fundamental discipline, mathematics plays a vital role in understanding the world, making informed decisions, and optimizing solutions. Its rationale lies in its ability to shape our thinking, provide practical tools, and contribute to the progress of society.
Course Revision / Approval Date	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Aware students about algebraic and linear equations. **2.** Give a brief idea about interpolation. **3.** Comprehend working of numerical calculus. **4.** Provide information regarding curve fitting. **5.** Elaborate linear programming.

Course Content	Weightage	Contact Hours
Unit 1: Solution Algebraic and Transcendental Equations Bisection, False position, Newton Raphson Method, Secant Method. Solution using Matlab. Solution of system of Linear Equations:Gauss Elimination method, LU decomposition method, Gauss Seidel method. Solution using MATLAB. Eigenvalues and Eigenvectors using MATLAB.	**20%**	**09**
Unit 2: Interpolation Newton's forward & backward interpolation, Newton's divided difference interpolating polynomials, Lagrange Interpolating polynomials. Solution using MATLAB.	**20%**	**09**
Unit 3: Numerical Differentiation First and second order differentiation Equations of Equally Spaced Data. Solution using MATLAB. Numerical Integration: Trapezoidal rule, Simpson's one third and 3 / 8th rule. Solution using MATLAB. Numerical methods for Solution of ordinary differential equations: Taylor's Series method, Euler's method, Runge Kutta fourth order method, Milne's Predictor Corrector Method. Finite element method to solve second order ODE. Solution using MATLAB.	**20%**	**09**
Unit 4: Curve Fittings General Linear Least Squares - forecasting method, Fitting of quadratic and exponential curves.Solution using MATLAB.	**20%**	**09**

Unit 5: Linear Programming Formulation of LPP, Solving LPP using graphical method, areas of applications. Fourier series: Periodic functions, Fourier series, Euler's formula, Fourier series of even and odd functions, Fourier series of periodic functions with arbitrary periods. Introduction to Harmonic analysis, Applications to computer science, Application in field of Periodic Signals.	**20%**	**09**

Instructional Method and Pedagogy Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Organise & present** quantitative data and think critically with respect to quantitative information characterised by the centre, spread, & skewness of data.	Cognitive	Understand
CO2	**Develop** the concept of a sampling distribution & infer some characteristics of a population by examining a portion of the population & to make informed decisions in a probabilistic environment.	Cognitive	Create
CO3	**Evaluate** a derivative and integration at a value using an appropriate numerical method.	Cognitive	Evaluate
CO4	Express quantitatively the degree and direction of association between two linearly related variables and fit a regression model to the data as well as investigating the explained portion.	Cognitive	Understand
CO5	**Apply** knowledge of linear programming in real scenarios and optimization problems particularly constrained linear models.	Cognitive	Apply

Learning Resources	
1.	**Textbook** **1.**
2.	**Reference Books:** **1.** Kevin Night and Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, Mc-Graw Hill - 2008. **2.** Dan W. Patterson, “Introduction to AI and ES”, Pearson Education, 2007. **3.** Peter Jackson, “Introduction to Expert Systems”, 3rd Edition, Pearson Education, 2007. **4.** Stuart Russel and Peter Norvig “AI – A Modern Approach”, 2nd Edition, Pearson Education 2007. **5.** Deepak Khemani “Artificial Intelligence”, Tata Mc Graw Hill Education 201.
3.	**Other Electronic Resources** **1.** http://nptel.ac.in

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	Able to **understand** the basics of python programming.
2.	**Understand** the concepts of loops and control structures for different purposes.
3.	**Comprehend** about working of list & dictionaries.
4.	**Design** python application with the use of date - time and other functions.
5.	**Apply** in development of real time applications of IOT.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	0	0	1	1	0	1	1	2
CO2	2	1	2	2	1	0	0	0	0	1	0	1
CO3	2	1	2	1	0	0	0	0	0	0	0	0
CO4	3	2	3	1	0	0	1	1	0	1	1	2
CO5	2	0	2	0	0	1	0	0	0	1	0	1

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	2	1	2
CO2	1	1	2
CO3	2	1	2
CO4	3	2	3
CO5	0	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS402	Course Name Computer Networks	Semester IV

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Basic Computer Knowledge
Course Category	Professional Core Courses
Course focus	Employability
Rationale	Computer networks provide the underlying infrastructure for modern communication and information exchange. Their rationale lies in enabling the efficient and reliable transmission of data between interconnected devices. Networks facilitate collaboration, resource sharing, and access to remote services, supporting various applications and services such as email, web browsing, video conferencing, and cloud computing. They play a vital role in connecting people, organizations, & systems across geographical distances, enabling seamless communication and data transfer. Additionally, networks enhance productivity, enable data storage and retrieval, and foster innovation and technological advancement. The rationale of computer networks lies in their ability to create a connected world, facilitating information sharing and transforming the way we live, work, and interact.
Course Revision / Approval Date	19/8/2019

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1. Give brief knowledge of computer network components 2. Aware students about protocols at different layers 3. Inculcate students about network layer functionalities 4. Make students understand regarding transportation among the different components. 5. Familiarize Students about security aspects of network architecture.

Course Content	Weightage	Contact Hours
Unit 1: Introduction Basics of Network. Layered Architecture of Computer Networks, OSI and TCP / IP architectures Physical Layer- Transmission Media,, Data encoding Data link control. Multiplexing – Frequency - division, synchronous time - division, & statistical time - division multiplexing.	**20%**	**09**
Unit 2: Link Layer Medium Access Control, Spanning Trees; The Channel Allocation Problem, Multiple Access Protocols, Ethernet, Wireless LANs, Broadband Wireless, Bluetooth, Data Link Layer Switching, Switched networks. Circuit- switched networks. Switching concepts. Routing in circuit-switched networks. Standard. LAN Technology - LAN architecture. Topologies	**20%**	**09**
Unit 3: Network Layer Network layer design issues. Routing algorithms, Static and Dynamic routing and its algorithm.The network layer in the Internet: Protocols, Network - Address - Translation (NAT)	**20%**	**09**

Unit 4: Transport Layer TCP introduction, Reliable / Un Reliable Transport, TCP, UDP, Congestion Control, Intra-Domain Routing: Distance- Vector, Intra - Domain Routing: Link State, Wireless networks: 802.11 MAC, Efficiency considerations: Application Layer: DNS - The Domain Name System, Electronic Mail, HTTP, FTP, Simple network management protocol (SNMP)	**20%**	**09**
Unit 5: Web and Multimedia Security: Introduction, Cryptography and Cryptanalysis, Public Key Cryptography Algorithms, RSA Algorithm, DES, Authentication and Authorization.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: Study of different types of Network cables and Practically implement the cross - wired cable and straight through cable using crimping tool.	**10%**	**03**
Practical 2: Install and Configure Wired and Wireless NIC & transfer files between systems in LAN and Wireless LAN.	**10%**	**03**
Practical 3: Install & configure Network Devices: HUB, Switch & Routers.	**10%**	**03**
Practical 4: Configure Host IP, Subnet Mask and Default Gateway in a System in LAN (TCP / IP Configuration).	**10%**	**03**
Practical 5: Establish Peer to Peer network connection using two systems using Switch and Router in a LAN.	**10%**	**03**

Practical 6: Configure Internet connection and use IPCONFIG, PING / Tracer and Net stat utilities to debug the network issues.	**10%**	**03**
Practical 7: Transfer files between systems in LAN using FTP Configuration, install Print server in a LAN and share the printer in a network.	**10%**	**03**
Practical 8: Study of basic network command and Network configuration commands.	**10%**	**03**
Practical 9: Configure a Network topology using packet tracer software.	**10%**	**03**
Practical 10: Demonstrate working of different cryptography techniques.	**10%**	**03**

Instructional Method and Pedagogy

Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Analyze** any network configuration.	Cognitive	Analyse
CO2	**Understand** TCP/IP protocol for different layers	Cognitive	Understand
CO3	**Understand** the network traffic and their communication.	Cognitive	Understand
CO4	**Comprehend** the working of the transport layer.	Cognitive	Understand
CO5	**Apply** security encryption aspects in different technologies.	Cognitive	Apply

Learning Resources	
1.	**Textbook** **1.**
2.	**Reference Books:** **1.** Computer Networks: by Andrew S Tanenbaum, PHI. (2010). **2.** Data and Computer Communications, by Walliam Stallings, PHI. (2002)4.Stuart Russel and Peter Norvig "AI – A Modern Approach", 2nd Edition, Pearson Education 2007. **3.** Deepak Khemani "Artificial Intelligence", Tata Mc Graw Hill Education 201. **4.** Data Communications, Computer networking on OSI, by Fred Halsall, Addison Wesley Publishing Co.1998. **5.** Computer Networking: A Top-Down Approach Featuring the Internet by James F. Kurose. **6.** Computer Networks: Protocols standards and interfaces, by Uyless Black, Prentice Hall.2002. **7.** Data communication & Networks: by Behrouz A. Forouzan, Tata McGraw Hill. 2002.
3.	**Journals & Periodicals** **1.**

4.	**Other Electronic Resources** **1.** http://nptel.ac.in

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Analyze** any network configuration.
2.	**Understand** TCP/IP protocol for different layers
3.	**Understand** the network traffic and their communication.
4.	**Comprehend** the working of the transport layer.
5.	**Apply** security encryption aspects in different technologies.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	1	0	2	2	0	2	3
CO2	2	2	2	1	2	1	0	2	1	0	2	3
CO3	2	2	2	1	2	2	0	2	2	1	2	3
CO4	2	2	2	1	2	2	0	2	2	0	2	3
CO5	2	2	2	1	2	3	0	3	2	0	2	3

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	3	3
CO2	1	3	3
CO3	1	3	3
CO4	1	3	3
CO5	1	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS403	Course Name Microprocessor & Interfacing	Semester IV

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Logic gates and basic computer hardware knowledge
Course Category	Professional Core Courses
Course focus	Employability
Rationale	The rationale of microprocessors and interfacing lies in their pivotal role in modern computing and technology. Microprocessors serve as the brain of electronic devices, executing instructions and performing complex calculations. They enable the development of powerful and versatile computing systems, ranging from personal computers to smartphones, embedded systems, and IoT devices. Interfacing, on the other hand, allows microprocessors to communicate with external devices and peripherals, expanding their functionality and facilitating data exchange. This enables seamless integration with sensors, actuators, displays, and other hardware components, enabling the creation of interactive systems and enabling control over external devices. The rationale of microprocessors and interfacing lies in their ability to drive technological innovation, enhance computational capabilities, and connect the digital world with the physical environment.
Course Revision / Approval Date	4/3/2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Understand the basic components of a micro - processor. **2.** Aware students about 8085 architecture. **3.** Familiarize students about assembly language. **4.** Give brief knowledge about an architecture of 8086. **5.** Inculcate students for ARM Processor.

Course Content	Weightage	Contact Hours
Unit 1: 8085 Microprocessor Architecture, Address, Data And Control Buses, 8085 Pin Functions, De - multiplexing of Buses, Generation Of Control Signals, Instruction Cycle, Machine Cycles, T - States, Memory Interfacing. Assembly Language Programming Basics, Classification of Instructions, Addressing Modes, 8085 Instruction Set, Instruction & Data Formats, writing, assembling & executing a Program, debugging the programs.	**20%**	**09**
Unit 2: Writing 8085 assembly language Programs with decision, making and looping using data transfer, arithmetic, logical and branch instructions. Stack & Subroutines, Developing Counters and Time Delay Routines, Code Conversion, BCD Arithmetic and 16-Bit Data operations. Interfacing Concepts, Ports, Interfacing Of I/O Devices, Interrupts In 8085, Programmable Interrupt Controller 8259A, Programmable Peripheral Interface 8255A.	**20%**	**09**
Unit 3: 8086 logical block diagram and segments, 80286 Architecture, Registers (Real / Protected mode), Privilege levels, descriptor cache, Memory access in GDT and LDT, multitasking, addressing modes, flag register 80386: Architecture, Register organization, Memory access in protected mode, Paging 80486: Only the technical features Pentium: Architecture and its versions.	**20%**	**09**
Unit 4: Introduction to 8051 microcontrollers Introduction to 8051 microcontrollers Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051. 8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers & Counters	**20%**	**09**
Unit 5: Interfacing with 8085 and 8051 Study of Architecture and programming of ICs: 8255 PPI, 8259 PIC and interfacing with 8085 I/O And Memory Interface: LCD, Keyboard, UART.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: Microprocessor 8085 and 8086 **1.** To perform addition & subtraction of two 8, 16 and 32 – bit hexadecimal numbers (using 8085 and 8086). **2.** To perform multiplication of two 8 bit (using 8085) and two 16 bit (using 8086) hexadecimal numbers . **3.** To perform division of 16 – bit numbers with 8-bit numbers (using 8086). **4.** To find positive & negative bytes from 100 data bytes. **5.** To find even & odd bytes from 100 data bytes. **6.** To find largest & smallest byte from 100 data bytes **7.** To perform string manipulation (string transfer, compare and read) using 8086.	**10%**	**03**
Practical 2: Microcontroller 8051 **1.** Write a microcontroller 8051 program to transfer the bytes into RAM locations starting at 50H,assuming that ROM space starting at 240H contains GSFCU by using **A.** Counter, **B.** null character for end of string. **2.** Write a microcontroller 8051 program to get hex data on the range of 00-FFh from port 0 and convert it into decimal. **3.** Save the digits in R7, R6 and R5, where the least significant digit is in R7. **4.** Write a microcontroller 8051 program to add and subtract two 16 Bit and 32 bit unsigned numbers. Operands are two RAM variables. Results to be in the R1-R0 pair. **5.** Write a microcontroller 8051 program to convert a binary number to equivalent BCD. **6.** Write a microcontroller 8051 program to convert a packed BCD number to two ASCII numbers and place them in R5 and R6 and vice - versa. **7.** Write a microcontroller 8051 program that generates 2 kHz square wave on pin P1.0, 2.5 kHz on pin P1.2 and 25 Hz on pin P1.3. **8.** Write a microcontroller 8051 program for counter 1 in mode 2 to count the pulses and display the state of the	**10%**	**03**

TL1 count on P2. Assume that the clock pulses are fed to pin T1. **9.** Write a microcontroller 8051 program to transfer word "GSFCU" serially at 4800 baud and one stop bit, continuously. **10.** Assume crystal frequency to be 11.0592 MHz.		

Instructional Method and Pedagogy

Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** the working of each component in the microprocessor.	Cognitive	Understand
CO2	**Comprehend** architecture of 8085 with its instruction and addressing formats.	Cognitive	Understand
CO3	**Write** assembly code and understand the working of 8255A.	Cognitive	Apply
CO4	**Analyze** various components of 8086 components and how it is different from 8085.	Cognitive	Analyze
CO5	**Apply** the knowledge regarding ARM processors in real time applications.	Cognitive	Apply

Learning Resources	
1.	**Learning Resources** **1.** Architecture, Programming and Applications of the 8085, R. Gaonkar, 5th Edition, McGraw-Hill. **2.** Advanced Microprocessor and Peripherals, A. K. Ray and Bhurechandi, 3rd Edition, McGrawHill. **3.** 8051 microcontroller and embedded systems: using Assembly and C, 2nd Edition, Muhammad Ali Mazedi, Pearson Prentice Hall **4.** IBM PC Assembly Language and Programming, P. Abel, 5th Edition, PHI/Pearson Education. **5.** Introduction To Assembly Language Programming, Sivarama

	P.Dandamudi, Springer Int. Edition,2003. 6. The 8088 and 8086 Microprocessors: Programming, Interfacing, Software,Hardware and Application,4th edition, W.A.Triebel, A.Singh, N.K.Srinath,Pearson Education.
2.	**Other Electronic Resources:** **1.** http://nptel.ac.in

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Understand** the working of each component in the microprocessor.
2.	**Comprehend** architecture of 8085 with its instruction and addressing formats.
3.	**Write** assembly code and understand the working of 8255A.
4.	**Analyze** various components of 8086 components and how it is different from 8085.
5.	**Apply** the knowledge regarding ARM processors in real time applications.

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Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	0	0	0	0	0	1	0	2
CO2	3	1	0	1	0	0	0	0	0	1	0	3
CO3	3	2	1	1	0	0	0	0	0	1	0	3
CO4	3	0	0	1	0	0	0	0	0	1	0	2
CO5	3	2	2	1	0	0	0	0	0	1	0	2

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	2	3	2
CO2	2	3	3
CO3	2	2	2
CO4	2	3	3
CO5	2	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS404	Course Name Database Management System	Semester IV

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	2	0	4

Course Prerequisites	Basic Computer knowledge
Course Category	Professional core courses
Course focus	Employability
Rationale	The rationale of database management systems (DBMS) lies in their ability to efficiently and effectively manage vast amounts of structured and organized data. DBMS provides a centralized platform for storing, retrieving, and manipulating data, enabling organizations to handle data - intensive tasks and support critical decision - making processes. DBMS ensures data integrity, security, & concurrency control, facilitating data consistency & reliability. It offers robust query capabilities, allowing users to extract meaningful insights from complex datasets. DBMS also supports data sharing & collaboration, enabling multiple users to access & update information simultaneously. The rationale of DBMS lies in its role as a foundational technology for data - driven applications, enabling organizations to optimize data management, improve operational efficiency, and gain competitive advantages.
Course Revision / Approval Date	30/05/2025
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Gain knowledge about basic concepts of DBM. **2.** Aware students about the structure of DBMS. **3.** Give a brief idea about transaction processing. **4.** Understand different rules to design databases. **5.** Inculcate understanding of MySQL.

Course Content	Weightage	Contact Hours
Unit 1: Introduction and applications of DBMS Purpose of database, Data, Independence, Database System architecture- levels, Mappings, Database, users and DBA. Structure of relational databases, Domains, Relations, Relational algebra – fundamental operators and syntax, relational algebra queries, tuple relational calculus.	**20%**	**09**
Unit 2: Basic concepts of E-R Diagram Design process, constraints, Keys, Design issues, E-R diagrams, weak entity sets, extended E-R features – generalization, specialization, aggregation, reduction to E-R database schema. Functional Dependency – definition, trivial and non-trivial FD, closure of FD set, closure of attributes, irreducible set of FD, Normalization – 1Nf, 2NF, 3NF, Decomposition using FD- dependency preservation, BCNF, Multivalued dependency, 4NF, Join dependency and 5NF	**20%**	**09**
Unit 3: Overview of Query Processing and Transaction management Measures of query cost, selection operation, sorting, join, evaluation of expressions, transformation of relational expressions, estimating statistics of expression results, evaluation plans, materialized views. Transaction concepts, properties of transactions, serializability of transactions, testing for serializability, System recovery, Two- Phase Commit protocol, Recovery and Atomicity, Log-based recovery, concurrent executions of transactions and related problems, Locking mechanism, solution to concurrency related problems, deadlock, two- phase locking protocol, Isolation, Intent locking.	**20%**	**09**
Unit 4: Introduction to SQL Discretionary access control, Mandatory Access Control, Data Encryption. Basics of SQL, DL,DML,DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator, Functions - aggregate functions, Built-in functions – numeric, date, string functions, set operations, sub - queries, correlated sub- queries, Use of group by, having, order by, join and its types, Exist, Any, All, view and its types. transaction control commands – Commit, Rollback, Savepoint. Cursors, Stored Procedures, Stored Function, Database Triggers.	**20%**	**09**

Unit 5: **Introduction to advanced database technologies including Key-Value Databases:** Overview, architecture, Document Databases: Flexible schema, Graph Databases: Data modeling with nodes and edges, Vector Databases: High-dimensional vector storage, In-Memory Databases: High-speed data processing and real-time analytics.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: Create tables in SQL and Inserting values in tables.	**10%**	**03**
Practical 2: Demonstrate use of DDL commands with an appropriate example of applying it on a table.	**10%**	**03**
Practical 3: Describe use of SQL constraint by applying it on an appropriate table	**10%**	**03**
Practical 4: Demonstrate use of DML commands.	**10%**	**03**
Practical 5: Create a view for SQL tables.	**10%**	**03**
Practical 6: Show working of different view manipulation.	**10%**	**03**
Practical 7: Describe the use of TCL commands with appropriate examples.	**10%**	**03**

Practical 8: Describe use of Oracle SQL Functions with appropriate examples.	**10%**	**03**
Practical 9: Working of different join operations Describe use of Null Value Handling Oracle, Creating Users and DCL commands with appropriate examples.	**10%**	**03**
Practical 5: Demonstrate the use of Oracle and SQL Joins with appropriate examples.	**10%**	**03**

Instructional Method and Pedagogy

Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** various aspects of the relational database like models, functional dependencies and normalization.	Cognitive	Understand
CO2	**Design** databases for various scenarios	Cognitive	Create
CO3	Interpret transaction processing, concurrency and recovery protocols for Database.	Cognitive	Apply
CO4	**Design** database withall necessary constraints.	Cognitive	Create
CO5	**Evaluate** various storage and retrieval methods to correlate with relational models through appropriate indexing.	Cognitive	Evaluate

Learning Resources

1.	**Textbook** **1.**
2.	**Reference Books:** **1.** "Database System Concepts" by Abraham Silberschatz, Henry F. Korth, and S. Sudarshan. **2.** "Database Management Systems" by Raghu Ramakrishnan and Johannes Gehrke. **3.** "Fundamentals of Database Systems" by RamezElmasri and Shamkant B. Navathe. **4.** "Database Systems: Design, Implementation, and Management" by Carlos Coronel, Steven Morris, and Peter Rob:
3.	**Journals & Periodicals** **1.** ACM Transactions on Database Systems. **2.** IEEE Transactions on Knowledge and Data Engineering.
4.	**Other Electronic Resources** **1.** http://nptel.ac.in

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks

Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Understand** various aspects of the relational database like models, functional dependencies and normalization.
2.	**Design** databases for various scenarios
3.	Interpret transaction processing, concurrency and recovery protocols for Database.
4.	**Design** database withall necessary constraints.
5.	**Evaluate** various storage and retrieval methods to correlate with relational models through appropriate indexing.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	0	1	3	0	2	2	1	1	0	0	3	2
CO2	0	1	1	1	2	2	0	1	2	0	3	2
CO3	2	2	2	1	2	3	0	3	2	0	2	3
CO4	0	1	1	1	2	2	0	1	2	0	3	2
CO5	2	2	2	1	2	1	0	2	2	0	2	3

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	3	3
CO2	1	3	3
CO3	1	3	3

CO4	1	3	3
CO5	1	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS405	Course Name Fundamentals of AI & MI	Semester IV

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	2	0	4

Course Prerequisites	Basic Programming
Course Category	Professional Elective courses
Course focus	Employability
Rationale	The rationale of studying the fundamentals of AI (Artificial Intelligence) and ML (Machine Learning) lies in their transformative potential in various domains. AI and ML provide tools and techniques for creating intelligent systems that can learn, reason, and make decisions autonomously. Understanding the fundamentals of AI and ML enables individuals to harness the power of data and algorithms to solve complex problems, optimize processes, and extract valuable insights. It empowers the development of intelligent applications, such as computer vision, natural language processing, and predictive analytics. The rationale lies in leveraging AI and ML to drive innovation, improve efficiency, and create intelligent systems that can adapt and evolve in a rapidly changing world.
Course Revision / Approval Date	2/8/2022
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Understand the basic concepts of AI. **2.** Aware students about Machine learning basics. **3.** Familiarize students about linear regression. **4.** Introduce logistic regression. **5.** Inculcate Students regarding real time applications of AI and Machine learning.

Course Content	Weightage	Contact Hours
Unit 1: Introduction to AI & Search Strategies Introduction - What is intelligence? Foundations of artificial intelligence (AI). History of AI; Problem Solving- Formulating problems, problem types, states and operators, state space, search strategies. Informed Search Strategies- Best first search, A* algorithm, heuristic functions, Iterative deepening A*(IDA), small memory A*(SMA); Game playing - Perfect decision game, imperfect decision game, evaluation function, alpha - beta pruning.	**20%**	**09**
Unit 2: Knowledge Representation & Planning Reasoning-Representation, Inference, Propositional Logic, predicate logic (first order logic), logical reasoning, forward chaining, backward chaining; AI languages and tools- Lisp, Prolog, CLIPS Planning- Basic representation of plans,, planning in the blocks world.	**20%**	**09**
Unit 3: Knowledge Inference & Expert System Uncertainty - Basic probability, Bayes rule, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic; Decision making- Utility theory, utility functions, Decision theoretic expert systems.	**20%**	**09**
Unit 4:Introduction to ML - Supervised Learning & Optimization Techniques Idea of Machine Learning from data, Supervised Learning, Linear and multi-class classifier, Linear and logistic regression, Decision Boundary, Cost Function Optimization, Introduction to Genetic Algorithm.	**20%**	**09**
Unit 5: Unsupervised Learning & Cluster Analysis Unsupervised Learning, Clustering, K - means clustering, hierarchical clustering, DBSCAN clustering, K - medoids clustering, Spectral clustering.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: Implementation of search methodology.	**10%**	**05**
Practical 2: Different Puzzle solving methodologies.	**10%**	**05**
Practical 3: **1.** Write the Conceptual Dependency for following statements. **A.** John gives Mary a book. **B.** John gave Mary the book yesterday.	**10%**	**05**
Practical 4: Demonstration of classification problems.	**10%**	**05**
Practical 5: Working of optimization techniques.	**10%**	**05**
Practical 6: Implementation of real time applications.	**10%**	**05**

Instructional Method and Pedagogy
Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** basic concepts for AI.	Cognitive	Understand
CO2	**Analyze** use of machine learning in real - time applications.	Cognitive	Analyze
CO3	**Develop** critical thinking skills to evaluate the performance and limitations of different AI techniques and algorithms.	Cognitive	Create
CO4	**Understanding** the different types of machine learning algorithms, such as supervised, unsupervised, and reinforcement learning.	Cognitive	Understand
CO5	**Implement** real time applications with AI and Machine Learning.	Cognitive	Apply

Learning Resources	
1.	**Reference Books:** **1.** Stuart Russell and Peter Norvig (1995), Artificial Intelligence: A Modern Approach", Third edition, Pearson, 2003. **2.** Shai shalev-shwartz, Shai Ben-David: Understanding Machine Learning from Theory to Algorithms, Cambridge University Press, ISBN-978-1-107-51282-5, 2014. **3.** Artificial Intelligence by Elaine Rich, Kevin Knight and Nair, TMH.
2.	**Journals & Periodicals** **1.** Journal of Machine Learning Research. **2.** IEEE Transactions on Neural Networks and Learning Systems.
3.	**Other Electronic Resources** **1.** http://nptel.ac.in

<table>
<tr><th colspan="2">Evaluation Scheme</th><th>Total Marks
150</th></tr>
<tr><td>Mid semester Marks</td><td colspan="2">20</td></tr>
<tr><td>End Semester Marks</td><td colspan="2">40</td></tr>
<tr><td rowspan="5">Practical Marks</td><td>Attendance</td><td>5 marks</td></tr>
<tr><td>Practical Exam</td><td>20 marks</td></tr>
<tr><td>Viva</td><td>10 marks</td></tr>
<tr><td>Journal</td><td>10 marks</td></tr>
<tr><td>Discipline</td><td>5 marks</td></tr>
<tr><td rowspan="4">Continuous Evaluation Marks</td><td>Attendance</td><td>5 marks</td></tr>
<tr><td>MCQs</td><td>10 marks</td></tr>
<tr><td>Open Book Assignment</td><td>15 marks</td></tr>
<tr><td>Article Review</td><td>10 marks</td></tr>
</table>

Sr. No.	Course Outcomes
1.	**Understand** basic concepts for AI.
2.	**Analyze** use of machine learning in real - time applications.
3.	**Develop** critical thinking skills to evaluate the performance and limitations of different AI techniques and algorithms.
4.	**Understanding** the different types of machine learning algorithms, such as supervised, unsupervised, and reinforcement learning.
5.	**Implement** real time applications with AI and Machine Learning.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	0	1	1	2	0	0	1	0	0	2	2
CO2	1	0	2	0	2	0	0	1	1	0	2	2
CO3	3	0	0	0	3	0	0	1	0	1	2	3
CO4	2	0	1	0	3	0	0	1	0	1	2	2
CO5	2	1	2	1	3	0	1	1	1	1	2	3

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	1	2	2
CO3	1	1	3
CO4	1	2	2
CO5	1	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS406	Course Name Fundamental of IOT	Semester IV

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	2	0	4

Course Prerequisites	Basic Computer Knowledge, Digital Electronics
Course Category	Professional Elective courses
Course focus	Employability
Rationale	The rationale of studying the fundamentals of IoT (Internet of Things) lies in its potential to revolutionize how we interact with the physical world. IoT connects everyday objects and devices to the internet, enabling them to gather and exchange data. Understanding the fundamentals of IoT allows individuals to harness the power of connected devices, sensors, and actuators to create smart and efficient systems. IoT enables applications in areas like smart homes, healthcare, Agriculture, transportation, and industry, leading to improved efficiency, automation, and decision making it also opens up new possibilities for Innovation sustainability, and enhancing the quality of life. The rationale of IoT lies in its ability to create a seamlessly connected world where objects and devices collaborate to make our lives more convenient and productive.
Course Revision / Approval Date	19/8/2019

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Aware students about basics of IOT. **2.** Make students understand basic hardware components and their configurations. **3.** Provide brief ideas about protocols used for IOT device communication. **4.** Elaborate understanding of remote data monitoring **5.** Gain knowledge about real-time applications of IOT and its executions.

Course Content	Weightage	Contact Hours
Unit 1: Architectural Overview Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals - Devices & gateways, Data management, Business processes in IoT, Everything as a Service(XaaS), Role of Cloud in IoT.	**20%**	**09**
Unit 2: Hardware Components Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I / O interfaces Software Components - Programming API's (using Python / Node.js/Arduino) for Communication.	**20%**	**09**
Unit 3: Protocols MQTT, UDP, TCP, Solution framework for IoT applications - Implementation of Device integration, Data acquisition and integration, Sensing temp, pressure, distance, light, humidity and principles of sensing, Stepper Motor operating principle.	**20%**	**09**
Unit 4: Device data storage Unstructured data storage on cloud / local server, Authentication, authorization of devices, Simple operations using SIM card - basics of AT commands.	**20%**	**09**

Unit 5:IoT case studies IoT case studies & mini projects based onIndustrial automation, Transportation, Agriculture, Healthcare, Home Automation.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: To interface LED / Buzzer with Arduino / Raspberry Pi and write a program to turn ON LED.	**10%**	**03**
Practical 2: To interface Push button / Digital sensor (IR / LDR) with Arduino / Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.	**10%**	**02**
Practical 3: To interface the motor using a relay with Arduino/Raspberry Pi and write a program to turn ON the motor when push button is pressed.	**10%**	**03**
Practical 4: To interface OLED with Arduino / Raspberry Pi and write a program to print temperature and humidity readings on it. thingspeak clouds.	**10%**	**02**
Practical 5: To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to Smartphones using Bluetooth.	**10%**	**03**
Practical 6: To interface Bluetooth with Arduino/Raspberry Pi & write a program to turn LED ON/OFF when ‘1’/’0’ is received from a Smartphone using Bluetooth.	**10%**	**02**
Practical 7: Write a program on Arduino / Raspberry Pi to upload temperature and humidity data.	**10%**	**03**

Practical 8: Write a program on Arduino / Raspberry Pi to retrieve Temperature and humidity data from thingspeak clouds.	**10%**	**02**
Practical 9: To install a MySQL database on Raspberry Pi and perform basic SQL queries.Write a program on Arduino / Raspberry Pi to publish temperature data to MQTT broker.	**10%**	**03**
Practical 10: Write a program on Arduino / Raspberry Pi to subscribe to MQTT broker for temperature data and print it.	**10%**	**02**
Practical 11: Write a program to create TCP server on Arduino / Raspberry Pi using GSM SIM card and respond with humidity data to TCP client when requested.	**10%**	**03**
Practical 12: Write a program to create a UDP server on Arduino / Raspberry Pi and respond with humidity data to the UDP client when requested.	**10%**	**02**

Instructional Method and Pedagogy

Computer based learning, Chalk – Talk, Presentation

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** basics of IoT.	Cognitive	Understand
CO2	**Understand** the basics of hardware components and its configurations.	Cognitive	Understand
CO3	**Provide** a brief idea about protocols used for IoT device communication.	Cognitive	Understand
CO4	**Elaborate** understanding of remote data monitoring.	Cognitive	Evaluate
CO5	**Implement** real time applications with IoT.	Cognitive	Apply

Learning Resources	
1.	**Textbook** **1.**
2.	**Reference Books** **1.** Vijay Madisetti, ArshdeepBahga, Ïnternet of Things, "A Hands on Approach", University Press. **2.** Dr. SRN Reddy, RachitThukral and Manasi Mishra, "Introduction to Internet of Things: A Practical Approach", ETI Labs. **3.** Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi..
3.	**Journals & Periodicals** **1.**
4.	**Other Electronic Resources** **1.** http://nptel.ac.in

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Understand** basics of IoT.
2.	**Understand** the basics of hardware components and its configurations.
3.	**Provide** a brief idea about protocols used for IoT device communication.
4.	**Elaborate** understanding of remote data monitoring.
5.	**Implement** real time applications with IoT.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	0	0	0	1	0	0	0	0	1	0	0	0
CO2	1	0	3	2	1	1	0	0	0	0	1	0
CO3	1	0	2	1	2	0	1	0	0	1	0	0
CO4	1	0	2	2	1	0	1	1	1	0	1	1
CO5	2	1	2	1	3	0	1	1	1	1	2	3

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	3	1
CO2	1	2	1
CO3	1	3	1
CO4	1	2	3
CO5	1	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS408	Course Name Fundamentals of Cyber Security	Semester IV

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	2	0	4

Course Prerequisites	Basic Computer Knowledge
Course Category	Professional Elective Courses
Course focus	Employability
Rationale	The rationale of studying the fundamentals of cybersecurity lies in the critical need to protect sensitive information & secure digital systems from cyber threats.As technology advances, the risk of cyberattacks & data breaches increases. Understanding cybersecurity fundamentals equips individuals with the knowledge & skills to safeguard data, networks, and digital assets. It enables the identification and mitigation of vulnerabilities, implementation of robust security measures, & development of incident response strategies. By studying cybersecurity, individuals can contribute to safeguarding privacy, preventing financial losses, preserving reputation, & ensuring the integrity & availability of digital resources. The rationale lies in building a secure & resilient digital ecosystem that fosters trust, innovation, & the protection of individuals and organizations.
Course Revision / Approval Date	30/5/2025

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Identify key concepts and terminology in cyber security. **2.** Define the key concepts, roles & domains of cyber security. **3.** Identify thevarious types of cyber security architecture. **4.** Identify the key components of securing networks, systems and data.

Course Content	Weightage	Contact Hours
Unit 1: Introduction to Cyber Security & Cryptography Introduction to cyber security, Difference between information security and cyber security, Cyber security objectives, roles and domains, Event vs. incident, Security incident response. Introduction to Cryptography, Security Threats, Vulnerability, Active and Passive attacks, Security services and mechanism, Conventional Encryption Model, CIA model. Introduction to Cyber Crime and Law :Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behaviour, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world, A Brief History of the Internet, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000.	**20%**	**09**

Unit 2: Cyber security Concepts Risk, Common attack types & vectors, Policies & procedures, Cyber security controls, Investigations, legal holds, and preservation, Forensics, Disaster recovery and business continuity. Systems Vulnerability Scanning Overview of vulnerability scanning, Open Port / Service Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning - Netcat, Socat, understanding Port and Services tools - Datapipe, Fpipe, WinRelay, Network Reconnaissance – Nmap, THC-Amap and System tools. Network Sniffers and Injection tools – Tcpdump and Windump, Wireshark, Ettercap, Hping Kismet	**20%**	**09**
Unit 3: Security Architecture Overview of security architecture, The OSI model, Defense in depth, Information flow control, Isolation and segmentation, Logging, monitoring and detection, Encryption fundamentals, techniques and applications.	**20%**	**09**
Unit 4: Security of Networks, Systems, Applications and Data Process controls Risk assessment, Vulnerability management, Penetration testing, Network security, Operating system security, Application security, Data security.	**20%**	**09**
Unit 5: Security Implications and Adoption of Evolving Technology Current threat landscape, Advanced persistent threats (APTs), Mobile technology Vulnerabilities, threats, and risk, Consumerization of IT and mobile devices, Cloud and digital collaboration.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: Implement Caesar cipher encryption - decryption.	**10%**	**03**

Practical 2: Implement Monoalphabetic cipher encryption - decryption.	**10%**	**02**
Practical 3: Implement Polyalphabetic cipher encryption - decryption.	**10%**	**03**
Practical 4: Implement Playfair cipher encryption - decryption.	**10%**	**02**
Practical 5: Implement Hill cipher encryption - decryption.	**10%**	**03**
Practical 6: To implement Simple DES or AES.	**10%**	**02**
Practical 7: Implement Diffie - Hellman Key exchange Method.	**10%**	**03**
Practical 8: Implement RSA encryption-decryption algorithm.	**10%**	**02**
Practical 9: Write a program to generate SHA - 1 hash.	**10%**	**03**
Practical 10: Implement a digital signature algorithm.	**10%**	**02**
Practical 11: Perform various encryption - decryption techniques with cryptool.	**10%**	**03**
Practical 2: Study & use the Wireshark for the various network protocols.	**10%**	**02**

Instructional Method and Pedagogy
Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** fundamentals of cyber security.	Cognitive	Understand
CO2	**Learn** about risk, policies and procedures related to cyber security.	Cognitive	Remember
CO3	**Learn** about security architecture.	Cognitive	Understand
CO4	**Learn** about secure systems and networks.	Cognitive	Remember
CO5	**Learn** about security implications.	Cognitive	Analyse

Learning Resources	
3.	**Textbook** **1.**
4.	**Reference Books:** **1.** Fundamentals Of Cyber Security. by Bhushan / Rathore / Jamshed. **2.** The Art of Deception" by Kevin Mitnick. **3.** "The Hacker Playbook" by Peter Kim.
5.	**Journals & Periodicals** **1.**
6.	**Other Electronic Resources** **1.** http://nptel.ac.in

Evaluation Scheme	**Total Marks 150**
Mid semester Marks	20

End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Understand** fundamentals of cyber security.
2.	**Learn** about risk, policies and procedures related to cyber security.
3.	**Learn** about security architecture.
4.	**Learn** about secure systems and networks.
5.	**Learn** about security implications.

Mapping of POs & COs

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

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	3	1
CO2	3	3	2
CO3	3	1	1
CO4	3	3	3
CO5	1	3	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code AECC401	Course Name Environmental Studies	Semester IV

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
2	0	0	2	2	0	0	2

Course Prerequisites	Basics of Science
Course Category	Ability Enhancement Compulsory Course
Course focus	Employability
Rationale	
Course Revision / Approval Date	14/4/2017
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Remember: To acquire an awareness of and sensitivity to the total environment and its allied problems. **2.** Apply: To make educated judgments about environmental issues. **3.** Create: Develop skills and a commitment to act independently and collectively to environment sustainability. **4.** Apply & Analysis: Students are able to debate environmental science with use of appropriate scientific information. **5.** Apply & Understand: Engaging with students of all disciplines to think critically, ethically, and creatively when evaluating environmental issues.

Course Content	Weightage	Contact Hours
Unit 1: Introduction Introduction of Ecology Ecology - Objectives and Classification Concepts of an ecosystem-structure & function of ecosystem components of ecosystem, Hydrological cycle, carbon cycle, oxygen cycle, Nitrogen cycle, Sulphur cycle.	**20%**	**02**
Unit 2: Ecological Pyramids Ecological pyramids of various ecosystems: Forest Ecosystem, Grassland Ecosystem, Desert Ecosystem, Aquatic ecosystem, Estuarine Ecosystem.	**20%**	**01**
Unit 3: Air Pollution and control Introduction, Classification of air pollutants, air pollutants and their effects, acid rain, photochemical smog, particulates. Characteristics and biochemical effects of some important air pollutants, Effect of air pollutants on man and environment, Air quality standard, air monitoring and control of air pollution.	**20%**	**12**
Unit 4: Water Pollution and control Introduction, Classification of water pollutants, physical, chemical and biological characteristics of waste water, wastewater treatment: Primary treatment- Sedimentation, coagulation, equalization, neutralization, secondary treatment - aerobic treatment-aerated lagoons, trickling filter, activated sludge process, oxidation ditch process, oxidation pond, anaerobic treatment-anaerobic sludge digestion, sludge treatment and disposal & tertiary treatment - evaporation, ion exchange, adsorption, chemical precipitation, Electrodialysis, reverse osmosis.	**20%**	**08**
Unit 5: Solid and Hazardous Waste Introduction, Classification and origin, characteristics of solid wastes, objectives and considerations in solid waste management, methods of solid waste treatment and disposal - composting, land filling, thermal processes - incineration, pyrolysis, recycling and reuse of solid waste-co-disposal, bioconversion.	**20%**	**07**

Instructional Method and Pedagogy
Chalk - board, Powerpoint Presentation.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** the environmental issues with a focus on sustainability.	Cognitive	Understand
CO2	**Understand** the physical, chemical & biological components of the earth's systems.	Cognitive	Understand
CO3	**Understand** and analyse the global scale of environmental problems.	Cognitive	Understand
CO4	**Apply** sustainability as a practice in life, society and industry.	Cognitive	Apply
CO5	**Understand** the pollution control techniques.	Cognitive	Understand

Learning Resources	
1.	**Textbook** 1. Fundamental concepts in Environmental studies by DD Mishra, S. Chand Publishing, India. 2. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology by PS Verma and VK Agarwal, S. Chand Publication, India. 3. Fundamentals of Ecology by PD Sharma, Rastogi Publications. 4. Ecology and Environment by PD Sharma, Rastogi Publications. 5. Environmental Chemistry by BK Sharma, GOEL Publishing house. 6. Textbook of Environmental Studies, by E. Bharucha, UGC universities Press. 7. Environmental Studies by R. Rajagopalan, Oxford University Press. 8. Environmental Pollution and Control by JF Peirce, RF Weiner, and PA Vesilind, Elsevier Science & Technology Book. 9. Ecology by Mohan P. Arora, Himalaya Publishing House. 10. Fundamentals of Ecology by M.C. Dash Reference Books. 11. Fundamentals of Ecology by EP Odum Cengage. 12. Big Questions in Ecology & Evolution by TN Sherratt & DM Wilkinson, Oxford. 13. Ecology: Experimental Analysis of Distribution & Abundance by CJ Krebs, Pearson Education, London.

	14. Concept of Ecology by EJ Kormondy, Pearson Education, London. **15.** Conservation Biology: Voices from the Tropics. Bys Sodhi, N.S., Gibson, L. & Raven, P.H. (eds) John Wiley & Sons. **16.** Plastic and Environment by RE Hester and RM Harrison, Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge, CB4 0WF, UK. **17.** Environmental Education and Ecotourism by Fernando Ramírez and Josefina Santana, Springer Nature Switzerland AG. **18.** Reclamation of Arid lands by Mohammad Jafari, Ali Tavili, Fatemeh Panahi, Ehsan Zandi Esfahan and Majid Ghorbani, Springer International Publishing Switzerland. **19.** Emerging Issues in Ecology and Environmental Science, Case studies from India by T. Jindal, Springer Nature Switzerland. **20.** Environmental Water Footprints Concepts and Case Studies from the Food Sector by SS Muthu, Springer Nature Singapore.
2.	**Reference Books** **1.**
3.	**Journals & Periodicals** **1.** Environmental Pollutants and Bioavailability. **2.** Clean Air Journal. **3.** Emerging Contaminants. **4.** Environment: Science and Policy for Sustainable Development. **5.** Annual Review of Environment and Resources. **6.** Renewable Energy. **7.** Renewable & Sustainable Energy Reviews. **8.** Environmental Health. **9.** Environment International. **10.** International Journal of Environmental Research and Public Health. **11.** The Environmental Magazine. **12.** Natural History (magazine). **13.** Environment News Service. **14.** The Environmentalist. **15.** Green Builder Media.
4.	**Other Electronic Resources** **1.** Green.tv - supported by UNEP - broadband TV channel for films about environmental issues. **2.** Climate Change TV - funded by companies, governments and organisations, and produced by the magazine Responding to Climate Change - the world's first web channel specific to climate change videos

	3. Terra: The Nature of Our World video podcast produced in conjunction with the Master of Fine Arts program in Science & Natural History Filmmaking at Montana State University, Filmmakers for Conservation, and PBS - weekly video show about science and natural history 4. Green Times Ahead—based in India—student run non-profit with a focus on evading the detrimental effects of air and water pollution, constantly involved in communal engagement. 5. IUCN Red data List. 6. Air quality index. 7. Nature Education Knowledge Project.

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Understand** the environmental issues with a focus on sustainability.
2.	**Understand** the physical, chemical & biological components of the earth's systems.
3.	**Understand** and analyse the global scale of environmental problems.
4.	**Apply** sustainability as a practice in life, society and industry.
5.	**Understand** the pollution control techniques.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	0	1	0	1	3	3	2	3	0	1
CO2	1	1	2	0	0	1	2	2	3	3	0	1
CO3	3	2	1	0	2	1	2	2	3	3	2	3
CO4	3	3	3	2	1	3	2	3	3	3	3	2
CO5	3	3	3	2	1	3	2	3	3	3	3	2

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	2	0	0
CO2	2	1	1
CO3	2	2	2
CO4	3	3	1
CO5	3	3	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Teaching Scheme

Semester – V B.Tech Computer Science & Engineering

Sr. No.	Course Code	Course Name	Teaching Scheme (Hours / week)				Teaching Credit			
			L	P	T	Total	L	P	T	Total
1.	NOC01	NPTEL Elective	2	0	0	2	2	0	0	2
2.	BTCS501	Design and Analysis of Algorithms	3	0	1	4	3	0	1	4
3.	BTCS502	Software Engineering	3	2	0	5	3	1	0	4
4.	BTCS503	Advanced Web Technologies	3	2	0	5	3	1	0	4
5.	BTCS504	Specialized Track Elective - I - Data Science for Engineers	3	2	0	5	3	1	0	4
	BTCS505	Specialized Track Elective - II - IoT Architecture & Protocols								
	BTCS507	Specialized Track Elective - III - Network security and access control								
6.	AECC502	Disaster Risk Management	2	0	0	2	2	0	0	2
7.	BTCS506	Industrial Internship	0	0	0	0	0	2	0	2
Total			**16**	**06**	**01**	**23**	**16**	**05**	**01**	**22**

Note
L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

<table>
<tr><th rowspan="2">Sr. No.</th><th rowspan="2">Course Code</th><th rowspan="2">Course Name</th><th colspan="6">Teaching Scheme (Hours / week)
Teaching Credit</th></tr>
<tr><th>Theory MS Marks</th><th>Theory CEC Marks</th><th>Theory ES Marks</th><th>Theory Marks</th><th>Practical Marks</th><th>Total Marks</th></tr>
<tr><td>1.</td><td>NOC01</td><td>NPTEL Elective</td><td>20</td><td>40</td><td>40</td><td>100</td><td>0</td><td>100</td></tr>
<tr><td>2.</td><td>BTCS501</td><td>Design and Analysis of Algorithms</td><td>20</td><td>40</td><td>40</td><td>100</td><td>0</td><td>100</td></tr>
<tr><td>3.</td><td>BTCS502</td><td>Software Engineering</td><td>20</td><td>40</td><td>40</td><td>100</td><td>50</td><td>150</td></tr>
<tr><td>4.</td><td>BTCS503</td><td>Advanced Web Technologies</td><td>20</td><td>40</td><td>40</td><td>100</td><td>50</td><td>150</td></tr>
<tr><td>5.</td><td>BTCS504</td><td>Specialized Track Elective - I - Data Science for Engineers</td><td rowspan="3">20</td><td rowspan="3">40</td><td rowspan="3">40</td><td rowspan="3">100</td><td rowspan="3">50</td><td rowspan="3">150</td></tr>
<tr><td>6.</td><td>BTCS505</td><td>Specialized Track Elective - II - IoT Architecture & Protocols</td></tr>
<tr><td>7.</td><td>BTCS507</td><td>Specialized Track Elective - III - Network security and access control</td></tr>
<tr><td>8.</td><td>AECC502</td><td>Disaster Risk Management</td><td>20</td><td>40</td><td>40</td><td>100</td><td>0</td><td>100</td></tr>
<tr><td>9.</td><td>BTCS506</td><td>Industrial Internship</td><td>0</td><td>0</td><td>0</td><td>0</td><td>100</td><td>100</td></tr>
<tr><td colspan="3">Total</td><td>120</td><td>240</td><td>240</td><td>600</td><td>250</td><td>850</td></tr>
</table>

Note

L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

Course Code BTCS501	Course Name Design & Analysis of Algorithms	Semester V

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	0	1	4	3	0	4	4

Course Prerequisites	Discrete Mathematics - sets, functions, relations; proofs, and proofs by induction; Boolean logic
Course Category	Professional course
Course focus	Employability
Rationale	Design and analysis of algorithms is important to study because it allows us to understand the efficiency and complexity of different methods for solving problems. By analyzing the time and space complexity of an algorithm, we can determine how well it will perform in different situations and make informed decisions about which algorithm to use for a specific task. Additionally, understanding how to design efficient algorithms can lead to significant improvements in the performance of software and systems. Overall, the study of algorithms is crucial for the development of efficient and effective computer programs.
Course Revision / Approval Date	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To Analyze the asymptotic performance of algorithms. **2.** To Write rigorous correctness proofs for algorithms. **3.** To Demonstrate a familiarity with major algorithms and data structures. **4.** To Apply important algorithmic design paradigms and methods of analysis. **5.** To Synthesize efficient algorithms in common engineering design situations.

Course Content	Weightage	Contact Hours
Unit 1: Introduction Fundamental characteristics of an algorithm. Basic algorithm analysis - Asymptotic analysis of complexity bounds - best, average and worst-case behaviour, standard notations for expressing algorithmic complexity. Empirical measurements of performance, time and space trade-offs in algorithms. Using recurrence relations to analyze recursive algorithms - Substitution method, Recursion tree method and Masters' theorem.	**10%**	**12**
Unit 2: Fundamental Algorithmic Strategies Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knapsack TSP. Heuristics – characteristics and their application domains. Divide and Conquer Algorithm: Introduction, Recurrence and different methods to solve recurrence, Problem Solving using divide and conquer algorithm.	**25%**	**12**
Unit 3: Graph and Tree Algorithms Depth - & Breadth - First traversals. Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sort, Network Flow problems.	**25%**	**12**
Unit 4: Tractable and Intractable Problems Computability. The Halting problem. Computability classes – P, NP, NP - complete and NP-hard. Cook's theorem. Standard NPcomplete problems Reduction techniques.	**20%**	**12**
Unit 5: Advanced Topics Approximation algorithms, Randomized algorithms, Class of problems beyond NP – PSPACE.	**20%**	**12**

List Of Practical	Weightage	Contact Hours
Practical 1: **A.** If f(n)=5n2 + 6n + 4, then prove that f(n) is O(n2).	**10%**	**12**
Practical 2: **A.** Compute the average case time complexity of quick sort. **B.** Use step count method and analyze the time complexity when two n×n matrices are added. **C.** Explain quick sort algorithm and simulate it for the following data 20, 35, 10, 16, 54, 21, 25. **D.** Sort the list of numbers using merge sort: 78, 32, 42, 62, 98, 12, 34, 83. **E.** Compute the optimal solution for job sequencing with deadlines using greedy methods. N=4, profits (p1,p2,p3,p4) = (100,10,15,27), Deadlines (d1,d2,d3,d4) = (2,1,2,1). **F.** Compute the optimal solution for knapsack problem using greedy Method .N=3, M= 20, (p1,p2,p3)= (25,24,15), (w1,w2,w3) =(18,15,10). **G.** Solve the solution for 0/1 knapsack problem using dynamic programming(p1,p2,p3, p4) = (11, 21, 31, 33), (w1, w2, w3, w4) = (2, 11, 22,15), M=40, n=4. **H.** Find the shortest tour of traveling salesperson for the following cost matrix using dynamic Programming ∞ 12 5 7 11 ∞ 13 6 4 9 ∞ 18 10 3 2 ∞.	**20%**	**12**

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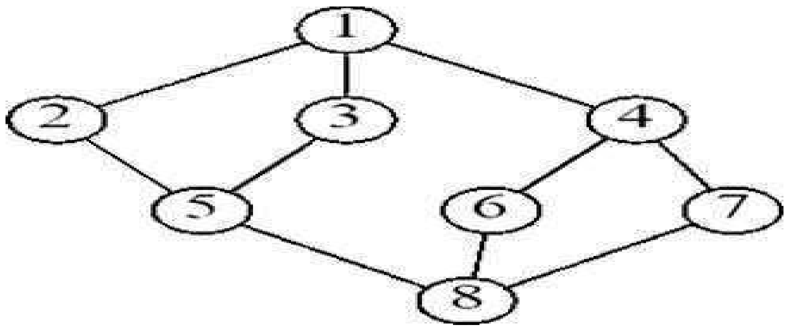
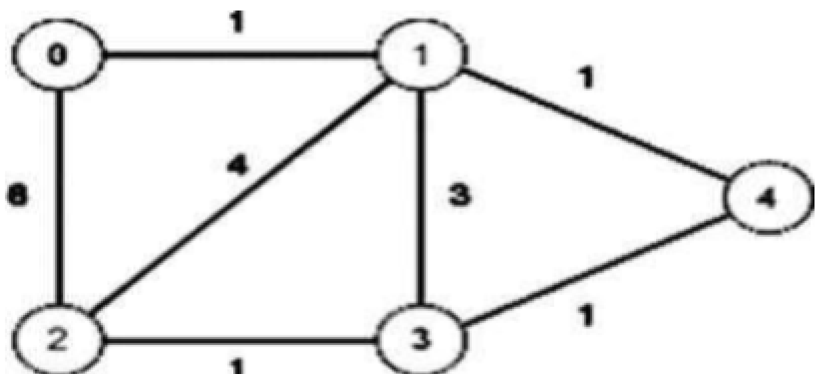
Practical 3:

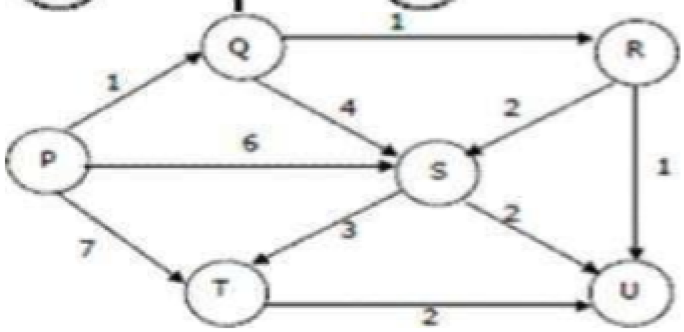
A. Solve BFS & DFS traversal of following graph.



B. Construct minimum cost spanning tree using
   a. Prims algorithm
   b. Kruskal algorithm

C. Apply single source shortest path algorithm for the following graph





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Practical 4:

A. Prove the Hamiltonian cycle is in NP.
B. Prove circuit-SAT is in NP.

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Instructional Method and Pedagogy
Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** the notion of algorithmic complexity and logic of fundamental algorithms.	Cognitive	Understand
CO2	**Apply** fundamental algorithms in real life problem solving.	Cognitive	Apply
CO3	**Evaluate** suitable algorithmic strategies to solve a problem effectively and efficiently.	Cognitive	Evaluate
CO4	**Evaluate** different algorithms with respect to time and space complexity.	Cognitive	Evaluate
CO5	**Create** algorithms to solve various computational problems.	Cognitive	Evaluate

Learning Resources	
1.	**Textbook** 1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw- Hill. 2. Fundamentals of Algorithms – E. Horowitz et al
2.	**Reference Books:** 1. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson. 2. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
3.	**Journals & Periodicals** 1.
4.	**Other Electronic Resources** 1. MOOC platform.

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Understand** the notion of algorithmic complexity and logic of fundamental algorithms.
2.	**Apply** fundamental algorithms in real life problem solving.
3.	**Evaluate** suitable algorithmic strategies to solve a problem effectively & efficiently.
4.	**Evaluate** different algorithms with respect to time and space complexity.
5.	**Create** algorithms to solve various computational problems.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	0	1	1	1	2	3	0	1	0	0	3	2
CO2	1	0	1	1	2	0	0	1	0	0	2	2
CO3	3	2	3	1	0	0	1	1	0	1	1	2
CO4	3	2	3	1	0	0	1	1	0	1	1	2
CO5	2	2	2	1	2	1	0	2	2	0	2	3

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	3	3
CO2	1	1	1
CO3	3	2	3
CO4	3	2	3
CO5	1	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS502	Course Name Software Engineering	Semester V

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Software engineers design, develop and improve upon the computer programs.
Course Category	Professional course
Course focus	Employability
Rationale	It is pivotal for developing modern software solutions, but it also serves as a vital link between business and technology. Through its principles and approaches, software engineers have been able to bridge the gap between technology and business and create reliable, secure, and efficient software solutions..
Course Revision / Approval Date	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To study pioneer of Software Development Life Cycle, Development models and Agile Software development. **2.** To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods. **3.** To discuss various software testing issues and solutions in software unit test; integration, regression, and system testing. **4.** To gain the techniques and skills on how to use modern software testing tools to support software testing projects. **5.** To expose Software Process Improvement and Reengineering.

Course Content	Weightage	Contact Hours
Unit 1: Introduction Notion of Software as a Product – characteristics of a good Software Product. Engineering aspects of Software production necessity of automation. Job responsibilities of Programmers and Software Engineers as Software developers. Introduction to SRS. Characteristics of SRS	**10%**	**05**
Unit 2: Process Models and Program Design Techniques Software Development Process Models – Code & Fix model, Waterfall model, Incremental model, Rapid Application development model, Prototyping model, Spiral (Evolutionary) model, overview of agile development (Scrum,Xtreme Programming) Good Program Design Techniques – Structured Programming, Coupling and Cohesion, Abstraction and Information Hiding, Automated Programming,Aesthetics. Software Modelling Tools –UML Diagrams(Use-case, Activity,Sequence,Class) Data Diagrams- ER diagram, Data flow Diagram,Data Dictionary,.	**25%**	**10**
Unit 3: Verification and Validation Testing of Software Products – Black-Box Testing and White-Box Testing, Static Analysis, Symbolic Execution and Control Flow Graphs – Cyclomatic Complexity. Introduction to testing of Real-time Software Systems, Test case scenarios	**25%**	**10**
Unit 4: Software Project Management Management Functions and Processes, Project Planning and Control, Project Scheduling(GANNT Chart, PERT Chart) Organization and Intra-team Communication, Risk Management. Software Cost Estimation, Metrics for estimating costs of software products – Function Points. Techniques for software cost estimation – Expert judgement, Delphi cost estimation, Work break-down structure and Process breakdown structure, COCOMO and COCOMO-II.	**20%**	**10**

Unit 5: Advanced Topics: Formal Methods in Software Engineering Advanced Software Engineering concepts, Re-engineering, Forward Engineering, Reverse Engineering, Software Reuse, Overview of Dependable systems (Reliability,Safety,security & resilience Engineering) Service- oriented software engineering.	**20%**	**10**

List Of Practical	Weightage	Contact Hours
Practical 1: **Identifying the requirements from problem statement** i. Define Requirements. ii. Discuss about methods of gathering requirement iii. Elaborate functional & non-functional requirements as per your selected application. iv. Identify the processes covered under functional & non-functional requirements	**10%**	**4**
Practical 2: **Introduction to UML Diagrams** i. Define UML. ii. Introduction of UML diagrams with history. iii. Discuss categories of UML diagrams according to the view(Static & Dynamic) & nature(Structural & Behavioural)	**10%**	**4**
Practical 3: **Modelling UML Use case diagrams and capturing Use case scenarios** i. Give a brief introduction about Use case diagrams with symbols (Actor, Use case,relationship,etc) ii. Create Use case diagram for the selected application **A.**	**10%**	**4**
Practical 4: **Identifying domain classes from problem statement & modelling UML Class Diagrams** i. Give a brief introduction about Class diagrams with symbols ii. Create a class diagram for the selected application	**10%**	**4**

Practical 5: **Activity Modelling** i. Give a brief introduction about activity diagram with symbols ii. Create an activity diagram for the selected application	**10%**	**2**
Practical 6: **Sequence Diagram Modelling** i. Give a brief introduction about sequence diagram with symbols ii. Create a sequence diagram for the selected application along with lifeline bars	**10%**	**2**
Practical 7: **E-R modelling from the problem statement** i. Give a brief introduction about E-R diagram with details about entity set, attributes, weak entity, generalization, specialization, mapping cardinalities & graphical notations for E-R diagrams ii. Create an E-R diagram for the selected application	**10%**	**2**
Practical 8: **Modeling of Data Flow Diagram** i. Give a brief introduction with graphical notations for data flow diagram, explanation of symbols used in DFD, Context diagram and levelling DFD ii. Create a level-0 & level-1 DFD for the selected application	**10%**	**2**
Practical 9: **Designing Test Suites & estimating test coverage metrics with structural complexity** i. List out different test scenarios for selected Application (Min 10-15). ii. Also create a Test case for each and every test scenario	**10%**	**2**
Practical 10: **Estimation of Project Metrics** i. Discussing various project estimation techniques: COCOMO-Basic, Intermediate & Complete, Halstead Complexity Metrics ii. Understand and try to apply COCOMO model to calculate time and efforts of different projects	**10%**	**4**

Instructional Method and Pedagogy
Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** SRS (Software Requirement Specification).	Cognitive	Understand
CO2	**Apply** the concept of Functional Oriented and Object Oriented Approach.	Cognitive	Apply
CO3	**Understand** and Recognize how to ensure the quality of software products.	Cognitive	Understand
CO4	**Apply** various testing techniques and test plans.	Cognitive	Apply
CO5	**Analyze** the modern Agile Development for the Concept of Industry.	Cognitive	Analyze

Learning Resources	
1.	**Textbook** 1. Roger S.Pressman, Software engineering- A practitioner's Approach, McGraw-Hill International Editions Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill. 2. Ian Sommerville, Software engineering, Pearson education Asia.
2.	**Reference Books:** 1. Pankaj Jalote, Software Engineering – A Precise Approach Wiley. 2. Software Engineering Fundamentals by Ali Behhforoz& Frederick Hudson OXFORD. 3. Rajib Mall, Fundamentals of software Engineering, Prentice Hall of India. 4. Engineering Software as a Service An Agile Software Approach, Armando Fox and David Patterson.
3.	**Journals & Periodicals** 1.

4.	**Other Electronic Resources** **1.**

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Understand** SRS (Software Requirement Specification).
2.	**Apply** the concept of Functional Oriented and Object Oriented Approach.
3.	**Understand** and Recognize how to ensure the quality of software products.
4.	**Apply** various testing techniques and test plans.
5.	**Analyze** the modern Agile Development for the Concept of Industry.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	2	2	2	2	0	2	2	2	2
CO2	1	2	1	2	2	0	0	0	2	2	2	2
CO3	1	0	1	2	2	1	0	0	2	0	2	3
CO4	1	2	2	0	2	2	2	0	2	0	2	3
CO5	1	2	0	2	2	0	0	0	2	2	2	3

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	0	1	1
CO2	0	1	1
CO3	0	1	1
CO4	0	1	1
CO5	0	1	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS503	Course Name Advanced Web Technologies	Semester V

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	2	0	4

Course Prerequisites	Basic Web Programming
Course Category	Professional Course
Course focus	Employability
Rationale	It is important to learn Advanced web programming as this course is a great way to learn the latest web development and security techniques. By mastering these skills, you can apply your knowledge to developing web applications, websites, and software. You will be able to design, build, and manage sophisticated information storage systems.
Course Revision / Approval Date	30/5/2025
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To make students aware about AngularJs. **2.** To make students aware about React Js. **3.** Provide an overview of NodeJs. **4.** To give brief knowledge about MongoDB. **5.** To Describe the applications of Django framework.

Course Content	Weightage	Contact Hours
Unit 1: INTRODUCTION TO ANGULARJS : Angularjs JSModel-View-Controller, Expression, Directives and Controllers, AngularJS Modules, Arrays, Working with ng-model, Working with Forms, Filters Directives :Interacting with Server, HTTP Services, Building Database, Frontend and BackEnd	**20%**	**14**
Unit 2: Introduction to React: React Upgrade, React ES6, React Render HTML, React JSX, React Components, React Class, React Props, React Events, React Conditionals, React List, React Forms, React Router, React Memo, React CSS styling, React Sass Styling	**25%**	**09**
Unit 3: Node.js Introduction – Using the Terminals – Editors –Building a Web Server with Node – The HTTPModule – Views and Layouts – Middleware – Routing – Form Handling with Express - The Request and Response Objects - Express.	**25%**	**06**
Unit 4: Introduction to MongoDB JSON and MongoDB – Adopting a Non-relational Approach – Opting for Performance vs. FeatureRunning the Database Anywhere – Generating or Creating a Key – Using Keys and Values – Implementing Collections.	**20%**	**06**
Unit 5: Advanced Django Model creation and migration, Data access via Django shell, Object operations (save, retrieve, modify), Queryset sorting and filtering, Admin interface customization, User roles and permissions, User data upload, Integration of external normal and AI/ML REST APIs.	**20%**	**10**

List Of Practical	Weightage	Contact Hours
Practical 1: **A.** Create a single web page with the model view controller & validate it. **B.** Connect the developed form with the HTTP Services and connect it with a database.	**20%**	**06**
Practical 2: **A.** Creating and Rendering a Functional React Component **B.** Form Handling in React Using Controlled Components	**25%**	**06**
Practical 3: **A.** Building a Single-page Application using a front-end framework (e.g. React, Angular, Vue.js). **B.** Creating a custom Web Component that can be reused across multiple projects.	**25%**	**06**
Practical 4: **A.** Implementing data validation rules using MongoDB's schema validation feature. **B.** Implementing transactions to maintain data consistency in MongoDB.	**20%**	**06**
Practical 5: **A.** Develop a Django web application to perform Create, Read, Update, and Delete (CRUD) operations for a Bookstore. **B.** Build a Django application that sends user input to an external AI/ML REST API for sentiment analysis and displays the predicted result.	**20%**	**06**

Instructional Method and Pedagogy
Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Develop** web applications using AngularJs.	Cognitive	Apply
CO2	**Apply** the concept of React Js	Cognitive	Develop
CO3	**Design** & develop interactive web applications using NodeJs.	Cognitive	Design
CO4	**Connect** MongoDB with realtime web applications.	Cognitive	Connect
CO5	**Develop** real time applications through the Django framework.	Cognitive	Develop

Learning Resources	
1.	**Textbook** **1.** Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India **2.** Web Technologies, Black Book, dreamtech Press **3.** Beginning Node.js, Express & MongoDB Development, Greg Lem **4.** Node.js, MongoDB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications, brad dayley, brendan daley, Caleb
2.	**Reference Books:** **1.** Developing Web Applications in PHP and AJAX, Harwani, McGrawHill **2.** Full Stack Javascript Development With Mean - MongoDB, Express, AngularJS, and Node.JS, Adam Bretz, Colin J Ihrig
3.	**Journals & Periodicals** **1.**
4.	**Other Electronic Resources** **1.** MOOC Platform

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Develop** web applications using AngularJs..
2.	**Apply** the concept of React Js
3.	**Design** & develop interactive web applications using NodeJs.
4.	**Connect** MongoDB with realtime web applications.
5.	**Develop** real time applications through the Django framework.

Mapping of POs & COs

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

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	1	3
CO2	1	1	3
CO3	1	1	3
CO4	1	1	3
CO5	1	1	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS504	Course Name Data Science for Engineers	Semester V

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Python Programming
Course Category	Engineering Specific Elective
Course focus	Employability
Rationale	Engineers who have learned data science can easily connect the dots of the data ecosystem within a company or institution. Besides, learning data science comes with a list of advantages as listed below. Data science is evolving to be the backbone of decision - making. Engineers who have learned data science are responsible for both the works of a data analyst and data scientist. Engineers can understand coding better when they mend their skills with data science. They find easy and convenient ways to create abstract, broad, efficient, and scalable solutions. Learning data science comes with great financial rewards.
Course Revision / Approval Date	
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To help students learn, understand, and practice the basics of python and data structure. **2.** To aware students about various data preprocessing techniques. **3.** To give an overview of visualization techniques. **4.** To brief students data warnling methodologies. **5.** To provide knowledge about statistical analysis.

Course Content	Weightage	Contact Hours
Unit 1: Overview of Python and Data Structures Basics of Python including data types, variables, expressions, objects and functions. Python data structures including String, Array, List, Tuple, Set, Dictionary and operations. Discovering the match between data science and python: Considering the emergence of data science, Outlining the core competencies of a data scientist, Linking data science, big data, and AI, Understanding the role of programming, Creating the Data Science Pipeline, Preparing the data, Performing exploratory data analysis, Learning from data, Visualizing, Obtaining insights and data products Understanding Python's Role in Data Science: Introducing Python's Capabilities and Wonders: Why Python?, Grasping Python's Core Philosophy, Contributing to data science, Discovering present and future development goals, Working with Python, Getting a taste of the language, Understanding the need for indentation, Working at the command line or in the IDE.	**10%**	**05**
Unit 2: Preprocessing Using the Jupyter Console, Interacting with screen text, Changing the window appearance, Getting Python help, Getting IPython help, Using magic functions, Discovering objects, Using Jupyter Notebook, Working with styles, Restarting the kernel, Restoring a checkpoint, Performing Multimedia and Graphic Integration, Embedding plots and other images, Loading examples from online sites, Obtaining online graphics and multimedia. Removing NAs/No Values, Basic Data Handling: Starting with Conditional Data Selection, Drop Column/Row, Subset and Index Data, Basic Data Grouping Based on Qualitative Attributes, Cross Tabulation, Reshaping, Pivoting, Rank and Sort Data, Concatenate, Merging and Joining Data Frames.	**20%**	**10**

Unit 3: Data Visualization Visualizing Information: Starting with a Graph, Defining the plot, Drawing multiple lines and plots, Saving your work to disk, Setting the Axis, Ticks, Grids, Getting the axes, Formatting the axes, Adding grids, Defining the Line Appearance, Working with line style, Using colors, Adding markers, Using Labels, Annotations, and Legends, Adding labels, Annotating the chart, Creating a legend. Visualizing the Data: Choosing the Right Graph, Showing parts of a whole with pie charts, Creating comparisons with bar charts, Showing distributions using histograms, Depicting groups using boxplots, Seeing data patterns using scatterplots, Creating Advanced Scatterplots, Depicting groups, Showing correlations Plotting Time Series, Representing time on axes, Plotting trends over time, Plotting Geographical Data, Using an environment in Notebook, Getting the Basemap toolkit, Dealing with deprecated library issues, Using Basemap to plot geographic data, Visualizing Graphs, Developing undirected graphs, Developing directed graphs.	**25%**	**10**
Unit 4: Data Wrangling Wrangling Data: Playing with Scikit-learn, Understanding classes in Scikit-learn, Defining applications for data science, Performing the Hashing Trick, Using hash functions, Demonstrating the hashing trick, Working with deterministic selection, Considering Timing & Performance, Benchmarking, with,timeit, Working with the memory profiler, Running in Parallel on Multiple Cores, Performing multicore parallelism, Demonstrating multiprocessing. Exploring Data Analysis: The EDA Approach, Defining Descriptive Statistics for Numeric Data, Measuring central tendency, Measuring variance and range, Working with percentiles, Defining measures of normality, Counting for Categorical Data, Understanding frequencies, Creating contingency tables, Creating Applied Visualization for EDA, Inspecting boxplots.	**25%**	**10**
Unit 5: Statistical Analysis Important statistical concepts used in data science, Difference between population and sample, Types of variables, Measures of central tendency, Measures of variability, Coefficient of variance, Skewness and Kurtosis, Normal distribution, Test hypotheses, Central limit theorem, Confidence interval, T-test, Type I and II errors, Student's T distribution, Regression, ANOVA,R square, Correlation and causation.	**20%**	**10%**

List Of Practical	Weightage	Contact Hours
Practical 1: **A.** Implement basic data type manipulation functions using Python. **B.** Implement python list & tuple manipulation commands using various examples.	**10%**	**05**
Practical 2: **A.** Implement Matrix functions and Identify getting Palindrome for a given input text/number using Python. **B.** Perform various data frame manipulation operations as well as dealing with missing values in the dataframe in python.	**20%**	**10**
Practical 3: **A.** Perform time series visualization for given data set through line plots, histograms, density plot, scatter plots, heat maps and auto-correlation plot. **B.** Perform geospatial visualization for a given data set in python.	**25%**	**10**
Practical 4: Perform data wrangling for a given dataset using python.	**25%**	**10**
Practical 5: **A.** Perform statistical data analysis as well as visualization for Exploratory data analysis through box plots. **B.** Implement student's t - test and central limit theorem in python.	**20%**	**10%**

Instructional Method and Pedagogy

Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** and manipulate the basics of python and data structure.	Cognitive	Understand
CO2	**Implement** various data preprocessing techniques.	Cognitive	Implement
CO3	**Visualize** the real time data.	Cognitive	Visualize
CO4	**Ability** to wrangle the data.	Cognitive	Ability
CO5	**Remember** to do statistical analysis.	Cognitive	Remember

Learning Resources	
1.	**Textbook** 1. Field Cady, 'The Data Science Handbook ', Wiley Publication ISBN- 13: 978-1119092940. 2. Jake VanderPlas, 'Python Data Science Handbook Essential Tools for Working With Data', O'REILLY ISBN:978-1-491-91205-8. 3. Rachel Schutt and Cathy O'Neil, Doing Data Science, O'REILLY.
2.	**Reference Books:** 1. Wes McKinney,Python for Data Analysis Data Wrangling with Pandas, NumPy, and IPython, 2nd Edition, O'REILLY. 2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012. 3. John W. Foreman (Author), Data Smart: Using Data Science to Transform Information into Insight, WILEY. 4. John Paul Mueller, Luca Massaron, Python for Data Science For Dummies, WILEY.
3.	**Journals & Periodicals** 1.
4.	**Other Electronic Resources** 1. MOOC Platform

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Understand** and manipulate the basics of python and data structure.
2.	**Implement** various data preprocessing techniques.
3.	**Visualize** the real time data.
4.	**Ability** to wrangle the data.
5.	**Remember** to do statistical analysis.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	0	0	0	2	0	0	0	0	0	0	0
CO2	0	3	3	0	3	3	0	3	3	2	1	2
CO3	0	0	2	3	0	0	0	0	0	0	1	2
CO4	3	3	3	0	3	0	3	3	0	0	0	0
CO5	3	3	3	0	3	0	0	2	0	0	0	0

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	0	3	0
CO2	3	0	3
CO3	3	0	3
CO4	3	0	0
CO5	3	0	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS505	Course Name IOT Architecture And Protocols	Semester V

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Programming: Python
Course Category	Engineering Specific Elective
Course focus	Employability
Rationale	The course teaches the systematic use of IoT management targeting economical and environmental needs and what the technology entails. As the number of connected devices increases, the need for engineers in this stream will have high demand. Doing research and real-world applications will become necessary.
Course Revision / Approval Date	30/5/2025
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To explore the interconnection and integration of various machines. **2.** To be able to design & develop IOT Devices. **3.** To understand the application protocols of IOT. **4.** To connect IoT devices with AWS Cloud. **5.** To apply the knowledge of IoT in various real time projects as case study.

Course Content	Weightage	Contact Hours
Unit 1: Overview & Reference Model IoT - An Architectural Overview – Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M & IoT Analytics, Knowledge Management.	**20%**	**09**
Unit 2: Reference Architecture Application Protocols for IoT: UPnP, CoAP, MQTT, XMPP. SCADA, WebSocket; IP-based protocols: 6LoWPAN, RPL; Authentication Protocols; IEEE 802.15.4.	**20%**	**09**
Unit 3: Application Protocols Application Protocols for IoT: UPnP, CoAP, MQTT, XMPP. SCADA, WebSocket; IP-based protocols: 6LoWPAN, RPL; Authentication Protocols; IEEE 802.15.4. Communication Protocols of Embedded Systems: UART, I2C, SPI, RS232, RS485, MODBUS	**20%**	**09**
Unit 4: AWS MQTT server on AWS, Amazon DynamoDB based MongoDB database, End to end IOT application using AWS.	**20%**	**09**
Unit 5: Case Study Case study: Cloud-Based mart-Facilities Management, Healthcare, Environment Monitoring System	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Unit 1: **1.** Setting up a basic IoT system using an IoT platform (e.g. AWS IoT, Azure IoT Hub) and connecting a device (e.g. Raspberry Pi) to it. **2.** Creating a custom IoT device using a microcontroller board (e.g. Arduino, ESP32) and connecting it to an IoT platform.	**20%**	**09**
Unit 2: **1.** Creating a RESTful API to expose IoT data to external applications. **2.** Implementing edge computing in an IoT system to process data closer to the source and reduce latency.	**20%**	**09**
Unit 3: **1.** Using MQTT as a lightweight messaging protocol to publish and subscribe to data in an IoT system. **2.** Implementing security measures for IoT systems, including data encryption, access control, and secure communication protocols (e.g. TLS).	**20%**	**09**
Unit 4: Designing an IoT architecture that includes sensors, gateways, & cloud services such as AWS IoT	**20%**	**09**
Unit 5: Developing a custom machine - to - machine communication protocol for IoT systems.	**20%**	**09**

Instructional Method and Pedagogy
Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Explore** the interconnection and integration of various machines.	Cognitive	Explore
CO2	**Ability** to design and develop IOT Devices.	Cognitive	Ability
CO3	**Understand** the application protocols of IOT	Cognitive	Understand
CO4	**Implement** and connect the IoT devices with AWS Cloud.	Cognitive	Implement
CO5	**Apply** the knowledge of IoT in various real time projects as case study.	Cognitive	Apply

Learning Resources	
1.	**Textbook** **1.** Bassi, Alessandro, et al, "Enabling things to talk", Springer-Verlag Berlin An, 2016. **2.** David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols, and Use.
2.	**Reference Books:** **1.** Cases for the Internet of Things", CISCO Press, 2017. **2.** Hersent, Olivier, David Boswarthick, and Omar Elloumi. The internet of things: Key applications and protocols. John Wiley & Sons, 2011. **3.** Buyya, Rajkumar, and Amir VahidDastjerdi, eds. Internet of Things: Principles and paradigms. Elsevier, 2016.
3.	**Other Electronic Resources** **1.** http://nptel.ac.in

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	**Course Outcomes**
1.	**Explore** the interconnection and integration of various machines.
2.	**Ability** to design and develop IOT Devices.
3.	**Understand** the application protocols of IOT
4.	**Implement** and connect the IoT devices with AWS Cloud.
5.	**Apply** the knowledge of IoT in various real time projects as case study.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	0	0	0	0	1	0	0	1	0	0	0
CO2	1	2	3	2	3	0	0	0	1	0	0	0
CO3	1	0	0	0	0	0	0	0	0	0	0	0
CO4	1	0	1	0	1	0	0	1	0	1	1	1
CO5	1	1	0	0	1	0	1	1	0	1	1	1

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	2	1
CO2	1	2	2
CO3	1	2	1
CO4	1	2	1
CO5	1	1	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS507	Course Name Network Security & Access Control	Semester V

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	2	0	4

Course Prerequisites	Basics of computer networks
Course Category	Engineering Specific Elective
Course focus	Employability
Rationale	Network security and access control is important because it keeps sensitive data safe from cyber attacks and ensures the network is usable and trustworthy.
Course Revision / Approval Date	30/5/2025
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Understand network security threats, security services, and countermeasures. **2.** Apply methods for authentication, access control, intrusion detection and prevention. **3.** Identify access control policies standards, procedure and guidelines. **4.** Identify access control systems. **5.** Implement access control for information systems.

Course Content	Weightage	Contact Hours
Unit 1: Introduction to Network Security Network specific threats and attack types, Use of cryptography for data and network security, Architectures for secure networks, Defense mechanisms and countermeasures. Network Defense tools	**20%**	**09**
Unit 2: Access Control and Assessing RiskAccess Control Process Identification, Authentication, Authorization, Qualitative and quantitative risk assessment, risk management strategies.	**20%**	**09**
Unit 3: Business Drivers and Access Control Policies Standards, Procedure, and Guidelines Access control of meet business model, solving business challenges with access control strategies, access control system design principles.	**20%**	**06**
Unit 4: Implementing Access Control Systems Access Control Models, Network Access Control, Transforming Access Control Policies and Standards into Procedures and Guidelines, Identity Management and Access Control, Multilayered Access Control Implementations.	**20%**	**10**
Unit 5: Access Control for Information Systems Access Control for Data, Access Control for File Systems, Access Control for Executables, Microsoft Windows Workstations and Servers, Supervisory Control and Data Acquisition (SCADA) and Industrial Control.	**20%**	**11**

List Of Practical	Weightage	Contact Hours
Practical 1: **A.** Installation of Kali Linux or Parrot Security Operating System in Virtual Box. **a.** Kali OS: Click here **b.** Parrot Security OS: Click here **c.** Download Kali Linux OS: Click here **d.** Download Parrot Security OS: Click here **B.** Practical approach to implement Footprinting: Gathering Target Information making use of following tools: **a.** Dmitry Deepmagic: Reference **b.** UA Tester: Reference **c.** Hatweb: Reference	**20%**	**06**
Practical 2: **A.** Study practical approach to implement scanning and enumeration techniques using Nmap. **B.** To identify anomalies in your network using Network anomaly detection engines (ADE).	**20%**	**06**
Practical 3: **A.** Study practical approaches to implement system hacking and learn. **B.** Trace the origin of Email using any Tool (e.g. emailTRackerPro). **C.** Trace the path of the website using Tracert Utility.	**20%**	**06**
Practical 4: **A.** Study practical approach to combine access control with the admission control mechanisms used to provide quality of service guaranteed in multimedia operating systems. **B.** Study practical approaches to implement and manage access control efficiently in large complex systems.	**20%**	**06**

Practical 5: **A.** Study practical approach to various Access Control Models like Attribute - based Access Control, Discretionary Access Control, History - Based Access Control, Identity-Based Access, Mandatory Access, Organization-Based Access control, Role-Based Access Control, Rule-Based Access Control.	**20%**	**06**

Instructional Method and Pedagogy

Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** major issues concerning network security.	Cognitive	Understand
CO2	**Understand** risk involved in access control.	Cognitive	Understand
CO3	**Explore** different Procedure & Guidelines for access control policies.	Cognitive	Analyse
CO4	**Implement** the access control system.	Cognitive	Apply
CO5	**Implementation** of access control system for information system.	Cognitive	Apply

Learning Resources	
1.	**Textbook** **1.** Network Security Essentials, Prentice-Hall by William Stallings
2.	**Reference Books:** **1.** "Network Security Essentials: Applications and Standards" by William Stallings. **2.** "Computer Networking: A Top-Down Approach" by James F. Kurose and Keith W. Ross.

3.	**Journals & Periodicals** **1.** .
4.	**Other Electronic Resources** **1.**

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Understand** major issues concerning network security.
2.	**Understand** risk involved in access control.
3.	**Explore** different Procedure & Guidelines for access control policies.
4.	**Implement** the access control system.
5.	**Implementation** of access control system for information system.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	0	0	0	0	0	0	0	0	0	0	0
CO2	1	0	0	0	0	0	0	0	0	0	0	0
CO3	0	0	2	3	0	0	0	0	0	0	1	2
CO4	1	0	1	0	1	0	0	1	0	1	1	1
CO5	1	1	0	0	1	0	1	1	0	1	1	1

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	2	1
CO2	1	2	1
CO3	3	0	3
CO4	1	2	1
CO5	1	1	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Teaching Scheme

Semester – VI B.Tech Computer Science & Engineering

Sr. No.	Course Code	Course Name	Teaching Scheme (Hours / week)				Teaching Credit			
			L	P	T	Total	L	P	T	Total
1.	BTCS601	Professional Elective -I	3	2	0	5	3	1	0	4
2.	BTCS602	Theory of Computation	3	0	1	4	3	0	1	4
3.	BTCS603	Advanced Java Technology	3	2	0	5	3	1	0	4
4.	BTCS604	Specialized Track Elective I - Deep Learning	3	2	0	5	3	1	0	4
	BTCS605	Specialized Track Elective-II - IoT Network, Signal & Signal Processing								
	BTCS608	Specialized Track Elective-III - Platform & Application Security Principles								
5.	BTCS606	Specialized Track Elective-I -Big Data Architecture and Programming	3	2	0	5	3	1	0	4
	BTCS607	Specialized Track Elective-II - Data Analytics for IoT								
	BTCS609	Specialized Track Elective -III - Wireless and Mobile Device Security Principles								
6.	AECC601	Disaster Risk Management	2	0	0	2	2	0	0	2
7.	BTCS610	Minor Project – I	0	6	0	6	0	3	0	3

8.	BTCS611	Industrial Internship	0	0	0	0	0	2	0	2
Total			**17**	**14**	**1**	**32**	**17**	**9**	**1**	**27**

Note
L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

Sr. No.	Course Code	Course Name	Teaching Scheme (Hours / week) Teaching Credit					
			Theory MS Marks	Theory CEC Marks	Theory ES Marks	Theory Marks	Practical Marks	Total Marks
1.	BTCS601	Professional Elective - I	20	40	40	100	50	150
2.	BTCS602	Theory of Computation	20	40	40	100	0	100
3.	BTCS603	Advanced Java Technology	20	40	40	100	50	150
4.	BTCS604	Specialized Track Elective I - Deep Learning	20	40	40	100	50	150
	BTCS605	Specialized Track Elective-II - IoT Network, Signal & Signal Processing						
	BTCS608	Specialized Track Elective - III - Platform & Application Security Principles						
5.	BTCS606	Specialized Track Elective - I - Big Data Architecture and Programming	20	40	40	100	50	150
	BTCS607	Specialized Track Elective - II - Data Analytics for IoT						

	BTCS609	Specialized Track Elective -III - Wireless and Mobile Device Security Principles						
6.	AECC601	Disaster Risk Management	20	40	40	100	0	100
7.	BTCS610	Minor Project – I	0	0	0	0	100	100
8.	BTCS611	Industrial Internship	0	0	0	0	100	100
Total			**120**	**240**	**240**	**600**	**400**	**1000**

Note
L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

BTCS601A	Cyber security
BTCS601B	Dot net technology
BTCS601C	Digital image processing
BTCS601D	R programming
BTCS601E	Concepts of AR / VR

Course Code BTCS601A	Course Name Cyber Security	Semester VI

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	45	3	1	0	4

Course Prerequisites	Basic Computer knowledge
Course Category	Department Elective
Course focus	
Rationale	
Course Revision / Approval Date	
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To make students aware about the fundamentals of cyber security. **2.** To brief students regarding security threats and vulnerabilities. **3.** To provide knowledge about network security. **4.** To elaborate system and network security. **5.** To aware students regarding blockchain technology.

Course Content	Weightage	Contact Hours
Unit 1: Cyber Security Foundation The Security Environment: Threats, vulnerabilities, and consequences, Advanced persistent threats, The state of security today, Why security matters to DoD (Department of Defence), Principles of Cyber security: Enterprise Roles and Structures: Information security roles and positions, Alternative enterprise structures and interfaces, Strategy and Strategic Planning: Strategy, Strategic planning and security strategy, The information security lifecycle, Architecting the enterprise, Security Plans and Policies: Levels of planning, Planning misalignment, The System Security Plan (SSP), Policy development and implementation.	**20%**	**09**
Unit 2: Security Threats And Vulnerabilities Overview of security threats, Hacking techniques, Password Cracking, Insecure network connections, Malicious code, Programming bugs, Cyber crime and Cyber Terrorism, Information Warfare and surveillance, Cryptography, Introduction to cryptography, Symmetric key cryptography, Asymmetric Key cryptography, Message authentication and Hash Functions, Digital Signature, Public Key Infrastructure, Application of cryptography.	**20%**	**09**
Unit 3: Network Security Access Control and Intrusion Detection: Overview of Identification and Authorization, I & A Techniques, Overview of IDS, Intrusion Detection Systems and Intrusion Prevention Systems. Server Management and Firewalls: User Management, DNS Routing and Load Balancing, Overview of Firewalls, Types of Firewalls, DMZ and firewall features. Security for VPN and Next Generation Networks: VPN Security, Fax Security, Link Encryption Devices.	**20%**	**09**

Unit 4: System And Application Security System Security: Desktop Security, email security: PGP and SMIME, Web Security: web authentication, SSL and SET, OS Security: OS Security Vulnerabilities, updates and patches, OS integrity checks, Anti-virus software, Design of secure OS and OS hardening, Configuring the OS for security, Trusted OS, Introduction to Cyber Physical System.	**20%**	**09**
Unit 5: Blockchain, Bitcoin & Cryptocurrency Blockchain- Public Ledgers, Blockchain as Public Ledgers -Bitcoin, Blockchain 2.0, Smart Contracts, Block in a Blockchain, Transactions-Distributed Consensus, The Chain and the Longest Chain - Cryptocurrency to Blockchain 2.0 -A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay, Consensus introduction, Distributed consensus in open environments-Consensus in a Bitcoin network.	**20%**	**09**

Instructional Method and Pedagogy

Chalk - Talk, Presentation, Computer based learning, Chalk – Talk, Presentation.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Able** to understand fundamental blocks of Cyber security.	Cognitive	Able
CO2	**Analyze** security threats and vulnerabilities.	Cognitive	Analyze
CO3	**Able** to analyze network security.	Cognitive	Able
CO4	**Comprehend** system and application security.	Cognitive	Comprehend
CO5	**Able** to explore the area of blockchain technology.	Cognitive	Able

Learning Resources	
1.	**Textbook** 1. Cybersecurity - Attack and Defence Strategies: Infrastructure security with Red Team and Blue Team tactics by Yuri Diogenes, ErdalOzkaya. 2. Cyber Law Law Of Information Technology And Internet (LexisNexis) Anirudh Rastogi. 3. Understanding Laws–Cyber Laws And Cyber Crimes (LexisNexis) 4. Cyber Crime Manual by Bibhas Chatterjee, Lawman Publication
2.	**Reference Books:** 1. 2. 3. Kaufman, c., Perlman, R., and Speciner, M., Network Security, Private Communication in a public world, 2nd ed., Prentice Hall PTR., 2002.
3.	**Journals & Periodicals** 1.
4.	**Other Electronic Resources** 1.

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks

	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Able** to understand fundamental blocks of Cyber security.
2.	**Analyze** security threats and vulnerabilities.
3.	**Able** to analyze network security.
4.	**Comprehend** system and application security.
5.	**Able** to explore the area of blockchain technology.

Mapping of POs & COs

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

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	2	2
CO2	1	2	2
CO3	1	2	2
CO4	1	2	2
CO5	1	2	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS601B	Course Name .NET Technology	Semester VI

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Basic Computer Programming
Course Category	Department Elective
Course focus	Skill development
Rationale	.Net technology, a software framework developed by Microsoft, offers a robust platform for building and deploying a variety of applications, from web to desktop and mobile. Its versatility, language interoperability, extensive class library, and strong support for security make it a preferred choice for developers aiming for scalable and efficient solutions. It plays a crucial role in society by empowering businesses to develop secure and scalable software solutions, enhancing efficiency and accessibility in various sectors. Its emphasis on reliability and interoperability aligns with societal values of trust and collaboration, driving technological advancements that benefit individuals and organizations while upholding ethical standards and societal well - being.
Course Revision / Approval Date	4/03/2024

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To aware students about basics of C# .Net Framework. **2.** To brief about fundamental steps of creating windows forms. **3.** To give an overview of ADO .Net. **4.** To make students understand advanced web programming using .NET. **5.** To elaborate security aspects while developing web applications.

Course Content	Weightage	Contact Hours
Unit 1: Overview of .NET Framework and Basics of C# General .NET Framework architecture, .NET features, the Common Language Runtime (CLR), The .NET Framework class library, Visual Studio .NET IDE 2013, C# language fundamentals: data types, variables, expressions, classes and objects, object-oriented concepts, arrays, strings and regular expressions and exception handling, System. Exception class. This keyword, indexers, delegates, properties, MetaData and reflection API, structure, enumeration.	**20%**	**09**
Unit 2: Building windows forms applications Windows forms fundamentals, creating windows form applications, adding controls to forms,handling events, the Control Class, windows forms controls: labels, linklabels, textboxes, richtextboxes, buttons, Checkboxes, Radio buttons, Listboxes, combo boxes, groupboxes, ImageList, ListView, TabControl, MenuStrip, DataGridView, DatePicker, Event Handlers, Validators, transferring data from one form to another to and from.	**20%**	**09**

Unit 3: ASP.NET Core Fundamentals and Basic Web App Development Introduction to ASP.NET Core Fundamentals: Overview of ASP.NET Core framework, Differences between ASP.NET Core and previous versions, Setting up development environment: Visual Studio, .NET Core SDK, ASP.NET Core project structure. Building Basic Web Applications: Creating and configuring ASP.NET Core web applications, Handling HTTP requests and responses, Working with static files and content, Implementing routing and URL mapping, Building views using Razor syntax.	**20%**	**09**
Unit 4: ASP .NET Core MVC & Entity Framework ASP .NET Core MVC Architecture:Understanding the Model-View-Controller (MVC)architectural pattern, Creating controllers and actions, Implementing views and partial views, Data validation and form submission handling, Routing and attribute-based routing in MVC DatabaseConnectivity using Entity Framework Core: Introduction to Entity Framework Core (EF Core) Configuring EF Core for database access, Creating models and DbContext, Performing CRUD operations using EF Core, Querying data with LINQ and EF Core.	**20%**	**09**
Unit 5: Security and Deployment of web application Introducing Security, Identity, Authentication, Authorization, An Introduction to the ASP.NET Application Services, Introducing the Login Controls, The Login Controls, Configuring Your Web Application, The Role Manager, Preparing Your Web Site for Deployment, Creating a Simple Copy of Your Web Site, Publishing Your Web Site, Running Your Site under IIS, Moving Data to a Remote Server. Introduction XML.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: 1. Introduction to Information Security and Cyber Security. 2. Installation and Configuration of VMWARE Workstation Pro, VM Windows 10 and VM UBUNTU Linux.	**20%**	**03**

Practical 2: Installation and Configuration of ACUNETIX Vulnerability Scanner on VM Windows 10 and VM UBUNTU Linux - Perform Scan on Websites and Download Reports.	**20%**	**03**
Practical 3: Installation and Configuration of GFI Languard Network Scanner on VM Windows 10 and VM UBUNTU Linux - Perform Scan on Websites and Download Reports.	**20%**	**03**
Practical 4: **1.** Installation and Configuration of NESSUS Vulnerability Scanner on VM Windows 10 and VM UBUNTU Linux- Perform Scan on Websites and Download Reports **2.** Installation and Configuration of NMAP Vulnerability Scanner on VM Windows 10 and VM UBUNTU Linux- Perform Scan on Websites and Download.	**20%**	**03**
Practical 5: **1.** Installation and Configuration of NIKTO Vulnerability Scanner on VM Windows 10 and VMUBUNTU Linux- Perform Scan on Websites and Download Reports.	**20%**	**03**

Instructional Method and Pedagogy

Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** the existing fundamental blocks of C# codes.	Cognitive	Understand
CO2	**Develop** the console and GUI applications using C# .Net.	Cognitive	Develop
CO3	**Create** the dynamic web page using ASP .NET Controls which interact with databases.	Cognitive	Create

CO4	**Comprehend** the advanced concepts of .NET Programming while preparing web applications.	Cognitive	Comprehend
CO5	**Analyze** the security aspect of an application.	Cognitive	Analyze

Learning Resources	
1.	**Textbook** **1.** C# 6.0 and the .NET 4.6 Framework Paperback, Andrew Troelson, Philip Japikse, 7th Edition, Apress.
2.	**Reference Books:** **1.** Essential C# 6.0, Mark Michaelis and Eric Lippert, Addison Wesley. 2. Microsoft Ado.Net Entity Framework Step by Step, John Paul Mueller, PHI.
3.	**Other Electronic Resources** 1. http://nptel.ac.in

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks

	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Understand** the existing fundamental blocks of C# codes.
2.	**Develop** the console and GUI applications using C# .Net.
3.	**Create** the dynamic web page using ASP .NET Controls which interact with databases.
4.	**Comprehend** the advanced concepts of .NET Programming while preparing web applications.
5.	**Analyze** the security aspect of an application.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	0	0	0	0	0	0	0	0	0	1
CO2	0	1	3	0	3	0	1	0	0	0	1	1
CO3	0	1	2	0	3	0	1	0	0	0	1	1
CO4	0	1	3	1	3	0	1	0	0	0	1	1
CO5	0	1	2	1	3	1	1	0	0	0	2	2

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	0	3	3
CO2	0	3	3
CO3	0	3	3
CO4	0	3	3
CO5	0	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS601C	Course Name Digital Image Processing	Semester VI

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
45	0	0	45	3	0	2	4

Course Prerequisites	Digital Signal Processing, Transform techniques.
Course Category	Professional Courses
Course focus	
Rationale	
Course Revision / Approval Date	
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To study the image fundamentals and explain basic principles of digital image processing. **2.** To understand mathematical transforms necessary for image processing. **3.** Design and implement algorithms that perform basic image processing (e.g. noise removal and image enhancement). **4.** Design and implement algorithms for advanced image analysis (e.g. image compression, image segmentation). **5.** Assess the performance of image processing algorithms and systems.

Course Content	Weightage	Contact Hours
Unit 1: Fundamentals Need for DIP- Fundamental steps in DIP – Elements of visual perception -Image sensing and Acquisition – Image Sampling and Quantization – Imaging geometry, discrete image mathematical characterization.	**10%**	**12**
Unit 2: Image Transforms Two dimensional Fourier Transform- Properties – Fast Fourier Transform – Inverse FFT,Discrete cosine transform and KL transform.-Discrete Short time Fourier Transform- Wavelet Transform- Discrete wavelet Transform- and its application in Compression.	**25%**	**06**
Unit 3: Image Enhancement and Restoration Spatial Domain: Basic relationship between pixels- Basic Gray level Transformations – Histogram Processing – Smoothing spatial filters- Sharpening spatial filters. Frequency Domain: Smoothing frequency domain filters- sharpening frequency domain filters Homomorphic filtering.	**25%**	**12**
Unit 4: Feature Extraction Detection of discontinuities – Edge linking and Boundary detection- Thresholding - Edge based segmentation-Region based Segmentation- matching-Advanced optimal border and surface detection- Use of motion in segmentation. Image Morphology –Boundary descriptors- Regional descriptors.	**20%**	**12**
Unit 5: Image Reconstruction from Projections Need - Radon Transform – Back projection operator - Projection Theorem - Inverse Radon Transform.	**20%**	**03**

Instructional Method and Pedagogy
Chalk - Duster, PPT, Notes

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Analyze** general terminology of digital image processing.	Cognitive	Analyze
CO2	**Examine** various types of images, intensity transformations and spatial filtering.	Cognitive	Examine
CO3	**Develop** Fourier transform for image processing in frequency domain.	Cognitive	Develop
CO4	**Evaluate** the methodologies for image segmentation, restoration etc.	Cognitive	Evaluate
CO5	**Implement** image process and analysis algorithms.	Cognitive	Implement

Learning Resources	
1.	**Textbook** **1.** Rafael C.Gonzalez & Richard E.Woods - Digital Image Processing - Pearson Education - 2/e – 2004. **2.** Anil.K.Jain - Fundamentals of Digital Image Processing- Pearson Education - 2003.
2.	**Reference Books:** **1.** B.Chanda & D.Dutta Majumder – Digital Image Processing and Analysis - Prentice Hall of India – 2002 **2.** William K. Pratt – Digital Image Processing – John Wiley & Sons-2/e, 2004.
3.	**Journals & Periodicals** **1.**
4.	**Other Electronic Resources** **1.**

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Analyze** general terminology of digital image processing.
2.	**Examine** various types of images, intensity transformations and spatial filtering.
3.	**Develop** Fourier transform for image processing in frequency domain.
4.	**Evaluate** the methodologies for image segmentation, restoration etc.
5.	**Implement** image process and analysis algorithms.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	0	0	1	2	0	1	0	0	0	0	2
CO2	1	0	1	1	2	0	0	0	1	0	0	2
CO3	1	0	1	1	3	0	1	0	0	0	0	2
CO4	1	0	2	1	2	0	0	0	1	1	0	2
CO5	1	2	3	1	2	0	1	0	3	2	0	2

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	1	3
CO2	1	1	3
CO3	1	2	3
CO4	1	2	3
CO5	1	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS601D	Course Name R Programming	Semester VI

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
50			50	3	2	0	4

Course Prerequisites	Basic linear algebra.
Course Category	Elective Course
Course focus	
Rationale	
Course Revision / Approval Date	
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To brief students about the basics of R Programming. **2.** To inform the students about the data preparation process. **3.** To give a brief introduction about basic logical concepts of R. **4.** To make students familiar with data visualization and analysis techniques. **5.** To provide knowledge about advanced R programming concepts.

Course Content	Weightage	Contact Hours
Unit 1: Introduction to R Programming History and overview of R, Install and configuration of R programming environment, Installation and demonstration of R-Studio, R Command Prompt, R Script File, Basic language elements and data structures,R - Data Types, Vectors, Lists, Matrices, Arrays, Factors, Data Frames, Variable Assignment, Data Type of a Variable, Finding and deleting Variables, Operators, Reading and writing in R.	**10%**	**09**
Unit 2: Data Preparation R Data Frame: Create, Append, Select, Subset, List in R: Create, Select Elements with Example, R Sort a Data Frame using Order(), R Dplyr Tutorial: Data Manipulation(Join) & Cleaning(Spread), Merge Data Frames in R: Full and Partial Match, In-built Functions in R Programming (with Example)	**25%**	**14**
Unit 3: Programming in R IF, ELSE, ELSE IF Statement in R, Switch Statement, if_else ladder, if else function, For Loop in R with Examples for List and Matrix, While Loop in R with Example, Repeat loop, Break and Next Statement, apply(), lapply(), sapply(), tapply() Function in R with Examples.	**25%**	**08**
Unit 4: Data Analysis and Visualization in R Import Data into R: Read CSV, Excel Files, How to Replace Missing Values(NA) in R: na.omit & na.rm, R Exporting Data to Excel, CSV, Text File, R Aggregate Function: Summarize & Group_by() Example, R Select(), Filter(), Arrange(), Pipeline with Example Scatter Plot in R using ggplot2, How to make Box plot in R, Bar Chart & Histogram in R, Line graph, Scatter plot, T Test in R: One Sample and Paired, R ANOVA Tutorial: One way & Two way (with Examples).	**20%**	**07**
Unit 5: Advance R Concepts Data querying: SQL & R, Writing functions Reporting, Interactive reporting with Rmarkdown.	**20%**	**12**

List Of Practical	Weightage	Contact Hours
Practical 1: Blank		

Instructional Method and Pedagogy
Chalk - Duster, PPT, Notes

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Prepare** or tidy data in preparation for analysis.	Cognitive	Prepare
CO2	**Able** to understand the process of data preparation.	Cognitive	Able
CO3	**Able** to understand basic programming of R.	Cognitive	Able
CO4	**Analyze** a data set in R and present findings using the appropriate R packages.	Cognitive	Analyze
CO5	**Query** data using SQL and R.	Cognitive	Query

Learning Resources	
1.	**Textbook** 1. Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011. 2. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison - Wesley Data & Analytics Series, 2013.
2.	**Reference Books:** 1. Mark Gardener, " Beginning R – The Statistical Programming Language", Wiley, 2013 2 Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc, 2013.
3.	**Journals & Periodicals** 1.

4.	**Other Electronic Resources** **1.**

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Prepare** or tidy data in preparation for analysis.
2.	**Able** to understand the process of data preparation.
3.	**Able** to understand basic programming of R.
4.	**Analyze** a data set in R and present findings using the appropriate R packages.
5.	**Query** data using SQL and R.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	0	1	0	3	0	0	0	0	0	0	0
CO2	1	0	1	0	3	0	0	0	1	0	0	1
CO3	3	2	2	0	3	1	0	0	1	0	0	0
CO4	2	2	2	1	3	0	0	0	1	0	0	2
CO5	1	2	1	0	3	1	1	0	1	0	0	2

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	0	1	1
CO2	0	1	3
CO3	0	1	2
CO4	0	3	3
CO5	0	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS601E	Course Name Concept of AR / VR	Semester VI

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Basic linear algebra.
Course Category	Professional core courses
Course focus	Skill development
Rationale	The Concepts of Augmented Reality (AR) and Virtual Reality (VR) subject holds local, national, and international relevance due to the transformative potential of these technologies. Locally, it equips individuals with skills in AR / VR development, fostering local innovation and enabling the creation of immersive experiences for various industries like education, healthcare, tourism, and entertainment. Nationally, expertise in this subject contributes to the growth of the digital economy, attracting investments & driving technological advancements. Internationally, proficiency in AR / VR facilitates global collaborations, knowledge sharing, and positions a country at the forefront of emerging technologies. The subject's relevance lies in its ability to revolutionize user experiences, create new business opportunities, and shape the future of human - computer interaction in a connected world.
Course Revision / Approval Date	24/1/2022

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To analyse the hardware & software requirements. **2.** To use the different intersection techniques. **3.** To design 3D interfaces. **4.** Learn the fundamental aspects of designing and implementing using VR. **5.** Learn about multimodal virtual displays for conveying the techniques for evaluating virtual interfaces.

Course Content	Weightage	Contact Hours
Unit 1:Virtual Reality and Virtual Environments The historical development of VR, scientific landmarks computer graphics, real-time computer graphics, virtual environments, requirements for VR, benefits of virtual reality. Hardware technologies for 3D user interfaces: visual displays, auditory displays, haptic displays, choosing output devices for 3D user interfaces.	**20%**	**09**
Unit 2: 3D User Interface Input Hardware Input device characteristics, desktop input devices, tracking devices, 3d mice, special purpose input devices, direct human input, home -brewed input devices, choosing input devices for 3D interfaces. Software technologies: database - world space, world coordinate, world environment, objects - geometry, position / orientation, hierarchy, bounding volume, scripts and other attributes, VR environment - VR database, tessellated data, LODs, Cullers andOccluders, lights and cameras, scripts, interaction simple, feedback, graphical user interface, control panel, 2D controls, hardware controls, room / stage / area descriptions, world authoring and playback, VR toolkits, available software in the market.	**20%**	**09**

Unit 3: 3D Interaction Techniques 3D manipulation tasks, manipulation techniques and input devices, interaction techniques for 3D manipulation, design guidelines - 3D travel tasks,travel techniques, design guidelines - theoretical foundations of wayfinding, user centered wayfinding support, environment centered wayfinding support, evaluating wayfinding aids, design guidelines - system control, classification, graphical menus, voice commands, Gestural commands, tools, multimodal system control techniques, design guidelines, case study: mixing system control methods, symbolic input tasks,symbolic input techniques, design guidelines, beyond text and number entry.	**20%**	**09**
Unit 4: Designing and Developing 3D User Interfaces: Strategies for designing and developing guidelines and evaluation. Advances in 3D user interfaces: 3D user interfaces for the real world, AR interfaces as 3D data browsers, 3D augmented reality interfaces, augmented surfaces and tangible interfaces, agents in AR, transitional AR-VR interfaces - the future of 3D user interfaces, questions of 3D UI technology, 3d interaction techniques, 3d UI design and development, 3D UI evaluation and other issues.	**20%**	**09**
Unit 5: Virtual Reality Applications Engineering, architecture, education, medicine, entertainment, science, training.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: **1.** Create an employee table. Access data from the employee table using SQL query in R. **2.** Use the undergraduate survey data from here. csv to create ordered factor variables for the excel, statistics and programming variables. In a R Markdown draw histograms for your new ordered factor variables.	**20%**	**03**
Practical 2: **1.** Installation of unity for AR/VR models. **2.** Learn the fundamental aspects of designing and implementing rigorous empirical experiments using VR. **3.** Study technology for managing VR environments in real time for software and hardware inputs.	**20%**	**03**
Practical 3: **1.** Develop the affinity transforms. **2.** Develop the image processing techniques in 3D.	**20%**	**03**
Practical 4: **1.** To design 3D User Interfaces. **2.** Create the Object and shapes and develop the movements of the objects. **a.** To design the interface for Augmented Reality. **b.** To design the interface for Virtual Reality.	**20%**	**03**
Practical 5: **1.** Develop a scene in Unity that includes: a cube, plane and sphere, apply transformations on the 3 objects. Add a video and audio source. **2.** Develop a simple UI menu with images, canvas, sprites and buttons. Write a C# program to interact with UI menu through VR trigger button such that on each successful trigger interaction displays a score on the scene.	**20%**	**03**

Instructional Method and Pedagogy
Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	To **analyse** the hardware requirements.	Cognitive	Analyze
CO2	**To use** the different intersection techniques.	Cognitive	Apply
CO3	**Developing** Big Data management.	Cognitive	Develop
CO4	**Evaluating** Wireless Access Environment Technology.	Cognitive	Evaluating
CO5	**Understand** sustainability of cloud data.	Cognitive	Understand

Learning Resources	
1.	**Textbook** **1.**
2.	**Reference Books:** **1.** Paul Mealy, Virtual & Augmented Reality for Dummies, John Wiley & Sons. **2.** Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann.

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	To **analyse** the hardware requirements.
2.	**To use** the different intersection techniques.
3.	**Developing** Big Data management.
4.	**Evaluating** Wireless Access Environment Technology.
5.	**Understand** sustainability of cloud data.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	0	0	0	1	0	1	0	0	1	0	2
CO2	1	1	2	2	1	0	1	0	2	1	0	2
CO3	1	2	2	2	1	0	1	0	2	1	0	2
CO4	1	0	0	0	1	0	1	0	0	1	0	2
CO5	1	0	0	2	1	0	1	0	2	1	0	2

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	0	2
CO2	1	0	2
CO3	1	0	2
CO4	1	0	2
CO5	1	0	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS602	Course Name Theory OF Computation	Semester VI

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	0	1	4	3	0	1	4

Course Prerequisites	Students should have a strong background in discrete mathematics, data structures, and algorithms
Course Category	Professional core courses
Course focus	Skill development
Rationale	The theory of computational subjects is of local, national, and international relevance due to its potential to drive economic growth, technological advancements, and global competitiveness. Locally, it equips individuals with in- demand skills, boosting employment prospects and fostering innovation. Nationally, it strengthens a country's workforce, attracting investment and driving economic development. Internationally, it enables collaboration, knowledge sharing, and participation in the global digital economy, ensuring competitiveness on a global scale. The theory of computational subjects addresses the evolving needs of societies in the digital age, making it vital for individuals, communities, and nations to thrive in the modern world.
Course Revision / Approval Date	19/8/2019

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Understand formal language theory and its application to computer science. **2.** Understand properties of the corresponding language classes defined by various computation models and the relations between them. **3.** Apply mathematical preliminaries to develop the basic components of language design. **4.** Evaluate computer science problems as mathematical statements and to formulate proofs. **5.** Design simple computational machines using the concepts of language theory.

Course Content	Weightage	Contact Hours
Unit 1: Finite Automata Introduction - Basic Mathematical Notation and techniques- Finite State systems – Basic Definitions – Finite Automaton – DFA & NFA – Finite Automaton with € - moves – Regular Languages- Regular Expression – Equivalence of NFA and DFA – Equivalence of NFA"s with and without €-moves – Equivalence of finite Automaton and regular expressions – Minimization of DFA - Pumping Lemma for Regular sets – Problems based on Pumping Lemma.	**20%**	**15**
Unit 2: Grammar Introduction– Types of Grammar – Context Free Grammars and Languages– Derivations and Languages – Ambiguity- Relationship between derivation and derivation trees – Simplification of CFG – Elimination of Useless symbols – Unit productions – Null productions – Greibach Normal form – Chomsky Normal form – Problems related to CNF and GNF.	**20%**	**15**
Unit 3: Pushdown Automata Pushdown Automata- Definitions – Moves – Instantaneous descriptions – Deterministic pushdown automata – Equivalence of Pushdown automata and CFL – pumping lemma for CFL – problems based on pumping Lemma.	**20%**	**15**

Unit 4: Turing Machine Definitions of Turing machines – Models – Computable languages and functions –Techniques for Turing machine construction – Multi head and Multi tape Turing Machines – The Halting problem – Partial Solvability – Problems about Turing machine- Chomskian hierarchy of languages.	**20%**	**15**
Unit 5: Unsolvable Problems and Computable Function Unsolvable Problems and Computable Functions – Primitive recursive functions – Recursive and recursively enumerable languages – Universal Turing machine. Measuring And Classifying Complexity: Tractable and Intractable problems-Tractable and possibly intractable problems – P and NP completeness – Polynomial time reductions.	**20%**	**15**

Instructional Method and Pedagogy

Lecture-based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** the basic concepts and application of Theory of Computation.	Cognitive	Understand
CO2	**Apply** this basic knowledge of Theory of Computation in the computer field to solve computational problems and in the field of compiler also.	Cognitive	Apply
CO3	**Apply** knowledge of computing and mathematics appropriate to the discipline.	Cognitive	Apply
CO4	**Apply** mathematical foundations, algorithmic principles and computer science theory to the modeling and design of computer based systems in a way that demonstrates.	Cognitive	Apply
CO5	**Apply** design and development principles in the construction of software systems of varying complexity.	Cognitve	Analyse

Learning Resources	
1.	**Textbook** 1
2.	**Reference Books:** **1.** THopcroft J.E., Motwani R. and Ullman J.D, “Introduction to Automata Theory, Languages and Computations”, Second Edition, Pearson Education, 2008. (UNIT 1,2,3). 2. John C Martin, “Introduction to Languages and the Theory of Computation”, Third Edition, Tata McGraw Hill Publishing Company, New Delhi, 2007. (UNIT 4,5).
3.	**Journals & Periodicals** **1.**
4.	**Other Electronic Resources** **1.**

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Understand** the basic concepts and application of Theory of Computation.
2.	**Apply** this basic knowledge of Theory of Computation in the computer field to solve computational problems and in the field of compiler also.
3.	**Apply** knowledge of computing and mathematics appropriate to the discipline.
4.	**Apply** mathematical foundations, algorithmic principles and computer science theory to the modeling and design of computer based systems in a way that demonstrates.
5.	**Apply** design and development principles in the construction of software systems of varying complexity.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	1	2	2	0	1	0	0	2	3
CO2	1	1	0	0	1	0	0	0	0	0	0	0
CO3	2	1	2	1	2	2	0	1	2	0	3	3
CO4	2	1	2	1	3	0	1	1	1	1	2	3
CO5	0	1	1	1	2	3	0	1	0	0	3	2

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	3	3
CO2	0	1	2
CO3	1	3	3
CO4	1	3	3
CO5	1	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS603	Course Name Advanced Java Technology	Semester VI

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Java Programming
Course Category	Professional core courses
Course focus	Skill development
Rationale	The Advanced Java Technology subject holds local, national, and international relevance due to its significance in the software development industry. Locally, it equips individuals with advanced Java programming skills, meeting the demand for Java developers and enhancing employment opportunities. Nationally, it contributes to the technological capabilities of the country, fostering innovation and attracting investment in the software sector. Internationally, proficiency in Advanced Java opens doors for global collaborations, job prospects, and participation in the thriving tech industry. The subject's relevance lies in its ability to empower individuals and nations to harness Java's power for creating robust and scalable software solutions, making it valuable at the local, national, and international levels.
Course Revision / Approval Date	24/1/22

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To understand knowledge of advanced features of the Java language syntax and SDK. **2.** To learn advanced features of the Java language to build and compile robust enterprise - grade applications. **3.** Understand how and when to apply object-oriented principles such as abstraction, polymorphism, and inheritance, etc. **4.** To identify major subsystems and interfaces. **5.** To develop error - free, well - documented Java programs; develop and test Java networks.

Course Content	Weightage	Contact Hours
Unit 1: Basics of Networking & Socket Programming Network Basics and Socket overview, TCP/IP client sockets, URL, TCP/IP server sockets, Datagram, java.net package Socket, ServerSocket, InletAddress, URL, URL Connection,	**20%**	**09**
Unit 2: JDBCProgramming JDBC Connectivity Model, Connecting to Database, Creating & Executing SQL Queries, Retrieving & Updating Data, Error Handling: SQLException, SQLWarning, JDBC Interfaces: Statement, PreparedStatement, CallableStatement, Transaction Management	**20%**	**09**
Unit 3: J2EE architecture, Servlet API and Overview J2EE Architecture, Enterprise Application Concepts, N-Tier Application Concepts, Servlet Model: Overview of Servlet, Servlet Life Cycle, HTTP Methods, Structure, and Deployment Descriptor, `RequestDispatcher` Interface, The Filter API: Filter and FilterChain, Cookies and Session Management: State and Session Handling, Session Timeout and Session Tracking, JSP Directives, JSP Implicit Objects, JSP Form Processing, JSP Session and Cookies Handling, JSP Database Access, JSP Exception Handling	**20%**	**09**

Unit 4: Hibernate 4.0 Overview of Hibernate, Hibernate Architecture, Hibernate Mapping Types, Hibernate O/R Mapping, Hibernate Annotation, Hibernate Query Language.	**20%**	**07**
Unit 5: Spring Boot Introduction to Spring and Spring Boot, Spring Boot Project Structure, Creating a Spring Boot Application, Spring Boot Auto-Configuration, Creating REST API using Spring Boot, Embedded Server in Spring Boot (Tomcat)	**20%**	**07**

List Of Practical	Weightage	Contact Hours
Practical 1: **A.** Create a chat application using either TCP or UDP protocol. **B.** Implement TCP Server for transferring files using Socket and Server Socket. **C.** Implement any one sorting algorithm using TCP / UDP on Server application and Give Input On Client side and client should sort output from server and display sorted on input side. **D.** Implement Concurrent TCP Server programming in which more than one client can connect and communicate with Server for sending the string and server returns the reverse of string to each client.		
Practical 2: **A.** Write an RMI application where client supplies two numbers and server response by summing it. Provide your custom security policy for this application. **B.** Implement Student information systems using JDBC and RMI.		

Practical 3: **A.** Create a Servlet file which contains the following functions: 1. Connect 2. Create Database 3. Create Table 4. Insert Records into respective table 5. Update records of particular table of database 6. Delete Records from table. 7. Delete table and also database. **B.** Users can create a new database and also create a new table under that database. Once a database has been created then the user can perform database operation by calling above functions. Use the following Java Statement interface to implement program: **a.** Statement **b.** Prepared statement **c.** Callable statement **C.** Create a Servlet file and study web descriptor files. **D.** Create login form and perform state management using Cookies, Http Session and URL Rewriting. **E.** Implement Authentication filter using filter API.		
Practical 4: Study and implement Hibernate: Create an application to save a few Employee's records and then apply CRUD operations on those records.		

Instructional Method and Pedagogy

Lecture-based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Use** advanced technology in Java such as Internationalization, and Remote method Invocation.	Cognitive	Create
CO2	**Learn** how to work with JavaBeans.	Cognitive	Understand
CO3	**Develop** web applications using Java Servlet & Java Server Pages technology.	Cognitive	Create
CO4	**Apply** event handling on AWT and Swing components.	Cognitive	Apply
CO5	Will also be exposed to advanced topics including Multithreading, internet networking, and JDBC database connectivity.	Cognitive	Create

Learning Resources	
1.	**Textbook** **1.**
2.	**Reference Books:** **1.** Black Book " Java server programming" J2EE, 1st ed., Dream Tech Publishers, 2008. 3. Kathy walrath " **2.** Complete Reference J2EE by James Keogh mcgraw publication.
3.	**Journals & Periodicals** **1.**
4.	**Other Electronic Resources** **1.**

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Use** advanced technology in Java such as Internationalization, and Remote method Invocation.
2.	**Learn** how to work with JavaBeans.
3.	**Develop** web applications using Java Servlet and Java Server Pages technology.
4.	**Apply** event handling on AWT and Swing components.
5.	Will also be exposed to advanced topics including Multithreading, internet networking, and JDBC database connectivity.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	1	2	2	0	1	0	0	2	3
CO2	2	1	2	1	2	2	0	1	0	0	2	3
CO3	2	1	2	1	2	2	0	1	2	0	3	3
CO4	2	1	2	1	2	2	0	1	2	0	3	3
CO5	2	1	2	1	2	2	0	1	2	0	2	3

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	3	3
CO2	1	3	3
CO3	1	3	3
CO4	1	3	3
CO5	1	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS604	Course Name Deep Learning	Semester VI

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Fundamentals of AI & ML
Course Category	Professional core courses
Course focus	Skill development
Rationale	The Deep Learning subject holds local, national, and international relevance due to its profound impact on various domains and industries. Locally, it enables individuals to acquire cutting-edge skills in artificial intelligence, paving the way for local innovation and research. Nationally, it contributes to the development of advanced technology ecosystems, attracting investments and fostering economic growth. Internationally, proficiency in Deep Learning establishes a country's position in the global AI landscape, facilitating collaborations, and ensuring competitiveness. The subject's relevance lies in its ability to revolutionize fields such as healthcare, finance, transportation, and more, empowering individuals, nations, and industries to leverage the transformative potential of Deep Learning for societal and economic progress.
Course Revision / Approval Date	24/1/2022

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To aware students about various types of signals and its processing. **2.** To give a brief overview of signal conditioning. **3.** To make students understand about the processing of digital signals. **4.** To provide a knowledge of digital signal transmission. **5.** To give fundamental knowledge about protocol conversion.

Course Content (Theory)	Weightage	Contact Hours
Unit 1: Types of Signals Signals, systems and signal processing, classification of signals, elements of digital signal processing system, concept of frequency in continuous and discrete time signals, Periodic Sampling, Frequency domain representation of sampling, Reconstructions of band limited signals from its samples.	**20%**	**09**
Unit 2: Signal Massaging with hardware Analog Signals & Digital Signals, Signal Conditioning, Chopping, Attenuation, Filters, types of Filters, Active Filters & Passive Filters, Amplitude Buffering, Software Filters, Noise & Noise filtering.	**20%**	**09**
Unit 3: Digital Signal Processing Z - transform & Inverse Z - transform, Linear convolution and its properties, Linear Constant Coefficient Difference equations, Frequency domain representation of Discrete - Time Signals & Systems,Fourier Transform, (DTFT), Properties of discrete time Fourier Transform, and correlation of signals, Fourier Transform Theorems. Architecture of DSP Processors & applications.	**20%**	**09**

Unit 4: Digital Signal Transmission Components of digital communication system, line coding, pulse shaping, Scrambling, Regenerative Repeater, Eye Diagram, Timing Extraction, Detection Error Probability, M- ary communication, Digital Carrier Systems, Modulation techniques for ASK, QASK, FSK, M-ary FSK, BPSK, DPSK,DEPSK, QPSK, M-ary PSK, QAM, MSK, GMSK	**20%**	**09**
Unit 5: Protocol Conversion TCP/IP (Transmission Control Protocol / Internet Protocol) MQTT (Message Queuing Telemetry Transport) , UDP (User Datagram Protocol), MQTT brokers, publish subscribe modes, HTTP (Hypertext Transfer Protocol), CoAP (Constrained Application Protocol),XMPP (Extensible Messaging and Presence Protocol) and gateway protocols	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: **1.** Classification of Signals: Implementing a classification of signals based on time domain, frequency domain, and energy content. **2.** Elements of Digital Signal Processing System: Implementing a digital signal processing system with elements like ADC, DAC, filters, and signal processors.		
Practical 2: **1.** Analog Signals & Digital Signals: Implementing a simple signal generator to generate analog and digital signals, and comparing their properties. **2.** Signal Conditioning: Implementing signal conditioning techniques like amplification, attenuation, and filtering to preprocess analog signals.		

Practical 3: 1. Z -transform & Inverse Z - transform: Implementing the Z - transform and inverse Z - transform to analyze and synthesize discrete - time signals and systems. 2. Linear Convolution and its Properties: Implementing linear convolution to process discrete-time signals and analyzing its properties like commutativity, associativity, and distributivity.		
Practical 4: 1. Implementing digital carrier systems like ASK, QASK, FSK, BPSK, DPSK, DEPSK, QPSK, MSK, GMSK, and analyzing their performance under different channel conditions.		
Practical 5: 1. TCP/IP (Transmission Control Protocol / Internet Protocol): Implementing a simple client-server communication using TCP/IP and analyzing its performance under different network conditions. 2. MQTT (Message Queuing Telemetry Transport): Implementing MQTT protocol and analyzing its usage for IoT applications.		

Instructional Method and Pedagogy

Lecture-based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	To aware students about various types of signals and its processing.	Cognitive	Understand
CO2	To give a brief overview of signal conditioning.	Cognitive	Analyse
CO3	To make students understand about the processing of digital signals.	Cognitive	Apply

CO4	To provide a knowledge of digital signal transmission.	Cognitive	Apply
CO5	To give fundamental knowledge about protocol conversion.	Cognitive	Create

Learning Resources	
1.	**Textbook** **1.**
2.	**Reference Books:** **1.** Tom M Mitchell, “Machine Learning”, McGraw Hill ,Peter Harrington, “Machine Learning in Action”, DreamTech. **2.** Deep Learning, An MIT Press book, Ian Goodfellow and YoshuaBengio and Aaron Courville. **3.** Shaishalev-shwartz, Shai Ben-David: Understanding Machine Learning from Theory to Algorithms, Cambridge University Press, ISBN-978-1-107- 51282-5, 2014.
3.	**Journals & Periodicals** **1.**
4.	**Other Electronic Resources** **1.**

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	To aware students about various types of signals and its processing.
2.	To give a brief overview of signal conditioning.
3.	To make students understand about the processing of digital signals.
4.	To provide a knowledge of digital signal transmission.
5.	To give fundamental knowledge about protocol conversion.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	0	0	1	0	0	0	0	0	0	0
CO2	1	2	2	1	1	1	0	0	1	0	0	0
CO3	1	1	1	0	0	0	0	1	0	0	0	0
CO4	0	0	1	0	1	0	1	0	0	0	0	1
CO5	1	1	1	0	0	0	1	1	1	1	1	0

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	0	1	2
CO2	0	1	2
CO3	1	1	1
CO4	1	1	2
CO5	0	1	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS605	Course Name IoT Network, Signal & Signal Processing	Semester VI

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Fundamentals of IoT
Course Category	Professional core courses
Course focus	Skill development
Rationale	The IoT Network, Signal & Signal Processing subject holds local, national, and international relevance due to its critical role in the rapidly expanding field of Internet of Things (IoT). Locally, it equips individuals with specialized knowledge in IoT network architecture, signal transmission, and processing, enabling local industries to leverage IoT technologies for smart infrastructure, healthcare, agriculture, and more. Nationally, expertise in this subject contributes to the development of national IoT frameworks, fostering innovation and driving economic growth. Internationally, proficiency in IoT network, signal, and signal processing facilitates global collaborations and ensures competitiveness in the interconnected world. The subject's relevance lies in its ability to harness IoT's transformative potential, creating opportunities for individuals, communities, and nations to thrive in the digital age.
Course Revision / Approval Date	24/1/2022

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To aware students about various types of signals and its processing. **2.** To give a brief overview of signal conditioning. **3.** To make students understand about the processing of digital signals. **4.** To provide a knowledge of digital signal transmission. **5.** To give fundamental knowledge about protocol conversion.

Course Content	Weightage	Contact Hours
Unit 1: Types of Signals Signals, systems and signal processing, classification of signals, elements of digital signal processing system, concept of frequency in continuous and discrete time signals, Periodic Sampling, Frequency domain representation of sampling, Reconstructions of band limited signals from its samples.	**20%**	**09**
Unit 2: Signal Massaging with hardware Analog Signals & Digital Signals, Signal Conditioning, Chopping, Attenuation, Filters, types of Filters, Active Filters & Passive Filters, Amplitude Buffering, Software Filters, Noise & Noise filtering.	**20%**	**09**
Unit 3: Digital Signal Processing Z - transform & Inverse Z - transform, Linear convolution and its properties, Linear Constant Coefficient Difference equations, Frequency domain representation of Discrete- Time Signals & Systems,Fourier Transform, (DTFT), Properties of discrete time Fourier Transform, and correlation of signals, Fourier Transform Theorems. Architecture of DSP Processors & applications.	**20%**	**09**

Unit 4: Digital Signal Transmission Components of digital communication system, line coding, pulse shaping, Scrambling, Regenerative Repeater, Eye Diagram, Timing Extraction, Detection Error Probability, M- ary communication, Digital Carrier Systems, Modulation techniques for ASK, QASK, FSK, M-ary FSK, BPSK, DPSK, DEPSK, QPSK, M-ary PSK, QAM, MSK, GMSK.	**20%**	**09**
Unit 5: Protocol Conversion TCP/IP (Transmission Control Protocol / Internet Protocol) MQTT (Message Queuing Telemetry Transport) , UDP (User Datagram Protocol), MQTT brokers, publish subscribe modes, HTTP (Hypertext Transfer Protocol), CoAP (Constrained Application Protocol),XMPP (Extensible Messaging and Presence Protocol) and gateway protocols.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: **A.** Classification of Signals: Implementing a classification of signals based on time domain, frequency domain, and energy content. **B.** Elements of Digital Signal Processing System: Implementing a digital signal processing system with elements like ADC, DAC, filters, and signal processors.		
Practical 2: **A.** Analog Signals & Digital Signals: Implementing a simple signal generator to generate analog and digital signals, and comparing their properties. **B.** Signal Conditioning: Implementing signal conditioning techniques like amplification, attenuation, and filtering to preprocess analog signals.		

Practical 3: **A.** Z - transform & Inverse Z - transform: Implementing the Z - transform and inverse Z - transform to analyze and synthesize discrete-time signals and systems. **B.** Linear Convolution and its Properties: Implementing linear convolution to process discrete-time signals and analyzing its properties like commutativity, associativity, and distributivity.		
Practical 4: Implementing digital carrier systems like ASK, QASK, FSK, BPSK, DPSK, DEPSK, QPSK, MSK, GMSK, and analyzing their performance under different channel conditions.		
Practical 5: A. TCP/IP (Transmission Control Protocol / Internet Protocol): Implementing a simple client-server communication using TCP/IP and analyzing its performance under different network conditions. B. MQTT (Message Queuing Telemetry Transport): Implementing MQTT protocol and analyzing its usage for IoT applications.		

Instructional Method and Pedagogy

Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**To aware** students about various types of signals and its processing.	Cognitive	Understand
CO2	**To give** a brief overview of signal conditioning.	Cognitive	Analyse
CO3	**To make** student understand about the processing of digital signal	Cognitive	Apply
CO4	**To provide** a knowledge of digital signal transmission.	Cognitive	Apply
CO5	**To give** fundamental knowledge about protocol conversion.	Cognitive	Create

Learning Resources	
1.	**Textbook** **1.**
2.	**Reference Books:** **1.** Signal and Systems By Anand Kumar, 3rd Edition, PHI **2.** Linear Systems and Signals by B.P.Lathi, Oxford University Press **3.** Signals and Systems by Michal J. Roberts and Govind Sharma, Tata Mc-Graw Hill Publications
3.	**Journals & Periodicals** **1.**
4.	**Other Electronic Resources** **1.**

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**To aware** students about various types of signals and its processing.
2.	**To give** a brief overview of signal conditioning.
3.	**To make** student understand about the processing of digital signal
4.	**To provide** a knowledge of digital signal transmission.
5.	**To give** fundamental knowledge about protocol conversion.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	0	0	0	0	0	0	0	0	0	0	0
CO2	3	3	2	3	0	0	0	0	0	0	0	0
CO3	3	3	3	3	3	0	0	2	0	0	1	0
CO4	3	3	3	3	0	0	0	0	0	0	0	0
CO5	3	0	3	3	2	0	0	0	1	0	0	0

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	2	3	0
CO2	3	2	2
CO3	3	2	3
CO4	3	2	3
CO5	3	2	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS606	Course Name Big Data Architecture & Programming	Semester VI

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Data Structure
Course Category	Professional core courses
Course focus	Skill development
Rationale	The Big Data Architecture and Programming subject holds local, national, and international relevance due to the increasing importance of big data in various sectors. Locally, it equips individuals with the skills to design and implement scalable big data architectures, enabling local businesses and organizations to harness the power of data for informed decision - making. Nationally, expertise in this subject contributes to the development of national data strategies, fostering innovation and driving economic growth through data-driven insights. Internationally, proficiency in big data architecture and programming facilitates collaboration and ensures competitiveness in the global data - driven economy. The subject's relevance lies in its ability to unlock the value of big data, empowering individuals, communities, and nations to navigate the challenges and opportunities of the digital era.
Course Revision / Approval Date	19/8/2019

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To understand the need of Big Data, challenges and different analytical architectures. **2.** Installation and understanding of Hadoop Architecture and its ecosystems. **3.** Processing of Big Data with Advanced architectures like Spark. **4.** Describe graphs and streaming data in Spark. **5.** To realistically assess the application of big data technologies for different usage scenarios.

Course Content	Weightage	Contact Hours
Unit 1: Introduction Concept and importance of big data, key trends, unstructured data, and industry applications in marketing, healthcare, finance, and fraud detection. Introduces big data technologies like Hadoop, open-source tools, cloud, mobile BI, crowdsourcing, and security analytics.	**20%**	**09**
Unit 2: NoSQL Introduces NoSQL databases, data models (key-value, document, graph), and concepts like schemaless design, sharding, and replication. Covers consistency models, MapReduce framework, and distributed data processing techniques.	**20%**	**09**
Unit 3: Hadoop Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop, pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java, interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures	**20%**	**09**

Unit 4: Mapreduce Map Reduce workflows, unit tests with MR Unit, test data and local tests, anatomy of Map Reduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats	**20%**	**09**
Unit 5: Advanced Big Data Tools Covers tools like HBase and Cassandra with their data models, clients, and Hadoop integration. Introduces Pig and Pig Latin scripting, and Hive with its data types, file formats, and HiveQL for data querying and manipulation.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: **A.** Case Study on Big Data and its. **B.** Applications in following sectors. **C.** Banking and Security. **D.** Healthcare. **E.** Finance and trading.	**20%**	**03**
Practical 2: **A.** Installation of MongoDB. **B.** Implement CRUD operations on MONGODB. **C.** Implementing Advance CRUD. **D.** Operations on MONGO-DB.	**20%**	**03**
Practical 3: **A.** Install Hadoop. **B.** Implement Hadoop commands.	**20%**	**03**
Practical 4: **A.** Implement Hadoop and mapreduce commands. **B.** Implement basic commands of Apache Cassandra with Python. **C.** Implement simple queries of data management using Apache Kafka.	**20%**	**03**

Practical 5:		
A. Implement Word count program With Hadoop. **B.** Extract, Transform, and Load Hive Data in Python. **C.** Implement User Defined functions in Pig with Python.	**20%**	**03**

Instructional Method and Pedagogy

Computer based learning, Chalk – Talk, Presentation

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Explain** the motivation for big data systems and identify the main sources of Big Data in the real world.	Cognitive	Understand
CO2	**Demonstrate** an ability to use frameworks like Hadoop, NOSQL to efficiently store, retrieve and process Big Data for Analytics.	Cognitive	Analyse
CO3	**Implement** several Data Intensive tasks using the Map Reduce Paradigm.	Cognitive	Apply
CO4	**Apply** several newer algorithms for Clustering Classifying and finding associations in Big Data.	Cognitive	Apply
CO5	**Design** algorithms to analyze Big data like streams, Web Graphs and Social Media data.	Cognitive	Create

Learning Resources	
1.	**Textbook** 1. **Tom White**, *Hadoop: The Definitive Guide*, O'Reilly Media, 4th Edition, 2015. 2. **Viktor Mayer-Schönberger and Kenneth Cukier**, *Big Data: A Revolution That Will Transform How We Live, Work, and Think*, Eamon Dolan/Houghton Mifflin Harcourt, 2013.
2.	**Reference Books:** 1. 2.Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc-Graw Hill- 2008.

	2. Dan W. Patterson, “Introduction to AI and ES”, Pearson Education, 2007
3.	**Journals & Periodicals** 1. IEEE Transactions on Big Data 2. Big Data Research (Elsevier) 3. Journal of Big Data (Springer)
4.	**Other Electronic Resources** **1. Coursera/edX/NPTEL** courses on Big Data Architecture **2. Apache Hadoop, Spark** official documentation **3. Google Cloud Big Data** whitepapers

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Explain** the motivation for big data systems and identify the main sources of Big Data in the real world.
2.	**Demonstrate** an ability to use frameworks like Hadoop, NOSQL to efficiently store, retrieve and process Big Data for Analytics.
3.	**Implement** several Data Intensive tasks using the Map Reduce Paradigm.
4.	**Apply** several newer algorithms for Clustering Classifying and finding associations in Big Data.
5.	**Design** algorithms to analyze Big data like streams, Web Graphs and Social Media data.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	0	0	0	0	0	0	0	0	0	0	0
CO2	3	3	2	3	0	0	0	0	0	0	0	0
CO3	3	3	3	3	3	0	0	2	0	0	1	0
CO4	3	3	3	3	0	0	0	0	0	0	0	0
CO5	3	0	3	3	2	0	0	0	1	0	0	0

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	2	3	0
CO2	3	2	2
CO3	3	2	3
CO4	3	2	3
CO5	3	2	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS607	Course Name Data Analytics For IOT	Semester VI

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Big data Frameworks, Internet of Things (IoT) Architecture
Course Category	Professional core courses
Course focus	The Big Data Architecture and Programming subject holds local, national, and international relevance due to the increasing importance of big data in various sectors. Locally, it equips individuals with the skills to design and implement scalable big data architectures, enabling local businesses and organizations to harness the power of data for informed decision-making. Nationally, expertise in this subject contributes to the development of national data strategies, fostering innovation and driving economic growth through data-driven insights. Internationally, proficiency in big data architecture and programming facilitates collaboration and ensures competitiveness in the global data-driven economy. The subject's relevance lies in its ability to unlock the value of big data, empowering individuals, communities, and nations to navigate the challenges and opportunities of the digital era.
Rationale	24/1/2022
Course Revision / Approval Date	

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To learn the concepts of big data analytics. **2.** To learn the concepts about the Internet of things. **3.** To understand and implement smart systems. **4.** To understand processing of IOT generated Big Data **5.** To understand different platforms of Big Data Analysis for IOT.

Course Content	Weightage	Contact Hours
Unit 1: Big Data Platforms For The Internet of Things Big Data Platforms for the Internet of Things: network protocol-data dissemination – current state of art- Improving Data and Service Interoperability with Structure, Compliance,Conformance and Context Awareness: interoperability problem in the IoT context- Big Data Management Systems for the Exploitation of Pervasive Environments - Big Data challenges and requirements coming from different Smart City applications.	**20%**	**09**
Unit 2:RFID False Authentications On RFID False Authentications: YA TRAP – Necessary and sufficient condition for false authentication prevention - Adaptive Pipelined Neural Network Structure in Self Aware Internet of Things: self-healing systems- Role of adaptive neural network-Spatial Dimensions of Big Data: Application of Geographical Concepts and Spatial Technology to the Internet of Things- Applying spatial relationships, functions,and models.	**20%**	**09**
Unit 3: FOG Computing Fog Computing: A Platform for Internet of Things and Analytics: a massively distributed number of sources - Big Data Metadata Management in Smart Grids: semantic inconsistencies – role of metadata	**20%**	**09**

Unit 4: Web Enhanced Building Toward Web Enhanced Building Automation Systems: heterogeneity between existing installations and native IP devices - loosely-coupled Web protocol stack –energy saving in smart building- Intelligent Transportation Systems and Wireless Access in Vehicular Environment Technology for Developing Smart Cities: advantages and achievements- Emerging Technologies in Health Information Systems: Genomics Driven Wellness Tracking and Management System (GO-WELL) – predictive care –personalized medicine	**20%**	**09**
Unit 5: Sustainability Data And Analytics Sustainability Data and Analytics in Cloud - Based M2M Systems – potential stakeholders and their complex relationships to data and analytics applications – Social Networking Analysis - Building a useful understanding of a social network - Leveraging Social Media and IoT to Bootstrap Smart Environments : lightweight Cyber Physical Social Systems - citizen actuation	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: **1.** Case Study on different Big Data Platforms and Mapping them IoT based applications. **2.** Develop an IoT application to collect, Analyze and store the data on any of the big data platforms.	**20%**	**03**
Practical 2: **1.** Develop an IoT application based on geographical concepts. **2.** Develop an IoT application based on geographical concept and embed the spatial.	**20%**	**03**
Practical 3: Case study on Fog Computing: Healthcare Applications Energy meter, Measurement of Continuity of any wire / fuse.	**20%**	**03**

Practical 4: 1. Case Study on building Intelligent Transportation Systems & Wireless Access in Vehicular Environment Technology. 2. Develop an IoT application for smart city.	**20%**	**03**
Practical 5: Perform the analytics on the dataset of Social Networking.	**20%**	**03**

Instructional Method and Pedagogy Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Exploring** several Big Data platforms for IoT.	Cognitive	Understand
CO2	**Examine** self - healing systems and the role of neural networks.	Cognitive	Analyse
CO3	**Developing** Big Data metadata management.	Cognitive	Understand
CO4	**Evaluating** Wireless Access in Vehicular Environment Technology.	Cognitive	Apply
CO5	**Understand** sustainability of cloud data.	Cognitive	Create

Learning Resources	
1.	**Textbook** **1.**
2.	**Reference Books:** **1.** Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc-Graw Hill- 2008. **2.** Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007

3.	**Journals & Periodicals** **1.**
4.	**Other Electronic Resources** **1.**

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Exploring** several Big Data platforms for IoT.
2.	**Examine** self - healing systems and the role of neural networks.
3.	**Developing** Big Data metadata management.
4.	**Evaluating** Wireless Access in Vehicular Environment Technology.
5.	**Understand** sustainability of cloud data.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	0	0	0	0	0	0	0	1
CO2	0	2	2	1	1	0	0	0	0	0	0	1
CO3	1	1	1	1	1	0	1	0	2	1	1	0
CO4	1	1	1	1	0	0	0	0	1	0	1	1
CO5	2	2	2	2	2	2	1	0	0	0	0	0

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	0	1	0
CO2	1	1	1
CO3	1	0	1
CO4	2	2	2
CO5	1	1	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS608	Course Name Platform & Application Security Principles	Semester VI

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	45	3	2	0	4

Course Prerequisites	Basic knowledge of operating systems (Windows/Linux), web technologies, programming fundamentals, and introductory cybersecurity concepts.
Course Category	Professional Courses
Course focus	Employability
Rationale	This syllabus is designed to address modern cybersecurity challenges by first establishing foundational knowledge of operating system security (Linux/Windows hardening, access controls) before progressing to secure system design (DevSecOps, SAST/DAST tools) and web application vulnerabilities (XSS, SQLi, CSRF), ensuring a balance between theoretical principles (OWASP guidelines, secure coding) and practical skills (static/dynamic analysis, threat mitigation) to align with industry demands and compliance standards like NIST, while preparing students to defend against real-world threats across platforms and applications.
Course Revision / Approval Date	

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Describe web -based applications and associated threats and differentiate from mainframe, client server, applications. **2.** Understand secure system design Develop and implement. **3.** Minimizing risks by combining application security testing tools. **4.** Identify the vulnerabilities in the web applications. **5.** Deploy and understand system security principal.

Course Content	Weightage	Contact Hours
Unit 1: Introduction Types of Applications, Platform (Windows, Linux) security principles, Security requirements, Linux Security Model, Linux File - System Security, Linux Vulnerabilities, Linux System Hardening, Application Security, Mandatory Access Controls, Application security Operations	**10%**	**09**
Unit 2: Secure System Design Devsecops Security design principle: OWASP Introduction, DevSecOps concepts, DevSecCops Life Cycle, DevSecCops tools and Activities, Dod Enterprise DevSecops Container Service, Containerized Software Factory	**25%**	**09**
Unit 3: Static and Dynamic Code Analysis,Introduction, static and dynamic code analysis tools, Injection (SQL, LDAP, etc Cross - Site Scripting Buffer Overflows, Applying SAST to Improve Application Security Software Composition Analysis: Identify Risk in Open Source Components.	**25%**	**09**
Unit 4: Web Application Security Overview of Web Application security, Security Fundamentals: Input Validation - Attack Surface Reduction Rules of Thumb - Classifying and Prioritizing Threads, Web Application Vulnerabilities, Origin Policy - Exceptions to the Same-Origin Policy - Cross-Site Scripting and Cross-Site Request Forgery - Reflected XSS - HTML Injection	**20%**	**09**
Unit 5: System Security Desktop Security,programming bugs and Malicious code, Database security, Validating security, Secure Coding Principles.	**20%**	**09**

Instructional Method and Pedagogy

Chalk - Duster, Notes

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	1. Explore your end-to-end perimeter security configuration based on your security posture	Cognitive Domain	Understanding
CO2	2. Secure your applications with Devescops		Applying
CO3	3. Understand SAST and DAST to improve application security		Understanding
CO4	4. Understand various Application and Network Security Principles of the web.		Applying
CO5	5. Understand Web application security to secure the web applications.		Understanding

Learning Resources	
1.	**Textbook** 1. BhavaniThuraisingham, "Database and Applications Security", Integrating Information Security and Data Management, Auerbach Publications, 2005.
2.	**Reference Books:** 1. Computer and Cyber Security Principles, Algorithms, Applications, and Perspectives By Brij B. Gupta. 2. Michael Gertz and SushilJajodia, "Handbook of Database Security—Applications andTrends", Springer, 2008. 3. Asoke K. Talukder, Manish Chaitanya, Architecting Secure Software Systems, ISBN 9781420087840, 2008 4. Sullivan, Bryan, and Vincent Liu. Web Application Security, A. 5. Beginner's Guide. McGraw Hill Professional, 2011.
3.	**Journals & Periodicals** 1. IEEE Security & Privacy 2. ACM Transactions on Privacy and Security (TOPS) 3. USENIX Security Symposium Proceedings

4.	**Other Electronic Resources** 1. http://www.us-cert.gov/cas/tips/ST06- 003.html 2. https://amrita.edu/course/database-and-web-application-security/ 3. http://www.apus.edu

<table>
<tr><th colspan="2">Evaluation Scheme</th><th>Total Marks
150</th></tr>
<tr><td>Mid semester Marks</td><td colspan="2">20</td></tr>
<tr><td>End Semester Marks</td><td colspan="2">40</td></tr>
<tr><td rowspan="5">Practical Marks</td><td>Attendance</td><td>5 marks</td></tr>
<tr><td>Practical Exam</td><td>20 marks</td></tr>
<tr><td>Viva</td><td>10 marks</td></tr>
<tr><td>Journal</td><td>10 marks</td></tr>
<tr><td>Discipline</td><td>5 marks</td></tr>
<tr><td rowspan="4">Continuous Evaluation Marks</td><td>Attendance</td><td>5 marks</td></tr>
<tr><td>MCQs</td><td>10 marks</td></tr>
<tr><td>Open Book Assignment</td><td>15 marks</td></tr>
<tr><td>Article Review</td><td>10 marks</td></tr>
</table>

Sr. No.	Course Outcomes
1.	
2.	
3.	
4.	
5.	

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	0	0	0	1	0	0	0	2	0	1
CO2	2	1	1	1	2	1	0	1	1	1	2	1
CO3	2	2	2	1	2	1	1	0	2	1	0	1
CO4	2	2	1	2	1	1	0	1	0	2	2	1
CO5	2	2	3	2	2	1	2	1	2	1	2	1

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	0	2	1
CO3	1	2	2
CO4	0	1	1
CO5	1	2	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS609	Course Name Wireless And Mobile Device Security Principles	Semester VI

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	
Course Category	Professional core courses
Course focus	Skill development
Rationale	The rationale for teaching and understanding Wireless and Mobile Device Security Principles is driven by the rapid proliferation of wireless and mobile technologies in our daily lives and the increasing reliance on these devices for critical tasks, such as communication, financial transactions, and access to sensitive information.
Course Revision / Approval Date	4/3/2024
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Comprehend the fundamental concepts of mobile and wireless network security. **2.** Identify security threats in wireless networks and design strategies to manage network security. **3.** Design secured network application considering all possible threats.

Course Content	Weightage	Contact Hours
Unit 1: Security Issues in Mobile Communication Introduction to Mobile Communication: Importance of Security in Wireless and Mobile Communication Systems, Security Measures for Mobile Applications: Advantages and Disadvantages of Application-level Security. Common Threats and Vulnerabilities in Mobile Devices, Best Practices for Securing Mobile Devices.	**20%**	**09**
Unit 2: Security at Network and Server Security at Network and Server Levels Security Measures for Mobile Wireless Networks: Techniques for Securing Servers in Mobile Communication Systems, Best Practices for Securing Server Infrastructure Attack Methods over WLANs and Countermeasures, Analysis of recent security trends & emerging technologies in mobile communication security.	**20%**	**09**
Unit 3:Mobile Application Security Introduction to Mobile Application Security: Common Attack Vectors and Vulnerabilities Secure Software Development Lifecycle (SDLC) for Mobile Applications: Understanding the Software Development Lifecycle (SDLC) for Mobile Applications, Integration of Security Practices into the SDLC, Authentication Mechanisms: Single Sign - On (SSO) Solutions for Mobile Applications.	**20%**	**09**
Unit 4: Data Security in Mobile Applications Data Storage Security: Encryption, Secure Key Management, Secure Transmission: Transport Layer Security (TLS), Secure Socket Layer (SSL), Implementing Secure Communication Protocols: HTTPS, RESTful APIs, Mitigating Man - in - the - Middle (MitM) Attacks,	**20%**	**09**
Unit 5: Secure Mobile Code Execution Secure Code Execution Environment: Sandboxing, Mobile Device Management (MDM). Mobile Platform Security: Understanding Platform - specific Security Mechanisms (iOS, Android), Jailbreaking and Rooting Risks, Mobile Application Permissions and Privacy Controls.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: **A.** Configure Wi-Fi and Bluetooth settings securely on a mobile device. **B.** Implement screen lock methods (password, PIN, biometrics) and explore their effectiveness.		
Practical 2: **A.** Implement two - factor authentication (2FA) for device login or account access. **B.** Test the effectiveness of different authentication methods. **C.** Implement password policies (complexity, expiration) on mobile devices.		
Practical 3: Measurement of AC Voltage at 230 V AC Mains plug, Measurement of DC Voltage for cell phone battery of 3.8 V DC, Measurement of Resistance of Current coil & Potential coil of Energy meter, Measurement of Continuity of any wire / fuse.		
Practical 4: **A.** Analyze and compare the security features of different mobile applications. **B.** Perform a security review of a mobile app to identify vulnerabilities.		
Practical 5: **A.** Explore Bluetooth pairing methods and their security implications. **B.** Investigate Bluetooth vulnerabilities and attacks (e.g., BlueBorne) and ways to mitigate them.		

Instructional Method and Pedagogy
Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Comprehend** the fundamental concepts of mobile and wireless network security.	Cognitive	Understand
CO2	**Identify** security threats in wireless networks and design strategies to manage network security.	Cognitive	Understand
CO3	**Design** secured network application considering all possible threats.	Cognitive	Apply

Learning Resources	
1.	**Textbook** 1.
2.	**Reference Books:** 1. Randall k. Nichols, Panos C. Lekkas : "Wireless Security Models, Threats and Solutions", 1st Edition, Tata McGraw Hill, 2006. 2. Bruce Potter and Bob Fleck : "802.11 Security" , 1st Edition, SPD O'REILLY 2005. 3. James Kempf: "Guide to Wireless Network Security, Springer. Wireless Internet Security– Architecture and Protocols", 1st Edition, Cambridge University Press, 2008.
3.	**Journals & Periodicals** 1.
4.	**Other Electronic Resources** 1.

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Comprehend** the fundamental concepts of mobile and wireless network security.
2.	**Identify** security threats in wireless networks and design strategies to manage network security.
3.	**Design** secured network application considering all possible threats.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	0	0	0	0	1	0	0	0	2	0	1
CO2	2	2	1	2	1	2	1	2	1	2	2	1
CO3	2	2	2	3	2	2	2	2	1	2	2	1

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	2	1
CO2	0	2	2
CO3	0	2	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Teaching Scheme

Semester – VII B.Tech Computer Science & Engineering

Sr. No.	Course Code	Course Name	Teaching Scheme (Hours / week)				Teaching Credit			
			L	P	T	Total	L	P	T	Total
1.	BTCS701	Professional Elective – II	3	2	0	5	3	1	0	4
2.	BTCS702	Mobile Application Development	2	4	0	6	2	2	0	4
3.	BTCS703	Specialized Track Elective - I - Natural Language Processing	3	2	0	5	3	1	0	4
	BTCS704	Specialized Track Elective - II - Fundamentals of Robotics & Automation								
	BTCS707	Specialized Track Elective III - Vulnerability & Risk Management								
4.	BTCS705	Specialized Track Elective - I Machine Learning for Intelligent Systems	3	2	0	5	3	1	0	4
	BTCS706	Specialized Track Elective - II - Industry 4.0 and Application Areas								
	BTCS708	Specialized Track Elective - III - Digital forensic, investigation and response								
5.	BTCS709	Minor Project - II	0	6	0	6	0	3	0	3
6.	BTCS710	Industrial Internship	0	0	0	0	0	2	0	2
Total			**11**	**16**	**0**	**27**	**11**	**10**	**0**	**21**

Note

L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

Sr. No.	Course Code	Course Name	Teaching Scheme (Hours / week) Teaching Credit					
			Theory MS Marks	Theory CEC Marks	Theory ES Marks	Theory Marks	Practical Marks	Total Marks
1.	BTCS701	Professional Elective – II	20	40	40	100	50	150
2.	BTCS702	Mobile Application Development	20	40	40	100	50	150
3.	BTCS703	Specialized Track Elective - I - Natural Language Processing	20	40	40	100	50	150
	BTCS704	Specialized Track Elective - II - Fundamentals of Robotics & Automation						
	BTCS707	Specialized Track Elective III - Vulnerability & Risk Management						
4.	BTCS705	Specialized Track Elective - I Machine Learning for Intelligent Systems	20	40	40	100	50	150
	BTCS706	Specialized Track Elective - II - Industry 4.0 and Application Areas						

	BTCS708	Specialized Track Elective - III - Digital forensic, investigation and response						
5.	BTCS709	Minor Project - II	0	0	0	0	100	100
6.	BTCS710	Industrial Internship	0	0	0	0	100	100
Total			**80**	**160**	**160**	**400**	**400**	**800**

Note

L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

BTCS701A	Service Oriented Architecture
BTCS701B	Compiler Construction
BTCS701C	Distributed Computing Systems
BTCS701D	Soft Computing
BTCS701E	Computer vision
BTCS701F	Cloud Computing
BTCS701G	Generative AI

Course Code BTCS701A	Course Name Service Oriented Architecture	Semester VII

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	2	0	4

Course Prerequisites	The ability to have different versions of a service running simultaneously on the network.
Course Category	Professional Elective courses.
Course focus	Employability
Rationale	Service-Oriented Architecture (SOA) promotes modularity, reusability, and flexibility in software development by breaking applications into smaller, loosely-coupled services. This approach improves interoperability, scalability, and fault tolerance while reducing development time and costs. SOA enables organizations to build agile, scalable, and adaptable software solutions aligned with business needs.
Course Revision / Approval Date	24/1/2022
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To formulate the foundational concepts of services, to evaluate existing approaches of service. **2.** Understand existing techniques from other areas that can be adopted for services. **3.** Discuss Emerging techniques for addressing challenges that are unique to services. **4.** Understand study about different services and architecture. **5.** Discuss the basic concepts, theories & techniques for service-oriented computing, standards related to Web services, approaches.

Course Content	Weightage	Contact Hours
Unit 1: Service oriented enterprise Service oriented enterprise – service oriented architecture (SOA) – SOA and web services – multi- channel access – business process management – extended web services specifications – overview of SOA – concepts – key service characteristics – technical benefits – business benefits	**20%**	**09**
Unit 2: Web services Soa and web services – web services platform – service contracts – service level data model – service discovery – service-level security – service-level interaction patterns – atomic services and composite services – proxies and skeletons – communication , integration	**20%**	**09**
Unit 3: Web services in SOA Overview - xml & web services - .NET & J2EE interoperability - service - enabling legacy systems - enterprise service bus pattern.	**20%**	**09**
Unit 4: Process management Multi - channel access – business benefits – SOA for multichannel access – tiers – business process management – concepts – bpm, SOA & web services – ws BPEL – web services composition.	**20%**	**09**
Unit 5: Java web services Java web services – JAX APIs – JAXP – JAX - RPC – JAXM – JAXR – JAXB module5: metadata management – web services security – advanced messaging – transaction management.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: Study different architecture and the technique of the services.	**10%**	**02**
Practical 2: To configure the Emerging techniques for addressing challenges that are unique to services.	**10%**	**02**
Practical 3: To discuss the basic concepts, and techniques for service - oriented computing, standards related to Web services, with the help of models.	**10%**	**02**
Practical 4: Formulate the foundational concepts of services, to evaluate existing approaches of service.	**10%**	**02**
Practical 5: To develop student detail using .Net ,Create addition web service in ASP.Net invoke it in using C#.	**10%**	**02**
Practical 6: Construct the inter-programming interfaces of J2EE for building such systems.	**10%**	**02**
Practical 7: Integrating mobile devices into an SOA presents Connected Computing for multiple channel access.	**10%**	**02**
Practical 8: Study JAXP (Java API for XML Processing) with example.	**5%**	**02**
Practical 9: Configure the running samples using the java API.	**10%**	**02**

Practical 10: Study and analyze the Services Security.	**05%**	**02**

Instructional Method and Pedagogy Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Able to design**, develop and test Web services.	Cognitive	Apply
CO2	**Understand** & Learn standards related to Web services: Web Services Description Language (WSDL), Simple Object Access Protocol (SOAP), and Universal Description, Discovery and Integration (UDDI).	Cognitive	Understand
CO3	**Develop** and Conceptually model Web services and formulate specifications of them in the Resource Description Framework (RDF) and the Web Ontology Language (OWL).	Cognitive	Apply
CO4	**Analyze** approaches to compose services.	Cognitive	Analyze
CO5	**Evaluate** emerging and proposed standards for the main components of Web services architectures.	Cognitive	Evaluate

Learning Resources	
1.	**Textbook** **1.**
2.	**Reference Books:** **1.** Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services",Pearson Education, 2005. **2.** James McGovern, Sameer Tyagi, Michael E Stevens, Sunil Mathew, "Java Web Services Architecture", Elsevier, 2003. **3.** Thomas Erl, "Service Oriented Architecture", Pearson Education, 2005.

3.	**Journals & Periodicals** **1.**
4.	**Other Electronic Resources** **1.**

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	**Course Outcomes**
1.	**Able to design**, develop and test Web services.
2.	**Understand** & Learn standards related to Web services: Web Services Description Language (WSDL), Simple Object Access Protocol (SOAP), and Universal Description, Discovery and Integration (UDDI).
3.	**Develop** and Conceptually model Web services and formulate specifications of them in the Resource Description Framework (RDF) and the Web Ontology Language (OWL).
4.	**Analyze** approaches to compose services.

5.	**Evaluate** emerging and proposed standards for the main components of Web services architectures.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	0	0	0	0	0	0	0	0	2	2	3
CO2	3	3	0	0	0	0	2	0	0	0	0	3
CO3	2	2	3	3		1		3	2	0	0	2
CO4	0	2	0	0	0	0	0	0	0	0	0	0
CO5	0	1	0	0	2	0	0	0	0	0	0	0

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	3	0	0
CO2	3	2	3
CO3	3	0	2
CO4	3	0	0
CO5	3	0	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS701B	Course Name Compiler Construction	Semester VII

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Theory of Computation
Course Category	Professional Elective courses
Course focus	Employability
Rationale	Compiler Construction focuses on the design, development, and implementation of compilers, which are crucial tools for transforming high-level programming languages into executable code or machine language.. It provides a deep understanding of the compilation process, enhances programming skills, bridges theory and practice, explores language design principles, enables optimization techniques, facilitates software development, fosters problem - solving and analytical thinking, and opens doors to further research and innovation in programming languages and compilers.
Course Revision / Approval Date	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1. Understand and list the different stages in the process of compilation. 2. Identify different methods of lexical analysis 3. Design top-down and bottom - up parsers. 4. Identify synthesized & inherited attributes and developed syntax directed translation schemes. 5. Develop algorithms to generate code for a target machine

Course Content	Weightage	Contact Hours
Unit 1: Overview of the Translation Process & Lexical Analyser Difference between interpreter, assembler and compiler. Phases of compilation, Analysis and Synthesis model Lexical Analysis (scanner), Input Buffering, Recognition of tokens, Regular languages, finite automata, regular expressions, from regular expressions to finite automata, scanner generator(lex, flex).	**15%**	**06**
Unit 2: Syntax Analyser Context - free languages & grammars, LL(1) grammars & 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) Semantic Analysis: Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree. S - Attributed Definitions, L - Attribute Definitions.	**30%**	**15**
Unit 3: Intermediate Code Generation & Error Recovery Different Intermediate Forms, Syntax Directed Translation Mechanisms & Attributed Mechanisms & Attributed Definition Error Detection & Recovery.	**15%**	**06**
Unit 4: Symbol Table and Run-Time Memory Management Symbol Table Structure, symbol attributes and management. Run - time environment: Procedure activation, parameter passing, value return, memory allocation, and scope.	**10%**	**06**
Unit 5: Code Optimization Code improvement local optimization, global optimization, loop optimization, peep - hole optimization etc. Architecture dependent code improvement: instruction scheduling (for pipeline), loop optimization (for cache memory) etc.	**15%**	**06**

Unit 5: Code Generation Issues in the Design of a Code Generator, The Target Machine, Run -Time Storage Management, Basic Blocks and Flow Graphs, Next - Use Information, A Simple Code Generator, Register Allocation and Assignment, The DAG Representation of Basic Blocks, Peephole Optimization, Generating Code from DAGs, Dynamic Programming Code-Generation Algorithm, Code - Generator Generators.	**15%**	**06**

List Of Practical
Practical 1: Study of Flex
Practical 2: **A.** Implement following programs using Lex. **a.** Write a lex program to print hello world **b.** Write a lex program to recognize tokens. **c.** Write a lex program to count vowels and consonants Create a Lexer to take input from text file and count no of characters, no. of lines &; no. of words. **d.** Write a Lex program to print out a. all numbers from the given file. **e.** Write a Lex program to print out all HTML tags in file. **f.** Write a Lex program to count the number of comment lines in a given C program. Also a. eliminate them and copy that program into a separate file.
Practical 3: Implement a lexical analyzer.
Practical 4: Write a program to identify whether a given line is a comment or not.
Practical 5: Write a program to test whether a given identifier is valid or not.
Practical 6: Write a program to simulate lexical analyzer for validating operators.

Practical 7: To Study about Yet Another Compiler - Compiler (YACC).
Practical 8: Write a Yacc Program to identify whether an identifier is valid or not.
Practical 9: Write a program for constructing LL (1) parsing.
Practical 10: Write a program to generate Directed acyclic graphs for a given number of edges. Write a program for Parameter passing techniques.

Instructional Method and Pedagogy Visual Aids & Demonstrations, Hands - On Approach, Active Learning Strategies, Real - World Examples, Project - Based Learning, Continuous Assessment.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** the basic concepts and application of Compiler Design.	Cognitive	Understand
CO2	**Apply** their basic knowledge of Data Structure to design Symbol Table, Lexical Analyser , Intermediate Code Generation, Parser (Top Down and Bottom Up Design) and will be able to understand the strength of Grammar and Programming Language.	Cognitive	Apply
CO3	**Understand** and Implement a parser.	Cognitive	Understand
CO4	**Understand and Analyze** various code optimization Techniques.	Cognitive	Analyze
CO5	**Understand and implement** various code Generation methods for compilation process.	Cognitive	Create

Learning Resources	
1.	**Textbook** 1. Compilers: Principles, Techniques and Tools By Aho, Lam, Sethi, and Ullman,Second Edition, Pearson, 2014.
2.	**Reference Books:** 1. Compiler Design in C By Allen I. Holub, Prentice-Hall / Pearson. 2. Advanced Compiler Design & Implementation By Muchnick, Morgan and Kaufmann, 1998.
3.	**Video Tutorial** 1. https://www.classcentral.com/course/compilers-328(Coursera Course)
4.	**NPTEL MOOC** 1. https://nptel.ac.in/courses/106/105/106105190/

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Understand** the basic concepts and application of Compiler Design.
2.	**Apply** their basic knowledge of Data Structure to design Symbol Table, Lexical Analyser , Intermediate Code Generation, Parser (Top Down and Bottom Up Design) and will be able to understand the strength of Grammar and Programming Language.
3.	**Understand** and Implement a parser.
4.	**Understand & Analyze** various code optimization Techniques.
5.	**Understand and implement** various code Generation methods for compilation process.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	2	2	0	0	1	0	0	1	0

CO2	2	3	3	0	2	0	0	0	0	0	0	0
CO3	2	3	3	3	0	0	0	0	0	1	1	1
CO4	3	3	3	2	0	0	1	2	0	0	1	2
CO5	3	3	2	0	3	0	1	1	0	0	1	1

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	2	3
CO2	2	1	3
CO3	1	2	1
CO4	1	2	1
CO5	2	1	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS701C	Course Name Distributed Computing System	Semester VI

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	System Programming, Operating System
Course Category	Professional Elective courses
Course focus	Employability
Rationale	To examine the fundamental principles of distributed systems, and provide students hands - on experience in developing distributed protocols. While we still look at issues in distributed operating systems, this course will address distributed systems in a broader sense. Emphasis will be placed on communication, process, naming, synchronization, consistency and replication, and fault tolerance. Distributed computing systems provide students with a strong foundation in understanding the principles, techniques, and challenges associated with designing and implementing such systems. Distributed systems operate on fundamental principles that include scalability, fault tolerance, consistency, concurrency, and communication. Understanding these principles is crucial for designing robust and efficient distributed systems. It involves various techniques for communication, coordination, and synchronization among processes in a distributed environment.

Course Revision / Approval Date	19/08/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** List the principles of distributed systems and describe the problems and challenges associated with these principles. **2.** Understand Distributed Computing techniques, Synchronous and Processes. **3.** Understand various Deadlock detection algorithms **4.** Design a distributed system that fulfils requirements with regards to key distributed systems properties. **5.** Understand and Implement Distributed File **6.** Systems and Distributed Shared Memory.

Course Content	Weightage	Contact Hours
Unit 1: Introduction to Distributed Systems Introduction to Distributed Systems Characterization of Distributed Systems: Introduction, Examples of distributed Systems, Issues in Distributed Operating Systems, Resource sharing and the Web Challenges. System Models: Architectural models, Fundamental Models Theoretical Foundation for Distributed System: Limitation of Distributed system, absence of global clock, shared memory, Logical clocks, Lamport's & vectors logical clocks, Causal ordering of messages, global state, termination detection. Distributed Mutual Exclusion: Classification of distributed mutual exclusion, requirement of mutual exclusion theorem, Token based and non - token based algorithms, performance metric for distributed mutual exclusion algorithms.	**20%**	**10**
Unit 2: Distributed Deadlock Detection system model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized deadlock detection, distributed deadlock detection, path pushing algorithms, edge chasing algorithms. Agreement Protocols: Introduction, System models, classification of Agreement Problem Interactive consistency Problem, Applications of Agreement algorithms.	**20%**	**06**

Unit 3: Distributed Objects and Remote Invocation Communication between distributed objects, Remote procedure call, Events and notifications, Java RMI case study. Transactions and Concurrency Control: Transactions, Nested transactions,Locks, Optimistic Concurrency control,Timestamp ordering, Comparison of methods for concurrency control	**20%**	**12**
Unit 4: Distributed Transactions Introduction, Flat and nested distributed transactions, Atomic commit protocols, concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery. Distributed shared memory – Design and Implementation issues, consistency models, CORBA Case Study: CORBA RMI, CORBA services.	**20%**	**12**
Unit 5: File service File service components, design issues, interfaces, implementation techniques, Sun Network File System – architecture and implementation, other distributed file systems – AFS,CODA. Name services – SNS name service model.	**20%**	**05**

List Of Practical	Weightage	Contact Hours
Practical 1: Study architectural models of distributed systems.	**10%**	**02**
Practical 2: Implement a system model for distributed deadlock detection.	**10%**	**02**
Practical 3: Implementation of RPC (Remote Procedure Call) Mechanism for echo server.	**10%**	**02**
Practical 4: Implementation of RPC Mechanism (Remote Procedure Call) for calculator.	**10%**	**02**
Practical 5: Write a program in C to implement the Domain Name System.	**10%**	**02**
Practical 6: Create a Java Program to demonstrate the concept of concurrency.	**10%**	**02**
Practical 7: Create a java Program to generate threads from runnable objects.	**10%**	**02**
Practical 8: Create a java Program to generate threads and implement a sleep method.	**10%**	**02**
Practical 9: Create a java Program to demonstrate thread priorities with one having maximum priority and one having minimum priority.	**10%**	**02**

Practical 10: use a synchronization method to avoid interference.	**10%**	**02**

Instructional Method and Pedagogy

Visual Aids and Demonstrations, Hands - On Approach, Active Learning Strategies, Real - World Examples, Project-Based Learning, Continuous Assessment.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Describe** the problems and challenges associated with these principles.	Cognitive	Understand
CO2	**Understand and Analyse** Distributed Computing techniques, Synchronous and Processes.	Cognitive	Analyse
CO3	**Apply** Distributed web-based system.	Cognitive	Apply, Understand
CO4	**Understand** the importance of security in distributed systems.	Cognitive	Apply, Understand
CO5	**Understand** and Implement Distributed File Systems and Distributed Shared Memory.	Cognitive	Apply

Learning Resources	
1.	**Textbook** **1.** "Advanced Concepts in Operating Systems", by Mukesh Singhal & Niranjan GShivaratri,Tata McGraw Hill(2001). **2.** “Distributed System: Concepts and Design”, by Coulouris, Dollimore, Kindberg, Pearson Education (2006)
2.	**Reference Books:** **1.** A.Tanenbaum S, “Distributed Operating Systems”, Pearson Education (2005). **2.** B. P K Sinha, “"Distributed System: Concepts and Design”, PHI(2004).

3.	**Journals & Periodicals** **1.**
4.	**Other Electronic Resources** **1.**

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	**Course Outcomes**
1.	**Describe** the problems and challenges associated with these principles.
2.	**Understand and Analyse** Distributed Computing techniques, Synchronous and Processes.
3.	**Apply** Distributed web-based system.
4.	**Understand** the importance of security in distributed systems.
5.	**Understand** and Implement Distributed File Systems and Distributed Shared Memory.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	3	1	1	0	0	1	1
CO2	2	2	3	3	2	1	1	1	0	0	0	0
CO3	3	3	3	3	1	1	1	1	0	0	0	0
CO4	1	3	3	2	1	1	1	0	0	0	0	0
CO5	2	2	2	3	0	0	0	0	0	0	1	1

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	2	1
CO3	2	2	1
CO4	2	1	1
CO5	1	1	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS701D	Course Name Soft Computing	Semester VII

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Basic knowledge of mathematics.
Course Category	Professional Elective courses
Course focus	Employability
Rationale	The conventional methods of computing relying on analytical or empirical relations become time consuming and labor intensive to solve some complex problem. Soft computing techniques like Genetic Algorithms, Fuzzy logic and Artificial Neural Network can be applied effectively to solve complex problem. This subject gives understanding of various soft computing techniques. It equips students with powerful computational tools that can handle complex and uncertain problems, optimize decision-making processes, analyze and learn from data, and adapt to changing environments. By studying soft computing, students gain valuable skills and knowledge that enable them to address real - world challenges and contribute to advancements in various industries.
Course Revision / Approval Date	30/5/2025

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Classify the various soft computing frameworks. **2.** Be familiar with the design of fuzzy logic and fuzzy systems. **3.** Learn mathematical background for optimized genetic programming. **4.** Be exposed to neuro - fuzzy hybrid systems and its applications. **5.** Develop some familiarity with current research problems and research methods inSoft Computing Techniques.

Course Content	Weightage	Contact Hours
Unit 1: Introduction What is Soft Computing? - Difference between Hard and Soft computing - Requirement of Soft computing - Major Areas of Soft Computing -Applications of Soft Computing	10%	04
Unit 2: Fuzzy Systems Fuzzy sets, Fuzzy Relations and Fuzzy reasoning, Fuzzy functions - Decomposition - Fuzzy automata and languages - Fuzzy control methods - Fuzzy decision making	25%	12
Unit 3: Neuro - Fuzzy Modelling Adaptive networks based Fuzzy inference systems - Classification and Regression Trees - Data clustering algorithms - Rule based structure identification - Neuro-Fuzzy controls - Simulated annealing - Evolutionary computation NEURAL NETWORKS: Basics of Neural Networks, Feed forward Networks, Radial Basis Function Networks : Reinforcement Learning,Single layer Perceptrons and Learning, Back Propagation networks- Architecture of Back propagation (BP) Networks; Backpropagation Learning	25%	12
Unit 4: Genetic Algorithms Survival of the Fittest - Fitness Computations - Cross over - Mutation - Reproduction - Rank method - Rank space method	20%	05

Unit 5: Application of Soft Computing Optimization of traveling salesman problem using Genetic Algorithm, Genetic algorithm based Internet Search Techniques, Soft computing based hybrid fuzzy controller, Introduction to MATLAB Environment for Soft computing Techniques.	20%	12

List Of Practical	Weightage	Contact Hours
Practical 1: Create a perception with appropriate numbers of inputs and outputs. Train it using a fixed increment learning algorithm until no change in weights is required. Output the final weights.	**10%**	**02**
Practical 2: Implementation of De-Morgan's Law.	**10%**	**02**
Practical 3: Implementation of Fuzzy Operations.	**10%**	**02**
Practical 4: Implementation of Fuzzy Relations (Max-min Composition).	**10%**	**02**
Practical 5: Implementation of Fuzzy Inference System.	**10%**	**02**
Practical 6: Implementation of Fuzzy Controller (Washing Machine) Implementation of Simple Neural Network.	**10%**	**02**
Practical 7: Implementation of Simple Genetic Application.	**10%**	**02**
Practical 8: Implement travelling salesperson problem (tsp) using genetic algorithms.	**10%**	**02**

Practical 9: Implement Soft computing based hybrid fuzzy controller.	**10%**	**02**
Practical 10: Study of MATLAB.	**10%**	**02**

Instructional Method and Pedagogy

Visual Aids and Demonstrations, Hands - On Approach, Active Learning Strategies, Real - World Examples, Project - Based Learning, Continuous Assessment

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Apply** various soft computing concepts for practical applications.	Cognitive	Apply
CO2	**Use** fuzzy rules and reasoning to develop decision making and an expert system.	Cognitive	Create
CO3	**Apply** fuzzy logic and reasoning to handle uncertainty and solve engineering problems, genetic algorithms to combinatorial optimization problems and neural networks to pattern classification and regression problems.	Cognitive	Apply
CO4	**Explain** the importance of optimization techniques and genetic programming.	Cognitive	Understand
CO5	**Review** the various hybrid soft computing techniques and apply in real time problems	Cognitive	Analyze

Learning Resources	
1.	**Textbook** **1.** J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004. **2.** B. Fuzzy Logic Engineering Applications – Timothy J.Ross, McGraw Hill, NewYork, 1997.

2.	**Reference Books:** 1. S.Rajasekaran and G.A.Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications”, Prentice- Hall of India Pvt. Ltd., 2006. 2. B.Genetic Algorithms: Search and Optimization, E. Goldberg
3.	**Journals & Periodicals** 1.
4.	**Other Electronic Resources** 1.

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Apply** various soft computing concepts for practical applications.
2.	**Use** fuzzy rules and reasoning to develop decision making and an expert system.
3.	**Apply** fuzzy logic and reasoning to handle uncertainty and solve engineering problems, genetic algorithms to combinatorial optimization problems and neural networks to pattern classification and regression problems.
4.	**Explain** the importance of optimization techniques and genetic programming.
5.	**Review** the various hybrid soft computing techniques and apply in real time problems

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	2	0	0	1	0	0	0	1
CO2	2	3	3	2	2	1	0	1	1	1	1	1
CO3	3	3	2	0	1	0	0	1	1	0	1	1
CO4	2	2	3	0	1	0	0	0	0	0	0	0
CO5	3	2	3	3	0	0	0	0	0	0	2	1

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	3	3	2
CO2	3	1	2
CO3	2	3	3
CO4	3	2	1
CO5	2	2	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS701E	Course Name Computer Vision	Semester VII

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Programming and Linear Algebra, Vector Calculus.
Course Category	Professional Elective courses
Course focus	Employability
Rationale	In this course students will learn basic principles of image formation, image processing algorithms and recognition from single or multiple images (video). This course emphasizes the core vision tasks of scene understanding and recognition. Applications to object recognition, image analysis, image retrieval and object tracking will be discussed. Computer Vision focuses on enabling computers to acquire, process, analyze, and understand visual information from the real world.
Course Revision / Approval Date	24/1/2022

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Introduce the student to computer vision algorithms, methods and concepts. **2.** Able to understand the concepts, theory and computational algorithms needed for several advanced real world interference tasks from given images. **3.** Understand how machines can accomplish recognition, reorganization and 3D reconstruction of objects of the scenes from the images. **4.** Can simulate and develop several exciting examples in generating descriptions and inferences from images in several domains ranging from medical, economical, engineering to state of the art industrial needs. **5.** To study applications of computer vision algorithms.

Course Content	Weightage	Contact Hours
Unit 1: Introduction to Computer Vision and Computer Graphics What is Computer Vision - Low- level, Mid-level, High level , Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content- Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality.	**20%**	**08**
Unit 2: Early processing and image filtering Image Formation Models, Monocular imaging system, Orthographic & Perspective Projection, Camera model and Camera calibration, Image representations (continuous and discrete), Edge detection. Image Processing and Feature Extraction: Harris corner detector, SIFT, HoG descriptor.	**25%**	**10**

Unit 3: Shape Representation contour-based and region-based shape representation, deformable models like snakes and level sets, and descriptors such as Fourier, wavelet, and medial representations. Includes multi-resolution analysis and image segmentation using region and contour methods.	**25%**	**12**
Unit 4: Motion estimation Motion field, optical flow - smoothness, boundary conditions, discontinuities of optical flow, block based method, Bayesian method, Motion segmentation method, motion from points and lines, token tracking, stereo and motion tracking, use of Kalman filter, focus of expansion, structure from motion	**20%**	**10**
Unit 5: Applications Explores face detection and recognition using Eigenfaces and 3D models. Covers surveillance (tracking, occlusion handling, multi-camera views), human gait analysis, and in-vehicle vision systems for road, sign, and pedestrian detection.	**10%**	**05**

List Of Practical	Weightage	Contact Hours
Practical 1: Literature Review on the state-of-the-art Computer Vision Applications.	**10%**	**02**
Practical 2: Write a program to perform following image processing operations. i. Reading an image and converting into grayscale image ii. Plot the histogram of a given image iii. Enhance the image using various techniques like Log - transformation, Gamma correction and histogram equalization.	**10%**	**02**
Practical 3: Apply various Linear Filters and MedianFilter on the given image.	**10%**	**02**

Practical 4: Detection of Edges using Edge Detection algorithms like Canny, Sobel and Prewitt.	**10%**	**02**
Practical 5: Feature Extraction using Harris corner detector, SIFT, HoG descriptor.	**10%**	**02**
Practical 6: Image segmentation using Region based representation and Contour based representation.	**10%**	**02**
Practical 7: Motion Estimation using Motion field and optical flow.	**10%**	**02**
Practical 8: Develop an application using Motion Tracking.	**10%**	**02**
Practical 9: Develop an application using Face Detection and Recognition.	**10%**	**02**
Practical 10: Develop an application for Surveillance System.	**05%**	**02**
Practical 11: Develop an application for locating roadways, Road markings, Identifying Road Signs, Locating pedestrians.	**05%**	**02**

Instructional Method and Pedagogy

Visual Aids, Active Learning Strategies, Real-World Examples, Continuous Assessment

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	To **Implement** fundamental image processing techniques required for computer vision.	Cognitive	Design

CO2	To **Implement** the shape Analysis.	Cognitive	Apply
CO3	To **develop** applications using computer vision techniques.	Cognitive	Apply
CO4	**Extract** features from Images and do Analysis of Images.	Cognitive	Analyze
CO5	**Understand** video processing, motion computation and 3D vision and geometry.	Cognitive	Understand

Learning Resources	
1.	**Textbook** **1.** D. H. Ballard and C. M. Brown: Computer Vision, Prentice Hall, New York,1986. **2.** R. M. Haralick, L. G. Shapiro: Computer and Robot Vision, Addison-Wesley Pub Co, reading, Mass., 1992. **3.** Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.
2.	**Reference Books:** **1.** Y. Shirai: Three - Dimensional Computer Vision, Springer - Verlag Berlin, 1988. **2.** B. K. P. Horn: Robot Vision, MIT Press, Cambridge, 1986
3.	**Journals & Periodicals** **1.** *International Journal of Computer Vision (IJCV)* **2.** *Computer Vision and Image Understanding (CVIU)* **3.** *Image and Vision Computing*
4.	**Other Electronic Resources** **1.** Computer Vision. Ballard and Brown **2.** Invitation to 3D Vision: From Images to Geometric Models: Y. Ma, S. Soatto, J. Kosecka and S. Sastry

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	To **Implement** fundamental image processing techniques required for computer vision.
2.	To **Implement** the shape Analysis.
3.	To **develop** applications using computer vision techniques.
4.	**Extract** features from Images and do Analysis of Images.
5.	**Understand** video processing, motion computation and 3D vision and geometry.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	2	1	0	1	1	0	1	1
CO2	2	3	3	0	2	0	0	0	0	0	1	1
CO3	3	3	3	2	2	0	0	0	0	1	2	2
CO4	2	3	3	1	2	0	0	0	0	0	1	1
CO5	3	2	1	0	1	0	0	0	0	1	1	1

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	3	2	2
CO2	3	3	2
CO3	3	2	2
CO4	2	3	1
CO5	2	2	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

COURSE CODE BTCS701F	COURSE NAME CLOUD COMPUTING	SEMESTER VII

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	2	0	5	3	1	0	4

Course Pre-requisites	Basics of Computer Architecture and Organization, Networking
Course Category	Professional Elective courses
Course focus	Skill development and employability.
Rationale	This course aims students to understand the hardware, software concepts and architecture of cloud computing. Students realize the importance of Cloud Virtualization, Abstractions and Enabling Technologies.
Course Revision/ Approval Date:	30/5/2025
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1. **Remember** key cloud concepts, models (IaaS, PaaS, SaaS), and cloud providers. 2. **Understand** cloud architecture, deployment models, and virtualization technologies. 3. **Apply** cloud services to deploy and manage scalable applications. 4. **Analyze** cloud service models and evaluate cloud solutions based on requirements. 5. **Create** cloud-based applications while ensuring security, performance, and cost optimization.

Course Content (Theory)	Weightage	Contact hours
Unit 1. Introduction to Cloud Computing: Cloud Computing, Benefits and Challenges of Cloud Computing, Cloud vs Traditional Computing Layers and Types of Clouds, Cloud Infrastructure Management, Challenges and Applications. Virtualization: Virtualization of Computing, Storage and Resources.	**15%**	**9**
Unit 2. Cloud Service Models: Introduction to Service Models: IaaS, PaaS, SaaS, Overview of IaaS: EC2, Google Compute Engine, Azure VMs, Overview of PaaS: Google App Engine, AWS Elastic Beanstalk, Overview of SaaS: Google Docs, Office 365, Comparison between Service Models.	**15%**	**7**
Unit 3 Cloud Deployment Models and Cloud Architecture: Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud, Comparison of Deployment Models, Key Features of Cloud Deployment, Cloud Architecture: Layers, Components, and Models: Multi-Tenant, Multi-Server, and Distributed Architectures, Cloud Providers: Amazon AWS, Microsoft Azure, Google Cloud Platform.	**20%**	**9**
Unit 4 Virtualization Technologies and Cloud Tools: Virtualization Concepts: Hypervisors: Type 1 & Type 2, Virtual Machines (VMs), Virtualization in Cloud Computing. Containers and Docker: Overview of Containers vs Virtual Machines, Cloud Management Platforms (Open Stack, Cloud Stack), Cloud Storage: Block, Object, File Storage, Networking in Cloud: SDN, VPN, Load Balancing, CDN.	**25%**	**10**
Unit 5 Security, Privacy, and Cloud Management: Cloud Security Issues: Data Security, Privacy, Compliance, and Governance, Cloud Authentication, Authorization, and Identity Management, Virtual Machine Security, Cloud Resource Management (Scalability, Elasticity), Case Studies and Real-World Cloud Security Incidents	**25%**	**10**

List Of Practical	**Weightage**	**Contact hours**
1: Exploring AWS Console and configure CLI.	**5%**	**2**
2: Gain hands-on experience with creating and managing EC2 instances	**5%**	**2**
3: Implement Management in AWS • Create new users who can login to AWS console • Create role for an application to access S3 Create policies for new user to have either admin or limited privileges.	**10%**	**2**
4: Implement the storage in AWS.	**10%**	**2**
5: Understand how to set up and manage load balancing for applications.	**10%**	**2**
6: Implement Networking Concept in AWS	**10%**	**2**
7: Understand and implement security measures in AWS cloud environments.	**10%**	**2**
8: Understanding the migration in cloud.	**10%**	**4**
9: Analyze and implement a real-world cloud computing solution based on an industry case study.	**10%**	**4**
10: Apply the learned concepts to build a cloud-based application using AWS services, focusing on innovation, scalability, and security	**20%**	**8**

Instructional Method and Pedagogy:
Lecture-based instruction, Hands-on Labs and Demos,Case Studies,Project-Based Learning, Collaborative Learning, Assessments and Quizzes.

☐ Assessments and Quizzes.

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to: CO1. Understand cloud computing models and their architecture. CO2. Learn the principles and practices of different cloud service models (IaaS, PaaS, SaaS).	Cognitive	 Understand Understand

CO3. Gain practical knowledge of cloud deployment models and real-world cloud architecture.		Apply
CO4. Master virtualization concepts and tools like hypervisors, containers, and cloud management platforms.		Apply
CO5. Understand cloud security, privacy, and resource management in virtualized environments.		Understand

Learning Resources	
1.	Textbooks: 1. Rajkumar Buyya, James Broberg, Andrzej M Goscinski, Cloud Computing: Principles and Paradigms, Wiley. 2. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini,Cloud Computing: Concepts, Technology & Architecture" Prentice Hall. Reference Books: 1. Toby Velte, Anthony Velte, Cloud Computing: A Practical Approach, McGraw-Hill Osborne Media. 2. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, O'Reilly Publication. 3. John Rhoton, Cloud Computing Explained: Implementation Handbook for Enterprises, Recursive Press.

Evaluation Scheme	**Total Marks**	
Theory: Mid semester Marks	20 marks	
Theory: End Semester Marks	40 marks	
Theory: Continuous Evaluation Component Marks	Attendance	05 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Open Book Assignment	10 marks
	Total	**40 Marks**

Practical Marks			
Project/Industrial Internship Marks	Quantity of the Project/Industrial in terms of Language, Presentation & format.	30 marks	
	Practical understanding of the subject on the Project/Industrial.	30 marks	
	Industry/University mentor's feedback on the Project/Industrial.	30 marks	
	Attendance	10 marks	
	Total	**100 Marks**	

Mapping of PSOs& COs

	PSO1	PSO2	PSO3
CO1	3	1	1
CO2	3	2	3
CO3	3	1	2
CO4	3	1	1
CO5	3	1	1

Mapping of POs& COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	2	2	2	0	0	0	0	0	0
CO2	2	3	3	2	2	1	0	0	0	0	0	0
CO3	2	2	2	1	3	3	0	0	0	0	0	0
CO4	2	3	3	2	3	3	0	0	0	0	0	0
CO5	2	2	2	2	3	2	3	1	2	2	0	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

GSFC UNIVERSITY
EDUCATION RE-ENVISIONED

COURSE CODE BTCS701G	COURSE NAME GENERATIVE-AI	SEMESTER -VII

Teaching Scheme (Hours)	Teaching Credit

Lecture	Practical	Tutorial	Total Hours	Lecture	Practical	Tutorial	Total Credit
3	2	0	4	3	0	1	4

Course Pre-requisites	Machine Learning, Deep Learning, Probability, and Linear Algebra
Course Category	Engineering Science
Course focus	Employability
Rationale	This course on Applied Generative AI equips B.Tech. CSE students with essential knowledge and hands-on skills in cutting-edge generative models like GANs and transformers. It bridges theory and practical applications across industries, fostering innovation and ethical AI practices, aligning with the university's goal of producing industry-ready professionals
Course Revision/ Approval Date:	30/5/2025
Course Objectives (As per Blooms' Taxonomy)	1. **Understand**: Demonstrate foundational knowledge of generative AI models and their underlying principles, including GANs, VAEs, and transformers. 2. **Apply**: Implement generative AI techniques to solve practical problems in domains such as image synthesis, text generation, and data augmentation. 3. **Analyze**: Evaluate the performance of generative models and identify challenges like mode collapse, vanishing gradients, and ethical concerns. 4. **Create**: Design and develop innovative solutions using advanced generative AI models, including multimodal applications like text-to-image and audio synthesis. 5. **Evaluate**: Assess the ethical implications of generative AI technologies, proposing strategies to mitigate risks related to bias, privacy, and security.

Course Content (Theory)	Weightage	Contact hours

Unit 1: Introduction to Generative AI Overview of Artificial Intelligence, Machine Learning, and Deep Learning, Introduction to Generative Models: Concepts and Scope, Probability Distributions: Gaussian, Multivariate, and Sampling Methods, Types of Generative Models: Generative Adversarial Networks, Variational Autoencoders, and Diffusion Models, Key Applications of Generative AI: Image Synthesis, Text Generation, Drug Discovery, etc.	**20%**	**07**

Unit 2: Deep Learning Foundations for Generative AI Neural Network Architectures: Feedforward, Convolutional, and Recurrent Networks, Review of Autoencoders: Vanilla and Sparse Autoencoders, Variational Autoencoders (VAEs): Latent Variable Representation and Reconstruction, Loss Functions: Cross-Entropy, KL Divergence, and Reconstruction Loss	**20%**	**08**
Unit 3: Generative Adversarial Networks (GANs) Introduction to GANs: Architecture and Workflow, Types of GANs: DCGAN, CGAN, CycleGAN, StyleGAN, Stability Challenges: Mode Collapse, Vanishing Gradients, and Solutions, Advanced GAN Techniques: Wasserstein GANs (WGAN), Gradient Penalty	**20%**	**10**
Unit4: Advanced Generative Models and Techniques Diffusion Models and Denoising Diffusion Probabilistic Models (DDPM), Transformers and Attention Mechanisms in Generative AI, Natural Language Processing (NLP): GPT, BERT, and Large Language Models (LLMs), Multimodal Generative AI: Text-to-Image (e.g., DALL-E), Audio Synthesis, and Video Generation	**20%**	**10**
Unit 5: Applications of Generative AI Healthcare: Drug Discovery, Medical Image Generation, Entertainment: Video Game Content, Animation, and Virtual Characters, Business: Chatbots, Virtual Assistants, and Data Augmentation, Cybersecurity: Deepfake Detection and Secure Generative Systems	**20%**	**10**
List Of Practical Tutorial	**Weightage**	**Contact hours**
Unit 1: Generating data distributions using Python libraries like NumPy, SciPy, and Matplotlib.	**20%**	**3**

Unit 2: Implementation of basic autoencoders and VAEs in TensorFlow/PyTorch.	**20%**	**3**
Unit 3: 1. Building and training a DCGAN for image generation. 2. Experimenting with StyleGAN for creating photorealistic images.	**20%**	**3**
Unit 4: 1. Implementing GPT-based text generation. 2. Exploring OpenAI's DALL-E API or Stable Diffusion for text-to-image synthesis.	**20%**	**3**
Unit 5: Develop a mini-project, such as an AI-based chatbot, a style transfer system, or synthetic image generation for data augmentation.	**20%**	**3**

Instructional Method and Pedagogy: For The course uses a blended approach with interactive lectures, hands-on labs, and project-based learning. Students will implement generative models using tools like TensorFlow, engage in assignments and group activities, and work on a capstone project. This method ensures practical skills, critical thinking, and real-world application aligned with industry needs.

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Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**

CO1: Understand the principles, architectures, and working mechanisms of key generative AI models, including GANs, VAEs, and transformers. CO2: Apply generative AI frameworks like TensorFlow and PyTorch to develop solutions for real-world problems such as image synthesis, text generation, and data augmentation. CO3: Analyze and evaluate generative model performance using metrics and identify issues like mode collapse and vanishing gradients, proposing optimization techniques. CO4: Apply and create advanced generative AI applications, such as multimodal systems for text-to-image or audio synthesis, integrating diverse datasets and tools. CO5: Analyze the ethical and societal impact of generative AI technologies, formulating strategies to address risks related to bias, privacy, and misuse.	Cognitiv e Cognitiv e Cognitiv e Cognitive Cognitive	Understan d Apply Analyze Apply Analyze

Learning Resources	
1.	Reference Books: David Foster, Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play" 1st Ed. O'Reilly Media, (2019)
2.	Journals & Periodicals: 1. Journal of Machine Learning ResearchJournal of Mathematical Modelling and Algorithms 2. IEEE Transactions on Neural Networks and Learning 3. Pattern Recognition 4. Neural Computation
3.	Other Electronic Resources: 1. https://github.com/sindresorhus/awesome 2. https://deepmind.google/research/

Attendance	05 marks
MCQs	10 marks
Open Book Assignment	15 marks
Open Book Assignment	10 marks
Total	**40 Marks**

Evaluation Scheme	Total Marks
Theory: Mid semester Marks	20 marks
Theory: End Semester Marks	40 marks
Theory: Continuous Evaluation Component Marks	
Practical Marks	

Attendance	05 marks
Practical Exam	20 marks
Viva	10 marks
Journal	10 marks
Discipline	05 marks
Total	**50 Marks**

Mapping of PSOs & Cos

	PSO1	PSO2	PSO3
CO1	0	2	2
CO2	0	0	1
CO3	0	0	0
CO4	0	2	2
CO5	0	2	3

Mapping of POs & Cos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	2	2	3	1	1	0	0	0	0	1	0	2
CO2	2	1	1	0	0	0	0	0	0	1	0	0
CO3	2	1	2	1	0	0	0	0	0	1	0	1
CO4	3	2	2	2	1	0	0	0	0	1	0	2
CO5	3	2	3	3	1	0	0	0	0	1	0	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

2.	Reference Books: 1. David Foster, Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play" 1st Ed. O'Reilly Media, (2019)

<table>
<tr><th>Evaluation Scheme</th><th colspan="2">Total Marks</th></tr>
<tr><td>Theory: Mid semester Marks</td><td colspan="2">20 marks</td></tr>
<tr><td>Theory: End Semester Marks</td><td colspan="2">40 marks</td></tr>
<tr><td rowspan="5">Theory: Continuous Evaluation Component Marks</td><td>Attendance</td><td>05 marks</td></tr>
<tr><td>MCQs</td><td>10 marks</td></tr>
<tr><td>Open Book Assignment</td><td>15 marks</td></tr>
<tr><td>Open Book Assignment</td><td>10 marks</td></tr>
<tr><td>Total</td><td>40 Marks</td></tr>
<tr><td rowspan="6">Practical Marks</td><td>Attendance</td><td>05 marks</td></tr>
<tr><td>Practical Exam</td><td>20 marks</td></tr>
<tr><td>Viva</td><td>10 marks</td></tr>
<tr><td>Journal</td><td>10 marks</td></tr>
<tr><td>Discipline</td><td>05 marks</td></tr>
<tr><td>Total</td><td>50 Marks</td></tr>
<tr><td rowspan="5">Project/Industrial Internship Marks</td><td>Quantity of the Project/Industrial in terms of Language, Presentation & format.</td><td>30 marks</td></tr>
<tr><td>Practical understanding of the subject on the Project/Industrial.</td><td>30 marks</td></tr>
<tr><td>Industry/University ment or's feedback on the Project/Industrial.</td><td>30 marks</td></tr>
<tr><td>Attendance</td><td>10 marks</td></tr>
<tr><td>Total</td><td>100 Marks</td></tr>
</table>

Mapping of PSOs& COs

	PSO1	PSO2	PSO3
CO1	1	3	1
CO2	1	1	1
CO3	3	2	3
CO4	1	3	3
CO5	1	3	1

Mapping of POs& COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	1	2	0	1	0	0	1	0	0
CO2	1	1	0	1	2	0	0	1	0	0	2	2
CO3	3	3	3	3	0	0	1	0	0	0	0	0
CO4	2	1	2	1	2	2	0	2	1	1	2	3
CO5	1	0	1	1	2	0	0	1	0	0	2	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0 None

Course Code BTCS702	Course Name Mobile Application Development	Semester VII

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
2	4	0	6	2	2	0	4

Course Prerequisites	Basic knowledge about programming, Object Oriented Concepts.
Course Category	Professional Subjects-Core (PC)
Course focus	Skill development
Rationale	Mobile application development is crucial due to the widespread usage and reliance on mobile devices in our daily lives. With the exponential growth of smartphones and tablets, mobile applications have become essential tools for communication, productivity, entertainment, and accessing information on the go. Mobile apps offer convenience, portability, and personalized experiences that cater to individual preferences and needs. They enable businesses to reach and engage with a larger audience, enhance customer experiences, and drive revenue. Additionally, mobile apps leverage the advanced capabilities of mobile devices, such as GPS, camera, and sensors, to deliver innovative features and functionalities. In a mobile-centric world, developing mobile applications is key to staying relevant, competitive, & connected in today's digital landscape.
Course Revision / Approval Date	24/1/2022

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** To understand the mobile application development trends, and various mobile networks. **2.** To analyze different security techniques for Mobile Computing. **3.** Learn to set up an Android Application development environment. **4.** Apply Multimedia, Animation and identify options to save persistent application data. **5.** To build any IOS app using Flutter.

Course Content	Weightage	Contact Hours
Unit 1: Introduction to Mobile computing Concepts of mobile Communication, Characteristics and applications of mobile communication. Different generations of Wireless technology, Basis of GSM architecture, 3 tier Architecture of Mobile computing Mobile ad - hoc Networks (manets), Mobile Agents.	**15%**	**06**
Unit 2: Android API's Android APIs, Android Architecture, Application Framework, The Application components, The manifest file, downloading and installing Android, Exploring the Development Environment, Developing and Executing the first Android application, Working with Activities and layouts,Using widgets	**15%**	**04**
Unit 3: Multimedia Playing audio, playing video, rotate animation, fadein/fadeout animation, zoom animation, scale animation, 2d and 3d graphics. Data storage: shared preferences, internal storage, external storage, sqlite databases, content provider.	**25%**	**08**
Unit 4: Web services & JSON Web services and Parsing, JSON Parsing, Access web data with JSON, Connect to Web Services, Using Third Party Libraries like Retrofit, Google Map, Creating Google Map	**25%**	**06**

Unit 5: Flutter Introduction to Flutter, Why Flutter? Installing and setup for flutter development. Create a flutter app.Add App icons to the ios and Android projects, Understanding Themes in flutter.	**20%**	**06**

List Of Practical	Weightage	Contact Hours
Practical 1: **A.** Understand the basic concept of GSM and MANET.	**10%**	**04**
Practical 2: **A.** Installation and configuration and Develop Of android studio along with all SDK:components and AVD. **a. Aim:** Write a java program to print multiplication table of given number **b. Aim:** Write a java program to implement inheritance. **c. Aim:** Write a java program to implement Interface. **B.** Create an android application that displays custom messages. **C.** Create an android application that displays sample toast messages. **D.** Design a single screen application, which adds two values inputted by the user. **E.** Design an application to demonstrate a concept of radio group and radio buttons. (Use Linear layout). **F.** Create an android application that converts KG into Pound. (Import image to enhance look and feel of UI, Image could be conversion logo or anything relevant). **G.** Create a simple Application, which shows the use of a Rating Bar. **H.** Create an android application to demonstrate Autocompletetextview. **I.** Create an application which demonstrates implicit type of Intent calls. **J.** Create an application, which demonstrates explicit intents. **K.** Create a multiscreen application with three activities	**30%**	**04**

(Login, Registration, and Display). Main activity(Login) checks for login, if entered data does not match then open registration activity, fill data and submit button click will transfer data to third(display) activity which displays registration data. **L.** Create an application to demonstrate option and context menu. **M.** Create an Android Application where the user will enter the destination email address, subject and a message. On clicking the Send button, it will prompt the email client only and email will compose. Also put some logic over the Edit Text field that no one fields are empty otherwise notify with toast.		
Practical 3: **A.** Create the MP3 player like application (this should also include playing music Through the web). **B.** Create a Video player like application. **C.** Create a sample application that draws the circle, oval shape and square. **D.** Create a sample application of frame-by-frame animation. **E.** Create a sample application that rotates an object, doubles the size of that object and then Again shrinks back to original size. **F.** Create an application to make Insert, update, Delete and retrieve Operation on the sqlite database.	**30%**	**04**
Practical 4: **A.** Installation of flutter for hybrid applications. **a.** Create a flutter application that will display “Custom Message” in the middle of the screen. **b.** Create a flutter application to implement a calculator.	**20%**	**04**

Instructional Method and Pedagogy

Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understanding** algorithms / protocols, environments and communication systems in mobile computing.	Cognitive	Understand
CO2	**Evaluate** the performance of GSM, GPRS and other technologies.	Cognitive	Evaluate
CO3	**Apply** methods in storing, sharing and retrieving data in Android applications.	Domain	Apply
CO4	**Implement** different Android applications CO5. Implement IOS applications.	Domain	Create

Learning Resources	
1.	**Textbook** 1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017. 2. Building Android Apps in easy steps by McGraw-Hill Education 3. Wireless Communications & Networks by William Stallings – Pearson
2.	**Reference Books:** 1. Mobile Computing Technology, Applications and service creation by Asoke K Telukder, Roopa R Yavagal – TMH Publication. 2. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014 3. Flutter Complete Reference by Alberto Miola (Author), Felix Angelov (Editor), Matej Rešetár (Editor), RémiRousselet (Editor).
3.	**Journals & Periodicals** 1.
4.	**Other Electronic Resources** 1. http://www.codelearn.org/android-tutorial/android-introduction 2. http://pl.cs.jhu.edu/oose/resources/android/Android-Tutorial.pdf 3. developer.android.com/training/basics/firstapp

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Sr. No.	Course Outcomes
1.	**Understanding** algorithms / protocols, environments and communication systems in mobile computing.
2.	**Evaluate** the performance of GSM, GPRS and other technologies.
3.	**Apply** methods in storing, sharing and retrieving data in Android applications.
4.	**Implement** different Android applications CO5. Implement IOS applications.
5.	

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	2	2	1	1	0	0	2	2	2
CO2	2	2	1	2	2	1	1	0	0	2	2	2

CO3	2	2	1	2	2	1	1	0	0	2	2	2
CO4	2	2	1	3	3	1	1	0	0	2	2	2
CO5	2	2	1	3	3	1	1	0	0	2	2	2

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	3	3
CO2	1	3	3
CO3	1	3	3
CO4	1	3	3
CO5	1	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS703	Course Name Natural Language Processing	Semester VII

Teaching Scheme (Hours)				Teaching Credit			
Lecture	**Practical**	**Tutorial**	**Total**	**Lecture**	**Practical**	**Tutorial**	**Credits**
3	2	0	5	3	1	0	4

Course Prerequisites	Data Structure and Algorithm
Course Category	Professional Elective courses
Course focus	Skill development

Rationale	Natural Language Processing (NLP) holds significant importance due to its ability to bridge the gap between human language and machine understanding. With the explosive growth of textual data in various forms, NLP enables machines to comprehend, analyze, and derive insights from human language. By automating language-related tasks, NLP streamlines information extraction, sentiment analysis, language translation, chatbots, and voice recognition systems. NLP enhances efficiency and accuracy in information retrieval, customer service, and decision-making processes. It enables personalized experiences, improves search algorithms, and empowers applications with intelligent language capabilities. With the increasing need to process and understand vast amounts of textual data, NLP is instrumental in unlocking valuable insights and transforming the way we interact with technology.
Course Revision / Approval Date	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Understand the key concepts of NLP. **2.** Remember the various part of speech Tagging methods. **3.** Understand different word forms to understand language. **4.** Understand various text analysis method for natural language processing. **5.** Understand various machine translation techniques.

Course Content	Weightage	Contact Hours
Unit 1: Introduction to Natural Language Processing Language Modeling Grammar - based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance Main Approaches to NLP, History of NLP, Applications of NLP, How to build an NLP Pipeline, Phases of NLP. NLP apis, NLP Libraries.	**15%**	**07**

Unit 2: Language Modeling and Part of speech Tagging Unigram Language Model, Bigram, Trigram, N-gram, Advanced smoothing for language modeling, Empirical Comparison of Smoothing Techniques Applications of Language Modeling, Natural Language Generation, Parts of Speech Tagging, Morphology, Named Entity Recognition.	**25%**	**10**
Unit 3: Word level Analysis Bag of words, skip - gram, Continuous Bag - Of - Words, Embedding representations for words Lexical Semantics, Word Sense Disambiguation, Knowledge Based & Supervised Word Sense Disambiguation.	**20%**	**10**
Unit 4: Text Analysis, Summarization and Extraction Context - Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar - Dependency Grammar - Syntactic Parsing, Ambiguity Sentiment Mining, Text Classification, Text Summarization, Information Extraction, Named Entity Recognition, Relation Extraction Question Answering in Multilingual setting; NLP in Information Retrieval, Cross - Lingual IR.	**20%**	**10**
Unit 5: Machine translation Need of mit, problems of machine translation, mit approaches, direct machine translations, rule based machine translation, knowledge based smt system, statistical machine translation (smt), parameter learning in smt (ibm models) using em. Encoder - Decoder architecture, neural machine translation.	**20%**	**08**

List Of Practical	Weightage	Contact Hours

Practical 1: **A.** Exploring the features of : **a.** Word tokenization **b.** Sentence tokenization **c.** Stopword understanding **d.** Wordcloud **e.** Frequency distribution and plotting **B.** Wordnet exercises **a.** Synonym **b.** Antonym **c.** Porter stemming **d.** Snowball stemming **e.** Lemmatization **C.** Parts of speech tagging	**20%**	**03**
Practical 2: **A.** Regular expressions in detail **B.** Text processing **a.** Noise removal **b.** Lexicon normalization **c.** Object standardization **C.** Bag of words understanding	**20%**	**03**
Practical 3: **A.** Program to understand tf - idf. **B.** Text summarization using tf - idf. **C.** Feature extraction from text.	**20%**	**03**
Practical 4: **A.** Understanding 1 - gram, 2 - gram and 3 - gram. **B.** Predating the next word using n - grams. **C.** Predicting sentences using n - gram. **D.** Part of speech tagging using algorithms.	**20%**	**03**

Practical 5:		
A. Tagging using named entity recognition. B. Poetry generation using n-gram. C. Continuous bag of words for next word prediction Cbow to fill in the blanks. a. Understanding word disambiguation. b. Understanding is tm. c. Text classification using is tm. d. Poetry generation using is tm Word embedding using gensim.	**20%**	**03**

Instructional Method and Pedagogy

Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** and comprehend the key concepts of NLP and identify NLP challenges and issues.	Cognitive	Understand
CO2	**Develop** language modelling for various texts across the different languages.	Cognitive	Create
CO3	**Apply** computational methods to understand language phenomena of word sense disambiguation.	Cognitive	Apply
CO4	**Design and develop** applications for text or information extraction and classification	Cognitive	Create
CO5	**Apply** different Machine translation techniques for translating a source to target languages.	Cognitive	Apply

Learning Resources	
1.	**Textbook** 1. Daniel Jurafsky and James H Martin. Speech and Language Processing, 2e, Pearson Education, 2009.

2.	**Reference Books:** 1. Speech and language processing: an introduction to natural language processing, computational linguistics and speech recognition jurafsky, david, and james h. Martin, pearson. 2. bharati a., sangal r., chaitanya v.. Natural language processing: a paninian perspective, phi, 2000
3.	**Journals & Periodicals** 1.
4.	**Other Electronic Resources** 1. Https://www.udacity.com/course/natural-language-processing-nanodegree-- nd892 2. Https://www.coursera.org/learn/language-processing

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks

Project / Industrial Internship Marks	Quantity of the Project/Industrial in terms of Language, Presentation & format.	30 Marks
	Practical understanding of the subject on the Project/Industrial.	30 Marks
	Industry/University mentor's feedback on the Project/Industrial.	30 Marks
	Attendance	10 Marks

Sr. No.	Course Outcomes
1.	**Understand** and comprehend the key concepts of NLP and identify NLP challenges and issues.
2.	**Develop** language modelling for various texts across the different languages.
3.	**Apply** computational methods to understand language phenomena of word sense disambiguation.
4.	**Design and develop** applications for text or information extraction and classification
5.	**Apply** different Machine translation techniques for translating a source to target languages.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	0	0	0	1	1	1	0	0	0	1
CO2	1	2	3	1	3	1	0	1	1	0	1	2
CO3	1	2	1	1	1	1	0	1	0	0	0	2
CO4	1	2	3	1	3	2	1	1	1	0	2	2
CO5	1	2	2	1	3	2	1	1	0	0	1	2

Mapping of PSOs & COs

	PSO1	PSO2	PSO3

CO1	1	3	3
CO2	1	3	3
CO3	1	3	3
CO4	1	3	3
CO5	1	3	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS704	Course Name Fundamental Of Robotic & Automation	Semester VII

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	A desire to learn about one of the most promising emerging technologies
Course Category	Professional Elective courses
Course focus	Skill development
Rationale	The study of fundamentals of robotics and automation is crucial in today's technological landscape. Robotics and automation have the potential to revolutionize industries, enhance productivity, and improve quality of life. By understanding the fundamentals, individuals gain insight into the design, control, and application of robotic systems. This knowledge enables the development of advanced automation solutions, including autonomous vehicles, industrial robots, and smart appliances. Robotics and automation offer benefits such as increased efficiency, reduced costs, improved safety, and expanded capabilities in various fields. Mastering the fundamentals empowers individuals to contribute to the advancement of technology, shape the future of automation, and address complex challenges in a rapidly evolving world.
Course Revision / Approval Date	19/8/2019

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1. Create awareness among students about the basics of robotics. 2. Demonstrate brief ideas about drive systems and end effectors. 3. Provide knowledge about sensors and machines. 4. Apply hands - on experience of robotic programming. 5. Elaborate bot creation process.

Course Content	Weightage	Contact Hours
Unit 1: Fundamentals of Robot Robot - Definition - Robot Anatomy - Coordinate Systems, Work Envelope Types and Classification - Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Payload Load Robot Parts & their Functions-Need for Robots- Different Applications.	**20%**	**09**
Unit 2: Robot Drive Systems and End Effectors Pneumatic Drives - Hydraulic Drives - Mechanical Drives - Electrical Drives - D.C. Servo Motors, Stepper Motors, A.C. Servo Motors - Salient Features, Applications and Comparison of all these Drives, End Effectors - Grippers - Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.	**20%**	**09**

Unit 3: Sensors and Machine Vision Requirements of a sensor, principles and applications of the following types of sensors - position sensors - piezoelectric sensor, lvdt, resolvers, optical encoders, pneumatic position sensors, range sensors triangulations principles, structured, lighting approach, time of flight, range finders, laser range meters, touch sensors ,binary sensors., analog sensors, wrist sensors, compliance sensors, slip sensors, camera, frame grabber, sensing and digitizing image data- signal conversion, image storage, lighting techniques, image processing and analysis-data reduction, segmentation, feature extraction, object recognition, other algorithms, applications - inspection, identification, visual serving and navigation.	**20%**	**09**
Unit 4: Robot kinematics and robot programming Forward kinematics, inverse kinematics and difference; forward kinematics and reverse kinematics of manipulators with two, three degrees of freedom (in 2 dimension), four degrees of freedom (in 3 dimension) jacobians, velocity and forces-manipulator dynamics, trajectory generator, manipulator mechanism design - derivations and problems. Lead through programming, robot programming languages - val programming - motion commands, sensor commands, end effector commands and simple programs.	**20%**	**09**
Unit 5:Introduction to Robotic Programming Introduction to RPA and Use cases – Automation Anywhere Enterprise Platform – Advanced features and capabilities – Ways to create Bots. Introduction - Features Panel - Dashboard (Home, Bots, Devices, Audit, Workload, Insights) - Features Panel - Activity (View Tasks in Progress and Scheduled Tasks) - Bots (View Bots Uploaded and Credentials) - Devices (View Development and Runtime Clients and Device Pools) - Workload (Queues and SLA Calculator) - Audit Log (View Activities Logged.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: Study and Understand the fundamentals mechanics of robotics.	**05%**	**01**

Practical 2: **A.** Demonstration of Pneumatic Drive. **B.** Demonstration of Hydraulic drive and its application. **C.** Demonstration of Servo Motor Drives & its application.	**10%**	**03**
Practical 3: **A.** Demonstration of Gripper Servo Drives & its application. **B.** Understand the concept of DSO as a signals analyzer in robotics. **C.** Demonstration of LVDT Sensor. **D.** Demonstration of Resolvers & Encoder Sensor. **E.** Demonstration of Fluid Flow Sensor kit. **F.** Demonstration of Piezoelectric Sensors.	**35%**	**05**
Practical 4: Demonstration of 6 Axis Robotics arm Trainer.	**25%**	**03**
Practical 5: Developing a bot.	**25%**	**03**

Instructional Method and Pedagogy

Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Acquiring** the basics knowledge robotics.	Cognitive	Remember
CO2	**Provide** a brief understanding of drive systems & end effectors.	Cognitive	Understand
CO3	**Acquire** knowledge about sensors & machine	Cognitive	Understand
CO4	**Provide** practical experience in robotic programming	Domain	Apply
CO5	**Analyse** the process for creating a bot.	Domain	Analyse

Learning Resources	
1.	**Textbook** **1.** Klafter R.D., Chmielewski T.A and Negin M., “Robotic Engineering - An Integrated Approach”, Prentice Hall, 2003. **2.** Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - uipath: Create Software robots. With the leading RPA tool. **3.** Groover M.P., “Industrial Robotics -Technology Programming and Applications”, mcgraw Hill, 2001.
2.	**Reference Books:** **1.** Craig j.j., “introduction to robotics mechanics and control”, pearson education, 2008. 2. Deb s.r., “robotics technology and flexible automation” tata mcgraw hill book co., 1994. 3. Koren y., “robotics for engineers", mc graw hill book co., 1992. 4. Fu.k.s.,gonzalez r.c. and lee c.s.g., “robotics control, sensing, vision and intelligence”, mcgraw hill book co., 1987. 5. Janakiraman p.a., “robotics and image processing”, tata mcgraw hill, 1995. 6. Rajput r.k., “robotics and industrial automation”, s.chand and company, 2008. 7. Surender kumar, “industrial robots and computer integrated manufacturing”, oxford and ibh publishing co. Pvt. Ltd., 1991. 8. Robotic process automation a complete guide - 2020 edition
3.	**Journals & Periodicals** **1.**
4.	**Other Electronic Resources** **1.**

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks
Project / Industrial Internship Marks	Quantity of the Project/Industrial in terms of Language, Presentation & format.	30 marks
	Practical understanding of the subject on the Project/Industrial.	30 marks
	Industry / University mentor's feedback on the Project/Industrial.	30 marks
	Attendance	10 marks

Sr. No.	Course Outcomes
1.	**Acquiring** the basics knowledge robotics.
2.	**Provide** a brief understanding of drive systems & end effectors.
3.	**Acquire** knowledge about sensors & machine
4.	**Provide** practical experience in robotic programming
5.	**Analyse** the process for creating a bot.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	0	1	1	3	0	0	0	1	2	2	1	0
CO2	3	1	2	1	2	0	0	0	0	0	1	2
CO3	3	1	2	1	1	0	0	0	0	0	1	0
CO4	3	3	3	2	2	1	0	0	2	1	2	0
CO5	2	3	2	2	2	1	0	1	1	0	0	1

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	2	3	0
CO2	2	2	2
CO3	1	1	1
CO4	3	3	3
CO5	3	2	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS705	Course Name Machine Learning for Intelligent Systems	Semester VII

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Python, Machine Learning
Course Category	Professional Elective courses
Course focus	Skill development
Rationale	Machine Learning (ML) for Intelligent Systems is of utmost importance due to its ability to enable systems to learn and make intelligent decisions based on data. ML algorithms and techniques empower intelligent systems to analyze and interpret vast amounts of complex information, extract patterns, and make predictions. By leveraging ML, intelligent systems can adapt and improve their performance over time, enhancing efficiency, accuracy, and effectiveness. ML algorithms enable tasks such as image and speech recognition, natural language processing, recommendation systems, and anomaly detection. The integration of ML in intelligent systems leads to advancements in various domains, including healthcare, finance, transportation, and cybersecurity. By harnessing the power of ML, intelligent systems can provide personalized experiences, automate tasks, optimize processes, and facilitate data-driven decision - making.
Course Revision / Approval Date	19/8/2019

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** understand the basic concept of machine learning. **2.** Understand the basic skills to decide which learning algorithm to use for what problem. **3.** Able code up your own learning algorithm and evaluate. **4.** and debug it. **5.** Understand various kernel methods and be able to create their own kernels. **6.** Get a better understanding about deep learning & ANN.

Course Content	Weightage	Contact Hours
Unit 1: Instance based learning and bayesian learning Overview of basic concepts of ml, instance based learning: (k-nearest neighbor learning, locally weighted regression, radial basis, function, case-based reasoning) , bayesian learning: (bayes theorem and concept learning, maximum likelihood and least- squared error hypothesis, naïve bayes classifier, bayesian belief Networks).	**20%**	**07**
Unit 2: ML Application to IoT Real time tracking and optimization of logistics and public transportation systems, Remote inspection and assessment of damage and accidents, Chronic disease management using remote expert consultation.	**20%**	**07**
Unit 3: ML Application to Computer Vision Human gesture estimation, creating 3D models from 2D images, Computer Vision in Healthcare: Medical Image Analysis, Crop and yield monitoring:- Automatic weeding, Insect detection.	**20%**	**10**
Unit 4: ML Application to Sentiment Analysis Social data analysis, product and market competitors research analysis, voice of customer and employee analysis, case studies on real time audio and video content analysis.	**20%**	**10**

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Unit 5: Recent trends in ML Case studies on RPA bots infused with ML, online support using chatbots.	**20%**	**08**

List Of Practical	Weightage	Contact Hours
Practical 1: **A.** Implement Machine learning model(linear Regression) to predict if a patient is having diabetes or not. **B.** Implement Machine learning model(Linear Regression) to predict house price based on input attributes. **C.** Explain K-Nearest Neighbor Classification Algorithm. **D.** Implement a machine learning model to classify Iris flower data through K nearest Neighbor Classifier in Python. **E.** Implement Radial basis function of instance based learning in python.	**20%**	**04**
Practical 2: **A.** Implement linear Programming for optimization in Python. **B.** Implement lane selection optimizing Pulp.	**10%**	**02**
Practical 3: Perform medical Image analysis using learning in python.	**10%**	**02**
Practical 4: A. Perform sentiment analysis of Amazon fine food reviews data. B. Perform Text analysis using python.	**25%**	**03**
Practical 5: A. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets. B. Implement RPA process for stock price collection and analysis.	**25%**	**02**

Instructional Method and Pedagogy

Lecture-based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	Acquiring the basics knowledge robotics.	Cognitive	Remember
CO2	Provide a brief understanding of drive systems and end effectors.	Cognitive	Understand
CO3	Acquire knowledge about sensors and machine	Cognitive	Understand
CO4	Provide practical experience in robotic programming.	Cognitive	Apply
CO5	Analyze the process for creating a bot.	Cognitive	Analyse

Learning Resources	
1.	**Textbook** 1. Machine Learning: A Probabilistic Perspective by Kevin P. Murpi.
2.	**Reference Books:** 1. Hastie, Tibshirani, Friedman The Elements of Statistical Learning.
3.	**Journals & Periodicals** 1.
4.	**Other Electronic Resources** 1.

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks
Continuous Evaluation Marks	Quantity of the Project/Industrial in terms of Language, Presentation & format.	30 Marks
	Practical understanding of the subject on the Project/Industrial.	30 Marks
	Industry/University mentor's feedback on the Project/Industrial.	30 Marks
	Attendance	10 Marks

Sr. No.	Course Outcomes
1.	Acquiring the basics knowledge robotics.
2.	Provide a brief understanding of drive systems and end effectors.
3.	Acquire knowledge about sensors and machine
4.	Provide practical experience in robotic programming.
5.	Analyze the process for creating a bot.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	0	1	1	3	0	0	0	1	2	2	1	0
CO2	3	1	2	1	2	0	0	0	0	0	1	2
CO3	3	1	2	1	1	0	0	0	0	0	1	0
CO4	3	3	3	2	2	1	0	0	2	1	2	0
CO5	2	3	2	2	2	1	0	1	1	0	0	1

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	2	3	0
CO2	2	2	2
CO3	1	1	1
CO4	3	3	3
CO5	3	2	2

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS706	Course Name Industry 4.0 And Application Areas	Semester VII

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Python Programming, Fundamentals of IoT.
Course Category	Professional Elective courses
Course focus	Skill development
Rationale	Industry 4.0, also known as the Fourth Industrial Revolution, is a paradigm shift in manufacturing and production processes driven by digital technologies. Its rationale lies in the transformative potential to optimize efficiency, productivity, and competitiveness across various industries. By integrating technologies like the Internet of Things (IoT), artificial intelligence (AI), big data analytics, and automation, Industry 4.0 enables smart factories and supply chains. Application areas encompass manufacturing, logistics, energy, healthcare, agriculture, and more. It brings benefits such as predictive maintenance, real-time monitoring, autonomous systems, data-driven decision-making, and personalized production. Industry 4.0 revolutionizes processes, improves resource utilization, reduces costs, and enhances agility, enabling businesses to adapt and thrive in an increasingly digital and interconnected world.
Course Revision / Approval Date	24/1/2022

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Able to know about Industry 4.0 and its scope, its building blocks, its applications and advantages compared to conventional production techniques. **2.** Learn & Design thinking principles and its usage. **3.** Develop the skills to use Visualization software. **4.** Understand how industry 4.0 works and product development. **5.** Understand a deep insight into how intelligent processes are. **6.** big data, and artificial intelligence can be used to build up the production of the future.

Course Content	Weightage	Contact Hours
Unit 1: Introduction to Industry 4.0 Introduction, core idea of Industry 4.0, Difference between conventional automation and Industry 4.0 ,origin concept of industry 4.0,Industry 4.0 production system, current state of industry 4.0, Technologies, How is India preparing for Industry 4.0.	**20%**	**08**
Unit 2: Basic principles and technologies of a Smart Factory Basic principles and technologies of a Smart Factory of Things (IoT) & Industrial Internet of Thing(IIoT) & Internet of Services Big Data Cyber - Physical Systems Value chains in manufacturing companies Customization of products Digital Twins Cloud Computing / Cloud Manufacturing Security issues within Industry 4.0 network.	**20%**	**10**
Unit 3: Advances in Robotics in the Era of Industry 4.0 Introduction, Recent Technological Components of Robots - Advanced Sensor Technologies, Internet of Robotic Things, Cloud Robotics, & Cognitive Architecture for Cyber - Physical Robotics,Industrial Robotic Applications - Manufacturing, Maintenance & Assembly.	**20%**	**10**

Unit 4: Basics of Industrial Internet of Things (IIoT) Introduction, Industrial Internet system, Industrial process, Key enablers of IOT Business Model and Reference Architecture: IIoT - Business Models - Part I, Part II, IIoT Reference Architecture - Part I, Part II, Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT - Part I, Part II. Big Data Analytics & Software Defined Networks: SDN in IIoT - Part I, Part II, Data Center Networks, Industrial IoT Security & Fog Computing.	**20%**	**10**
Unit 5: Industrial IoT- Application Domains Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security he Role of Augmented Reality in the Age of Industry 4.0 introduction, AR Hardware and Software Technology (Including AR and VR safety applications), Facility Management. Industrial IoT- Application Domains: Oil, chemical and pharmaceutical.	**20%**	**07**

List Of Practical	Weightage	Contact Hours
Practical 1: **A.** Case study on how to prepare for industry 4.0. **B.** Preparing and publishing the article on manufacturing units driving the solution based on industry 4.0.	**20%**	**03**
Practical 2: Developing & demonstrating the model based on CPS.	**20%**	**03**
Practical 3: Developing & demonstrating the model based on CPS.	**20%**	**03**
Practical 4: **A.** Case study on IoT-business models. **B.** Case study on big data analytics and software defined networks.	**20%**	**03**

Practical 5: **A.** Case study on automobile manufacturing units. **B.** Case study on implementation of IoT in petroleum industry.	**20%**	**03**

Instructional Method and Pedagogy Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** the basic concepts of Industry 4.0.	Cognitive	Remember
CO2	**Learn** Design thinking principles and its usage.	Cognitive	Understand
CO3	**Develop** the skills to use Visualization software.	Cognitive	Apply
CO4	**Understand** how industry 4.0 works and product development.	Cognitive	Understand
CO5	**Understand** a deep insight into how intelligent processes, big data, and artificial intelligence can be used to build up the production of the future.	Cognitive	Apply

Learning Resources	
1.	**Textbook** 1. The Concept Industry 4.0: An Empirical Analysis of Technologies and Applications in Production Logistics Book by Christoph Jan Bartodziej. 2. Industry 4.0: Entrepreneurship and Structural Change in the New Digital Landscape.
2.	**Reference Books:** 1. Gibson, I, Rosen, D W., and Stucker, B., Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing, Springer. 2. Bartolo, P J (editor), Virtual and Rapid Manufacturing: Advanced Research in Virtual and Rapid Prototyping, Taylor and Francis. 3. Hopkinson, N, Haque, R., and Dickens, P., Rapid Manufacturing: An

	Industrial Revolution for a Digital Age: An Industrial Revolution for the Digital Age, Wiley.
3.	**Journals & Periodicals** **1.**
4.	**Other Electronic Resources** **1.** https://nptel.ac.in/courses/106105195/

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks
Project/Industrial Internship Marks	Quantity of the project/ industrial in teams of language, presentation & format	30 marks
	Practical understanding of the subject on the project / Industrial.	30 marks
	Industrial / university mentor's feedback on the project/industrial	30 marks

	Attendance	10 marks

Sr. No.	Course Outcomes
1.	**Understand** the basic concepts of Industry 4.0.
2.	**Learn** Design thinking principles and its usage.
3.	**Develop** the skills to use Visualization software.
4.	**Understand** how industry 4.0 works and product development.
5.	**Understand** a deep insight into how intelligent processes, big data, and artificial intelligence can be used to build up the production of the future.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	2	0	0	0	0	0	0	0	0
CO2	2	2	2	1	1	0	0	0	0	1	1	0
CO3	3	3	3	3	3	2	2	2	2	1	1	1
CO4	2	2	2	2	2	1	0	2	2	1	0	0
CO5	3	2	2	2	2	1	1	0	2	1	0	0

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	3	2	0
CO2	2	3	1
CO3	0	3	2
CO4	1	2	1
CO5	2	1	3

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS707	Course Name Vulnerability & Risk Management	Semester VII

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Fundamentals of Cyber Security
Course Category	Professional Elective courses
Course focus	Skill development
Rationale	Risk management is essential in today's complex and unpredictable business landscape. Its rationale lies in the proactive identification, assessment, & mitigation of risks to protect organizations & their stakeholders. By implementing robust risk management processes, businesses can minimize potential threats, seize opportunities, & enhance decision - making. Effective risk management enables the identification of potential risks, evaluation of their potential impact, & implementation of strategies to mitigate or transfer risks. It promotes organizational resilience, safeguards assets, ensures compliance with regulations, and maintains stakeholder confidence. Risk management helps businesses navigate uncertainties, anticipate challenges, and adapt to changing market conditions, ultimately reducing losses, enhancing performance, and fostering sustainable growth.
Course Revision / Approval Date	30/05/2025

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Understand and Differentiate between vulnerability assessment, management, and mitigation. **2.** Employ the Vulnerability Assessment Framework in hands-on example. **3.** Apply industry - standard security tools to carry out a vulnerability assessment. **4.** Apply the output of various tools to make recommendations and remediate vulnerabilities. **5.** Discuss shortfall of many vulnerability assessment programs.

Course Content	Weightage	Contact Hours
Unit 1: Introduction to IT-security, Risk and Vulnerability IT-security: **1.** Standards, **2.** Requirements, **3.** Risk, **4.** Threat, **5.** Vulnerability; **a.** Identification, **b.** Analysis, **c.** Evaluation, **d.** Management models; Impact of vulnerabilities, Types of attacks on Confidentiality, Integrity and Availability; Malware: Viruses, Worms, Trojan horses security Countermeasures; Intrusion Detection, Antivirus Software.	**20%**	**09**
Unit 2: Intrusion Detection & Prevention system intrusion Detection System: Types, tools, needs and challenges Intrusion Prevention System: Types; Wireless Network Analysis, Packet Analysis, Malware Analysis.	**20%**	**09**

Unit 3: Vulnerability Assessment and Penetration Testing (VPAT) Introduction, Benefits, Methodology, Vulnerability Assessment, Reasons for Vulnerability Existence, Steps for Vulnerability Analysis, Web Application Vulnerabilities, Working of Vulnerability Assessment Tool, Penetration Testing, Penetration Testing Method, Report Preparation, Vulnerability Assessment vs Penetration Testing.	**20%**	**09**
Unit 4: Cyber Incident Handling and Reporting Cyber security Incident Management; Incidence Handling; Coordination & Information Sharing; Containment, Eradication, and Recovery. Advanced Penetration Testing: Red Team Operations, Blue team operations, Purple Teaming, Breach Attack Simulation, Bug Bounty Program, Guidelines for Penetration Testers, Gaining written permission, Non-disclosure agreements, Rules of engagement, Penetration Testing Report Writing	**20%**	**09**
Unit 5: Cyber Security Laws and Standards Basic IT-security risk treatment methods; Applicable IT-security standards for the IT - security risk management; Security Audit ,Investigation by Investing Agency; Indian IT Act - 2000; NIST Cyber Security Framework, ISO 27001/2, ISO/IEC 27005:2018, ISO 9001:2015, PCI DSS, SOC2, GDPR, FISMA, HIPAA etc. **Introduction to Ethical Hacking:** Footprint and Reconnaissance, System Hacking, Sniffing, Denial of Service, Hacking Web Servers, SQL Injection, Enumeration, Session Hijacking, Hacking Web Applications, Hacking Wireless Networks	**20%**	**09**

List Of Practical	Weightage	Contact Hours

Practical 1: **A.** Define risk and vulnerability in the context of energy production, environmental disaster and business sustainability relevant to commercial management. **B.** Study of the different requirements and standards for risk management **C.** Employ the Vulnerability Assessment Framework **D.** Identify Threats & Vulnerabilities in an IT Infrastructure.	**20%**	**03**
Practical 2: **A.** Implement and monitor appropriate management techniques relevant to specific situations. **B.** Implement the Intrusion Prevention System with Wireless Network Analysis, Packet Analysis.	**20%**	**03**
Practical 3: **A.** Use the output of various tools to make recommendation & remediate vulnerabilities programs. **B.** Study & carry out the Industry - standard security tools to carry out a vulnerability assessment.	**20%**	**03**
Practical 4: **A.** Identifying, analyzing, evaluating, & prioritizing various risks and vulnerabilities . **B.** Identify & implement the actions required to prevent the incident or event from spreading across the network.	**20%**	**03**
Practical 5: **A.** Study & analysis of IT -security risk treatment methods. **B.** Develop a Risk Mitigation Plan Outline for an IT Infrastructure.	**20%**	**03**

Instructional Method and Pedagogy

Lecture - based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Understand** risk and vulnerability in the context of energy production, environmental disaster to commercial management projects.	Cognitive	Understand
CO2	**Analyse** risk assessment & mitigation strategies in specific situations.	Cognitive	Analyze
CO3	**Understand** risk transference and vulnerability driven management decisions.	Cognitive	Understand
CO4	**Implement** & monitor appropriate management techniques relevant to specific situations.	Cognitive	Apply
CO5	**Understand** the shortfalls of many vulnerability assessment programs.	Cognitive	Understand

Learning Resources	
1.	**Textbook** **1.** McClure, S., Scambray, J. and Kurtz, G., 2012. Hacking Exposed 7 Network Security Secrets and Solutions. New York: McGraw - Hill. **2.** Engebretson, P., 2013. The Basics Of Hacking And Penetration Testing. Amsterdam: Syngress, an imprint of Elsevier.
2.	**Reference Books:** **1.** The Art of Software Security Assessment - Identifying & Preventing Software Vulnerabilities.
3.	**Journals & Periodicals** **1.**
4.	**Other Electronic Resources** **1.**

Evaluation Scheme		Total Marks 150
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks
Continuous Evaluation Marks	Quantity of the Project / Industrial in terms of Language, Presentation & format.	30 Marks
	Practical understanding of the subject on the Project / Industrial.	30 Marks
	Industry / University mentor's feedback on the Project / Industrial.	30 Marks
	Attendance	10 marks

Sr. No.	Course Outcomes
1.	**Understand** risk and vulnerability in the context of energy production, environmental disaster to commercial management projects.
2.	**Analyse** risk assessment & mitigation strategies in specific situations.
3.	**Understand** risk transference and vulnerability driven management decisions.
4.	**Implement** & monitor appropriate management techniques relevant to specific situations.
5.	**Understand** the shortfalls of many vulnerability assessment programs.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	0	0	0	0	0	1	0	0	1	1
CO2	1	2	0	1	0	0	2	1	1	0	1	1
CO3	1	1	0	0	0	0	0	1	0	0	1	1
CO4	1	2	2	2	1	0	2	1	2	0	1	1
CO5	1	1	0	0	0	0	0	1	1	0	1	1

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	3	0	0
CO2	3	2	3
CO3	3	0	2
CO4	3	0	0
CO5	3	0	0

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Course Code BTCS708	Course Name Digital Forensics, Investigation & Response	Semester VII

Teaching Scheme (Hours)				Teaching Credit			
Lecture	Practical	Tutorial	Total	Lecture	Practical	Tutorial	Credits
3	2	0	5	3	1	0	4

Course Prerequisites	Cryptography, Cyber Security
Course Category	Professional Elective courses
Course focus	Skill development
Rationale	Digital forensics, investigation, and response play a crucial role in today's digital world where cyber threats are prevalent. The rationale behind these practices lies in their ability to identify, analyze, and respond to digital incidents and crimes. Digital forensics involves collecting and preserving digital evidence, which can be crucial in criminal investigations, litigation, and cybersecurity incidents. Investigation and response help in uncovering the root causes of security breaches, identifying perpetrators, and preventing future attacks. These practices aid in incident response planning, recovery, and remediation, ensuring the integrity, confidentiality, and availability of digital assets. By leveraging digital forensics, investigation, and response, organizations can strengthen their cybersecurity posture, protect sensitive information, and mitigate potential risks associated with cybercrime & digital misconduct.
Course Revision / Approval Date	

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: **1.** Define Digital forensics. **2.** Understand Web Attacks. **3.** Understand report writing **4.** Understand benefits of digital forensics **5.** Understand Incident response & Incident handling.

Course Content	Weightage	Contact Hours
Unit 1: Introduction to Digital Forensic Understand computer forensics, objective of digital forensics, Forensics readiness, Computer forensics. Investigation process, Digital evidence & first responder, Types of evidence, Types of investigation, Understanding hard disks & file systems, Data acquisition & duplication, Defeating anti - forensics technique.	**20%**	**09**
Unit 2: Digital Forensics Operating System Forensics (Windows, Linux, Mac), Network Forensics, Investigating Web Attacks, Dark Web Forensics, Database Forensics, Cloud Forensics, Investigating Email Crimes, Malware Forensics, Mobile forensics, IoT Forensics,	**20%**	**09**
Unit 3: Forensics Report Writing and Presentation Investigative reports, expert witness and cyber regulations; Create well formatted computer forensic reports, Develop reports which organize and document recovered evidence and forensic processes used; Write and publish Computer Network Defense guidance & reports on incident findings to appropriate constituencies.	**20%**	**09**
Unit 4: Incident Response Threat intelligence, Security incidents, Incident handling, Incident readiness, Security auditing, Forensic investigation, Forensic readiness and first report, Digital evidence, Anti - forensics.	**20%**	**09**

Unit 5: Incident Handling Email security handling, Application level handling, Network & mobile incident handling, Malware incident handling, Cloud incident handling, Insider incident handling.	**20%**	**09**

List Of Practical	Weightage	Contact Hours
Practical 1: **A.** Study of Computer Forensics and different tools used for forensic investigation. **B.** How to recover deleted files using a Forensic tool.	**20%**	**03**
Practical 2: **A.** Comparison of two Files for forensics investigation by Compare IT software. **B.** How to Collect Email Evidence in Victim PC. **a.** Find Last Connected USB on your system (USB Forensics). **b.** How to make the forensic image of the hard drive using EnCase Forensics. **c.** How to Restore the Evidence Image using EnCase Forensics. **C.** Extract Browser Artifacts	**20%**	**03**
Practical 3: **A.** How to Extract Exchangeable image file format (EXIF) Data from Image Files using Exif Reader Software. **B.** Create a well formatted Forensic report. **C.** Create & publish Computer Network Defense guidance and reports on incident findings to appropriate constituencies.	**20%**	**03**
Practical 4: **A.** Access a sample incident response plan. **B.** Explore various Anti Forensics tools.	**20%**	**03**

Practical 5: Implement Live Forensics Case Investigation using Autopsy.	**20%**	**03**

Instructional Method and Pedagogy

Lecture - %based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning.

No:	Course Objectives	Blooms' Taxonomy Domain	Blooms' Taxonomy Subdomain
CO1	**Acquire** knowledge of various digital forensic tools.	Cognitive	Understand
CO2	**Interpret** security issues in the Information Communication Technology (ICT) world, & apply digital forensic tools for security and investigations.	Cognitive	Understand
CO3	**Achieve** adequate perspectives of digital forensic investigation in various applications / devices like Windows / Unix system, mobile, email etc.	Cognitive	Apply
CO4	**Generate** legal evidence and supporting Investigation reports.	Cognitive	Create
CO5	**Acquire** knowledge of various digital forensic tools.	Cognitive	Understand

Learning Resources	
1.	**Textbook** 1. Handbook of Digital Forensics and Investigation, AcademicPress. 2. Digital evidence and computer crime: Forensic science, computers & the internet. Academic Press. 3. John Sammons, "The Basics of Digital Forensics, The Primer for Getting 4. Started in Digital Forensics", Syngress, 2012.
2.	**Reference Books:** 1. Cory Altheide and Harlan Carvey, "Digital Forensics with Open Source Tools", Elsevier, 2011.

3.	**Journals & Periodicals** **1.**
4.	**Other Electronic Resources** **1.**

Evaluation Scheme		**Total Marks 150**
Mid semester Marks	20	
End Semester Marks	40	
Practical Marks	Attendance	5 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	5 marks
Continuous Evaluation Marks	Attendance	5 marks
	MCQs	10 marks
	Open Book Assignment	15 marks
	Article Review	10 marks
Project / Industrial Internship Marks	Quantity of the Project / Industrial in terms of Language, Presentation & format.	30 marks
	Practical understanding of the subject on the Project / Industrial.	30 marks
	Industry / University ment or feedback on the Project / Industrial.	30 marks
	Attendance	10 marks

Sr. No.	Course Outcomes
1.	**Acquire** knowledge of various digital forensic tools.
2.	**Interpret** security issues in the Information Communication Technology (ICT) world, & apply digital forensic tools for security and investigations.
3.	**Achieve** adequate perspectives of digital forensic investigation in various applications / devices like Windows / Unix system, mobile, email etc.
4.	**Generate** legal evidence and supporting Investigation reports.
5.	**Acquire** knowledge of various digital forensic tools.

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	1	2	0	1	0	0	1	0	0
CO2	1	0	1	1	2	0	0	1	0	0	2	2
CO3	3	3	3	3	0	0	0	0	0	0	0	0
CO4	2	1	2	1	2	2	0	1	2	0	3	3
CO5	1	0	1	1	2	0	0	1	0	0	2	2

Mapping of PSOs & COs

	PSO1	PSO2	PSO3
CO1	1	3	1
CO2	1	1	1
CO3	3	2	3
CO4	1	3	3
CO5	1	3	1

1: Slight (low); 2: Moderate (Medium); 3: Substantial (High); 0: None

Teaching Scheme

Semester – VII B.Tech Computer Science & Engineering

Sr. No.	Course Code	Course Name	Teaching Scheme (Hours / week)				Teaching Credit			
			L	P	T	Total	L	P	T	Total
1.	BTCS801	Major Project	0	30	0	30	0	10	0	15
Total			**0**	**30**	**0**	**30**	**0**	**10**	**0**	**15**

Note

L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester

Sr. No.	Course Code	Course Name	Teaching Scheme (Hours / week) Teaching Credit					
			Theory MS Marks	Theory CEC Marks	Theory ES Marks	Theory Marks	Practical Marks	Total Marks
1.	BTCS801	Major Project	0	0	0	0	100	100
Total			**0**	**0**	**0**	**0**	**100**	**100**

Note

L = Lecture, P = Practice, T= Tutorial, MS - Mid Semester, CEC - Continuous Evaluation Component, ES - End Semester