GSFC UNIVERSITY
EDUCATION RE-ENVISIONED
An ISO 9001:2015 Certified

COURSE CURRICULUM

B.Tech. Computer Science & Engineering

Batch:2022-2023
Academic Year: 2023-24
Updated on: July, 2023

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 learning ecosystem with flexible processes & systems.
- Holistic growth for industry readiness.

No.	Programme Outcomes (POs)	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
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 Sub Domain
PSO1	Preparing the students who can design, implement and evaluate computing-based solutions for industrial and societal requirements by laying 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:

	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	1 credit
1 Hour Tutorial (T) per week	1 credit
4 Hours Practical (P) per week	2 credit
2 Hours Practical (P) per week	1 credit
1 Hour Practical (P) per week	0.5 credit
3 Hours Experiential learning	1 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, IndustrialVisit, 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 and 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	2
7	Project work, seminar and internship	30
	Total	**177**

Category-wise Courses:

Humanities & Social Sciences Courses

i. Number of Humanities & Social Science Courses: 7
ii. 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	2	0	0	0	2
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									**14**

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

Basic Science Course

i. Number of Basic Science Course: 3
ii. 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	4
2	BTPY105	Engineering Physics	I	3	2	0	5	3	1	0	4
3	BTCS204	Mathematics - II	II	3	0	1	4	3	0	1	4
		Total				**13**					**12**

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

Engineering Science Course

i. Number of Professional Core Courses: 5
ii. 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 and 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 & 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					**19**				**15**

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

Professional Core Courses

iii. Number of Professional Core Courses: 17
iv. Credits: 68

Sr. No.	Course Code	Course Name	Sem	Teaching Scheme (Hours/week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1	BTCS201	Object Oriented Programming with C++	II	3	2	0	5	3	1	0	4
2	BTCS202	Data Structures & Algorithms	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									**68**

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Professional Elective Courses-

(i) Number of Professional Elective Course: 9
(ii) 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 and Protocols									

	BTCS507	Specialized Track Elective -III -Network security and access control									
4	BTCS604	Specialized Track Elecive I -Deep Learning	VI	3	2	0	5	3	1	0	4
	BTCS606	Specialized Track Elective-I -Big Data Architecture and 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 Elctive-III - Platform & Application security principles	VI	3	2	0	5	3	1	0	4
	BTCS609	Specialized Track Elctive -III - Wireless and 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 and 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 and response									
		Total									**36**

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Open Elective Courses:

i. Number of Open Elective Courses: 01

ii. Credits: 02

Sr. No.	Course Code	Course Name	Semester	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**

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

Project Work, Seminar and Internship In Industry Or Elsewhere

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

Sr. No.	Course Code	Course Name	Semester	Teaching Scheme (Hours/week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1	BTCS109	Industrial Internship	I	0	0	0	0	0	0	0	2
2	BTCS208	Industrial Internship	II	0	0	0	0	0	0	0	2
3	BTCS306	Industrial Internship	III	0	0	0	0	0	0	0	2
4	BTCS407	Industrial Internship	IV	0	0	0	0	0	0	0	2
5	BTCS506	Industrial Internship	V	0	0	0	0	0	0	0	2
6	BTCS610	Minor Project - I	VI	0	6	0	6	0	3	0	3
7	BTCS611	Industrial Internship	VI	0	0	0	0	0	0	0	2
8	BTCS709	Minor Project - II	VII	0	6	0	6	0	3	0	3
9	BTCS710	Industrial Internship	VII	0	0	0	0	0	0	0	2
10	BTCS801	Major Project/ Industry Internship	VIII	0	20	0	20	0	10	0	10
		Total									**30**

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Ability Enhancement Courses

i. Number of Ability Enhancement Courses: 7
ii. Credits: 14

Sr. No.	Course Code	Course Name	Semester	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	2	0	0	0	2
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									**14**

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

Skill Enhancement Compulsory/Elective Courses

i. Number of Skill Enhancement Courses: 6
ii. Credits: 16

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

Value Added Courses

i. Number of Skill Enhancement Courses: 2
ii. Credits: 2

Sr. No.	Course Code	Course Name	Semester	Teaching Scheme (Hours/week)				Teaching Credit			
				L	P	T	Total	L	P	T	Total
1	SECC101	Foundation Course	I	0	0	0	2	0	0	0	2
		Total									**2**

Research Project / Dissertation(must for the research students)

i. Number of Skill Enhancement Courses: 6
ii. Credits: 16

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

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				Evaluation Scheme					
			L	P	T	Total	L	P	T	Total	Theory: MS Marks	Theory: CEC Marks	Theory: ES Marks	Theory Marks	Practical Marks	Total Marks
1	BTEC101	Basics of Electrical & Electronics	3	2	0	5	3	2	0	4	20	40	40	100	50	150
2	BTMA103	Mathematics – I	3	0	1	4	3	0	1	4	20	40	40	100	0	100
3	BTCS104	Computer Programming	3	2	0	5	3	2	0	4	20	40	40	100	50	150
4	BTPY105	Engineering Physics	3	2	0	5	3	2	0	4	20	40	40	100	50	150
5	BTCS106	ICT Workshop	0	2	0	2	0	2	0	1	0	0	0	0	50	50
6	BTFS108	Fundamentals in Fire & Environment, Health, Safety	2	0	0	2	2	0	0	2	0	0	0	0	0	P/F
7	AECC101	Fundamentals of English	2	0	0	2	2	0	0	2	20	40	40	100	0	100
8	SECC101	Foundation Course	0	0	0	0	0	0	0	4	0	0	0	0	100	100
		Total	**16**	**08**	**1**	**25**	**14**	**10**	**1**	**25**						**850**

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

COURSE CODE BTEC101	COURSE NAME BASIC OF ELECTRICAL AND ELECTRONICS	SEMESTER I

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	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	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 (Theory)	Weightage	Contact hours
Unit 1: Electrical Engineering **Theory:** 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. **Theory:** 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 **Theory:** 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 **Theory:** Introduction of electronic components like diodes, LED's, transistors, O Amps, Gates Industrial specification and data sheets of the components. Characteristics and usage of the components. Signals: Analog & Digital. Introduction to industrial data acquisition.	**20%**	**10**
Unit 5:Test Equipment **Theory:** Introduction to Multimeter and Oscilloscope.	**10%**	**5**

List Of Practical	Weightage	Contact hours
1. Symbols of Electrical & Electronics equipment, Basics of Electrical safety & Study of Electrical Safety rules	**20%**	**3**
2. Patch cords, Digital Multimeter (DMM), Familiarization with Digital multimeter(DMM).	**20%**	**3**
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%**	**3**
4. Study the basics of phase control transformer & verify its turn-ratio, Familiarization with Digital Storage Oscilloscope (DSO)	**20%**	**3**
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%**	**3**

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.

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to:		
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.L., Calculus and Analytic Geometry, 9th Ed.,Wesley/Narosa, (1998).
2.	Journals & Periodicals: 1. Journal of Electrical Engineering and Electronics 2. IET Power Electronics 3. International Journal of Electronics 4. IEEE Transactions on Education:
3.	Other Electronic Resources: 1. www.electronicsclub.info 2. www.circuitlab.com

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
Article Review	10 marks
Total	**40 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	2	0	0
CO2	0	3	0
CO3	0	2	0
CO4	0	0	1
CO5	0	0	3

Mapping of POs & Cos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
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

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

Course Pre-requisites	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)	1. Gives a clear **understanding** of the ideas of calculus as a solid foundation for subsequent courses in mathematics and other disciplines. 2. **Comprehensive** focus on teaching calculus based on concepts as well as procedures. 3. Enables students to apply their **knowledge** and solve practical problems in physical sciences and engineering. 4. **Understanding** basic concepts of linear algebra (systems of linear equations, matrix calculus, vectors and basic vector operations) 5. **Solving** computational problems of linear algebra

Course Content (Theory)	Weightage	Contact hours
Unit 1: **Theory:** Review of limits, continuity, and differentiability of function of single variable; indeterminate forms and 'Hospital's Rule.	**20%**	**07**
Unit 2: **Theory:** 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: **Theory:**Limit and continuity of functions of two variables, chain rule, total derivatives, Taylor's series expansion of function of two variables.	**20%**	**10**
Unit4:Applications of Partial Derivatives:Theory: Maxima and minima, Lagrange multipliers, errors and approximation, implicit functions, tangent plane and normal to a surface.	**20%**	**08**
Unit 5: Linear Algebra: **Theory:** Elementary operations and their use in getting the Rank, Inverse of a matrix and solution of linearsimultaneous equations. Orthogonal, Symmetric, Skew-symmetric, Hermitian, Skew- Hermitian, Normal & amp; Unitary matrices and their elementary properties. Characteristic polynomials, Eigen- values and Eigenvectors of a matrix, Cayley Hamiltontheorem (without proof) and its use in finding the inverse of a matrix. Applications of Matrices.	**20%**	**10**

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

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.

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
CO1: **Apply** the concepts of limits, continuity and derivatives to solve problems.	Cognitive	Understand
CO2: **Determine** convergence or divergence of sequences and series	Cognitive	Understand
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** manners.	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
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	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

COURSE CODE **BTCS104**	**COURSE NAME** **COMPUTER PROGRAMMING-I**	**SEMESTER** **I**

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	**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 array and string which will help them to create applications in C. 3:To **familiarise** students with functions and pointers. 4: To give **brief** idea about structures in c programming 5:To gain **knowledge** about file handling using c language.

Course Content (Theory)	Weightage	Contact hours
Unit 1: Introduction to programming paradigms Structure of C program -C programming: Data Types, Storage Classes, Constants, EnumerationConstants, Keywords, Operators **,**Precedence and Associativity,**,**Expressions, Input / Output statements,Assignment statements, Decision making statements, control structure	**20%**	**09**
Unit 2:ARRAYS AND STRINGS Theory: Introduction to Arrays: Declaration, Initialization, One dimensional array, two dimensional arrays. Addition scaling determinant and Transpose, stein operation:- length, compare, concatenate, copy, bubble sort, linear and binary search.	**20%**	**09**

Unit 3:FUNCTIONS AND POINTERS **Theory:** Introduction to functions: Function prototype, function definition, function call, Built-in functions (string functions, math functions), Recursion, Pointer, pointer operators, Pointer arithmetic: Arrays and pointers, Array of pointers, Parameter passing: Pass by value, Pass by reference	**20%**	**09**
Unit 4:STRUCTURES **Theory:** 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 **Theory:**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

1: (1) Program to print "Hello GSFC University". (2) Program to find the sum of the 2 numbers. (3)Program to find area and circumference of the circle. (4) Program to find simple interest. (5) Program to convert degree centigrade to Fahrenheit. (5) Program to calculate sum of 5 objects and print average. (6) Program to show swapping of 2 numbers without using the third variable. (7) Program to show swapping of 2 numbers using a third variable. B. Control Structures: IF, Switch, Loops (8) Program to show reverse of given number. (9)Program to find greatest among 3 numbers. (10)Repeat program10 with conditional operator. (11)Program to find that entered year is Leap year or not. (12)Program to find the given number is even or odd. (13)Program to use Switch statement, Display percentage of student. (14)Program to display arithmetic operations using Switch. (15)Program to display first 15 natural numbers and their sum using For Loop. (16)Program to print Patterns (17)Program to print Fibonacci series till 40. (18)Program to find factorial of given number. (19)Program to find whether a given number is prime or not.	**20%**	**6**
2: (20)Program to create an array of 10 elements. Show the sum and average of 10 elements entered by the user. (21) Program to find maximum number in given Array. (22) Program to display matrix. (23)Program to find sum of two Matrices. (24)Program to find subtraction of two matrices. (25)Program to find multiplication of two matrices.	**20%**	**6**

3: (26)Program to find factorial of given number using function. (27) Program to show table of given number using function. (28)Program to show call by value. (29) Program to show call by reference. 36. Program to find the largest among two using functions. (30) Write a program to show how similar name variables can be used in different functions. (31) Write a program to return more than one value from a function. (32) Program for passing array from main function to display function. (33) Write a program in C to show the basic declaration of pointer. (34) Write a program in C to demonstrate how to handle the pointers in the program. (35) Write a program in C to demonstrate the use of &(address of) and *(value at address) operator. (36) Write a program in C to add two numbers using pointers. (37) Write a program in C to add numbers using call by reference. (38) Write a program in C to store n elements in an array and print the elements using a pointer.	**20%**	**6**
4: (38) Write a program to demonstrate declaration of structures. (39) Write a program to store student information using Structure. (40)Write a program to add two distances. (41)Write a program to store 10 student's information using structures. (42)Write a program to demonstrate nested structures. (43) Write a program to demonstrate how pointers will be used to create and access structure	**20%**	**6**
5: (44)Write a program to create a file and store information. (45)Write a program to read contents from a file. (46)Write a program to append content at the end of file.	**20%**	**6**

Instructional Method and Pedagogy:C programming, an effective instructional method involves a combination of hands-on programming, step-by-step guidance, code review and feedback, collaborative learning, and real-world application. Engage students in practical coding exercises and projects, breaking down complex concepts into manageable steps.

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
CO1: Gain basic understanding of basic components of programming language.	Cognitive	Understand
CO2: Understand any other programming language with the knowledge of array and string.	Cognitive	Understand
CO3: Apply function concepts in real time applications.	Cognitive	Apply
CO4: Analyse working of structure in c or other programming language programs.	Cognitive	Analyse
CO5: Students will be able to develop applications using C Programming	Cognitive	Apply

Learning Resources	
1.	Reference Books: 1. "The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie: 2. "C Programming Absolute Beginner's Guide" by Greg Perry and Dean Miller:
2.	Journals & Periodicals: 1. ACM Transactions on Programming Languages and Systems 2. IEEE Transactions on Software Engineering
3.	Other Electronic Resources: 1. https://www.gnu.org/software/libc/manual/ 2. https://www.learn-c.org/

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	

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

Mapping of POs & Cos

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
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

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

COURSE CODE BTPY 105	COURSE NAME ENGINEERING PHYSICS	SEMESTER I

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	**NIL**
Course Category	Basic 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 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 (Theory)	Weightage	Contact hours

Unit 1: Noise and Vibrations Theory: 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 Theory: 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 **Theory:** 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 **Theory:** 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:Unit 5: Quantum Physics **Theory:** Black body radiation and concept of Photons, Photoelectric effect, de Broglie hypothesis, wave-particleduality, Interpretation of wave-function, Uncertainty relations, Schrodinger's wave-equation, Particle in a box.	**20%**	**08**

List Of Practical	Weightage	Contact hours
1: (1)To determine the frequency of vibrations on a string using Melde's experiment (2)To determine the frequency of the A.C. mains source using a Sonometer	**20%**	**8**

2: (3)To determine magnetic hysteresis Properties of ferromagnetic materials. (4)To find the horizontal component of earth's magnetic field using a tangent galvanometer (5)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**
3: (6) To determine the wavelength of Monochromatic source using diffraction gratings. (7) To determine the dispersive power of a grating. (8) To determine wavelength of light using Newton's rings setup. (9) To determine refractive index of liquids using Newton's Ring (Virtual Lab)	**20%**	**8**
4: (10) To determine the specific rotation of sugar using a polarimeter (using setup/virtual lab).	**20%**	**4**
5: (11) To determine Planck's constant using photoelectric effect setup. (12) To determine 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.

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

After successful completion of the above course, students will be able to:		
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 and working of lasers	Cognitive	Analyse
CO5. To embrace the concept of quantum physics and have a basic understanding of its principles.	Cognitive	Apply

Learning Resources	
1.	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.
2.	Journals & Periodicals: 1. IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control 2. Journal of Magnetism and Magnetic Materials:
3.	Other Electronic Resources: 1. phet.colorado.edu 2. openstax.org

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	

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

Mapping of POs & COs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
0	2	0	2	0	1	0	1

Course Pre-requisites	**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 system 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 (Theory)	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
1: Computer Assemble & Dissemble	**20%**	**6**
2: (1) Installation of Virtual Machine. (2)Installation of Operating System (Windows10,11 & Linux)	**20%**	**6**
3: (1) Auto fill out Invoice (2) Auto fill out Marksheet	**20%**	**6**
4:Make ICT workshop Google Slider PPT	**20%**	**6**
5: Installation of Security Tools.	**20%**	**6**

Instructional Method and Pedagogy: The instructional methods and pedagogies for teaching ICT involve a combination of theoretical knowledge and practical application**.**

Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to:		
CO1. Upon completion of this laboratory course, students will be able to read and 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.	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).
2.	Journals & Periodicals: 1. Journal of Information Technology 2. ACM Transactions on Computer-Human Interaction 3. Journal of Computer-Mediated Communication"
3.	Other Electronic Resources: Online Professional Development Courses: Websites like LinkedIn Learning, Udemy, and Coursera offer online courses specifically designed for professional development in ICT.

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	

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

Mapping of POs & Cos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
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

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

COURSE CODE BTFS108	COURSE NAME FUNDAMENTALS OF FIRE, SAFETY, HEALTH &ENVIRONMENT	SEMESTER I

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

Course Pre-requisites	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 the student 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 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 (Theory)	Weightage	Contact hours
Unit 1: Theory: Challenges to safety in 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%**	**8**
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 central theme in safety. Concept of accident prevention, occupational health and environmental protection. Problems of Industrial safety, occupational health and environmental pollution & 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.	**20%**	**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.

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

After successful completion of the above course, students will be able to:		
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 attitude towards safety.	Cognitive	Learn
CO3. Students will become familiar with the history and development of fire & safety legislation, their current formand 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 fireand 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: OSHA, NFPA ,EPA Provides information on environmental regulations, guidelines, and resources.

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	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	**2**	**1**	**1**
CO2	2	2	1
CO3	1	1	0
CO4	1	2	0
CO5	0	2	0

Mapping of POs & COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
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

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

Teaching Scheme
Semester – II B. Tech. Computer Science & Engineering

Sr. No.	Course Code	Course Name	Teaching Scheme (Hours/week)				Teaching Credit				Evaluation Scheme					
			L	P	T	Total	L	P	T	Total	Theory: MS Marks	Theory: CEC Marks	Theory: ES Marks	Theory Marks	Practical Marks	Total Marks
1	BTCE201	Object oriented Programming with C++	3	2	0	5	3	2	0	4	20	40	40	100	50	150
2	BTCE202	Data Structures & Algorithms	3	2	0	5	3	2	0	4	20	40	40	100	50	150
3	BTCE203	Web Technologies	3	2	0	5	3	2	0	4	20	40	40	100	50	150
4	BTCE204	Mathematics - II	3	0	1	4	3	0	1	4	20	40	40	100	0	100
5	BTCE205	Digital Electronics	3	2	0	5	3	2	0	4	20	40	40	100	50	150
6	AECC201	Communication Skills in English	2	0	0	2	2	0	0	2	20	40	40	100	0	100
7	BTCS206	Industrial Internship	0	0	0	0	0	2	0	2	0	0	0	0	100	100
		Total	**17**	**8**	**01**	**24**	**17**	**10**	**01**	**24**						**900**

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

COURSE CODE BTCE201	COURSE NAME OBJECT ORIENTED PROGRAMMING WITH C++	SEMESTER II

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	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 O-O based programming language. 2. Be **familiar** with class and object with function. 3. **Understand** working and importance of constructor and destructor. 4. Get **brief idea** about inheritance. 5. Get an **overview** of file handling and templates.

Course Content (Theory)	Weightage	Contact hours
Unit 1: Principles of OOP: Programming Paradigms, Basic concepts, Benefits of OOP, Applications of OOP. Introduction to C++, History of C++, Structure of C++,	**20%**	**9**

Basic data types, Derived data types, Symbolic constants.Dynamic initialization, Type modifiers, Type Casting, Operator and control statements, Input and Output statements in C++.		
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, call by reference, Return by reference, Inline functions, Default arguments, Overloaded function.	**20%**	**9**
Unit 3: Array of objects, pointers to objects, this pointer, Dynamic allocation operators, Dynamic objects. Constructors, parameterized constructors, Overloaded constructors, Constructors with default arguments, copy constructors, static class members and static objects. Operator Overloading, Overloading unary and binary operator, Overloading the operator using friend function, stream operator overloading, data conversion.	**20%**	**9**
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, principle of Exception handling, Exception handling mechanism, multiple catch, Nested try, Rethrowing the exception.	**20%**	**9**
Unit 5: Streams in C++, Stream classes, Formatted and Unformatted data, manipulators User defined manipulators, file streams, file pointer manipulation, file open and close. Templates, Template functions and Template classes.	**20%**	**9**

List Of Practical	Weightage	Contact hours
1: 1. Write a program to demonstrate simple C++ structure with help of cout and cin.	**20%**	**4**

2. Write a program to demonstrate cascading I/O. Explain the use of name 3. space in C++ with proper examples. 4. Write a different program to demonstrate control statement available in C++. 5. Write a different program to demonstrate loops available in C++.		
2: 1. Write a program to demonstrate scope resolution operators and reference variables in C++. 2. Write a program to demonstrate implicit type casting and explicit type casting in C++. 3. Write a program to demonstrate const keyword and #define. 4. Write a program to demonstrate different types of user defined function and Function call 5. Write a program to demonstrate class and object creation. Define a member function inside the class and outside the class. 6. Write a program to show the working of different access specifiers . 7. What do you understand about the Inline function? How can you create an Inline function ?	**20%**	**6**
3: 1. Why do an array of objects require? Demonstrate an array of object with proper example. 2. Write a program to demonstrate concepts and different types of constructor. 3. Write difference between Constructor overloading and overriding. Also apply the concept with proper examples. 4. Write a program to demonstrate friend function. 5. Write a program to demonstrate the concept of copy constructor and static class member.	**20%**	**6**
4: 1. Write a program to demonstrate different type of inheritances 2. Write a program to demonstrate the concept of polymorphism and exception handling	**20%**	**8**

3. Explain the behavior of the constructor in derived class using examples.		
5: Perform following operation of file management • Count characters & spaces • Append to a file • Copy contents & change case • Merge two files • Count characters, words & lines • Arrange records in descending order • Add & read contents of file • Create file to store employee details • Display content of file	**20%**	**4**

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

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to: CO1: **Understand** object-oriented programming features in C++.	Cognitive	Understand
CO2: **Implement** computer programs to solve real world problems based on object-oriented principles		Apply
CO3:**Understand** the concept of Array, pointers and Polymorphism.		Understand
CO4: **Analyse** concept of inheritance and exception handling		Analyse
CO5:**Develop** the applications using object oriented programming with C++		Create

Learning Resources	
1.	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
2.	Video Tutorial https://www.studytonight.com/courses/cpp-video-tutorial/
3.	NPTEL MOOC **https://nptel.ac.in/courses/106/101/106101208/**

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

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

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

COURSE CODE BTCE202	COURSE NAME DATA STRUCTURES AND ALGORITHMS	SEMESTER II

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	NIL
Course Category	Mandatory courses
Course focus	Skill development
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 the student to: 1 To get an **idea** about data and how it is stored in memory structure. 2 To **aware** students about array 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 (Theory)	Weightage	Contact hours
Unit 1: Introduction to Data Structures & Algorithms: Arrays and Strings, AlgorithmDevelopment, Complexity analysis, Recursion.	**20%**	**9**
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%**	**9**
Unit 3: Sorting & Searching: Insertion Sort, Merge Sort, Quick Sort, Binary Search, Linear Search, Selection Sort	**20%**	**9**
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, AVI-trees, B-tree, External Search.	**20%**	**9**
Unit 5: Hashing Techniques, String algorithms: Hashing Techniques, Pattern Matching, Text Editor	**10%**	**4**

List Of Practical	Weightage	Contact hours

1: Introduction to dynamic memory allocation. DMA functions malloc(), calloc(), free() etc.	**20%**	**4**
2: 1. Implement a program for stack that performs following operation using array. a. PUSH b. POP c. PEEP d. CHANGE e. DISPLAY 2. Implementation a program to convert infix notation to postfix notation using stack. 3. Write a program to implement QUEUE using arrays that performs following operations: a. INSERT b. DELETE c. DISPLAY 4. Write a program to implement Circular Queue using arrays that performs following operations: a. INSERT b. DELETE c. DISPLAY 5. Write a menu driven program to implement following operations on singly linked list. a. Insert a node at the front of the linked list b. Insert a node at the end of the linked list. c. Insert a node such that linked list is in ascending order. d. Delete a first node of a linked list. e) Delete a node before specified position. 6. Delete a node after Specified position. 7. Write a program to implement stack using linked list	**20%**	**10**
3: 1. Write a program to implement linear search 2. Write a Program to implement Binary Search 3. Write a program to implement, Bubble sort, Merge sort, Quick sort 4. Write a program to create binary search tree 5. Implement recursive and non recursive tree traversing methods inorder, preorder and post order.	**20%**	**8**
4: 1. Solve various examples related to Graphs and Trees	**20%**	**4**

5: 1. Write a program to implement hashing using Linear Probe.	**10%**	**2**

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

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to: 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.		Analyse
CO3. **Implement** various data structures viz. Stacks, Queues, Linked Lists, Trees and Graphs		Apply
CO4. **Understand** various searching & sorting techniques.		Understand
CO5. **Identify** the appropriate data structure to design efficient algorithm for the given application.		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. YashwantKanetkar, 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: Data Structures and Algorithmic Puzzles, 5th Edition

2.	Video Tutorial https://www.youtube.com/playlist?list=PL2_aWCzGMAwI3W_JlcBbTwiQSsOTa6P
3.	NPTEL MOOC https://nptel.ac.in/courses/106/102/106102064/

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	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**	**PSO2**
CO1	0	1	1
CO2	0	2	1
CO3	0	3	3
CO4	0	2	3
CO5	0	2	3

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

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

COURSE CODE BTCE203	COURSE NAME WEB TECHNOLOGIES	SEMESTER II

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	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 brief **idea** about html for web page development 2. Be **aware** about CSS - to design web page 3. **Elaborate** working of JavaScript 4. **Understand** regarding how Jquery can enhance look and feel of webpage 5. **Familiarize** students with components and working of bootstrap.

Course Content (Theory)	Weightage	Contact hours
Unit 1: Introduction, Elements, Tags, Formatting, Links, Font, Images, Tables,WebForms,Frm Elements, Formatting Form Attributes, Form Input Types, Media Elements, Canvas, SVG, CSS3 Introduction, Borders, Backgrounds, Text Effects, Text, Transitions, Animations, Multiple Columns, Transforms	**20%**	**9**
Unit 2: Introduction, Operators, Function & Object, Methods, Conditional Statement & Looping Statement, Event Types	**20%**	**9**
Unit 3: Introduction, Retrieving Page Content, Manipulating Page Content, Working with Events, JQuery Animations and Effects, Using the jQuery UI PlugIns.	**20%**	**9**
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%**	**9**
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	**20%**	**9**

List Of Practical	Weightage	Contact hours
1: 1. Write a program in create a HTML page, which has properly aligned paragraphs with image, display list of items in different styles. 2. Display various text formatting tags available in HTML.(i.e.<h1>,<b>,<u> etc…), special characters. 3. Create a HTML file which displays 3 images at LEFT, RIGHT and CENTER respectively in the browser. 4. Demonstrate following attributes using CSS Color and background Font, Text, Border, Margin, hyperlinks and list 5. Demonstrate use of external style sheet.	**20%**	**6**

2: 1. To create an html page to explain the use of various predefined functions in an array & Date object in JavaScript. 2. Write a Program to show use of alert, confirm and prompt box. 3. Write JavaScript to perform the following operations: 4. to find highest from given three values 5. to calculate factorial of n 6. to calculate sum of 1 to n 7. to check whether given number is palindrome or not 8. Write a Java Script program to print current date & time	**20%**	**6**
3: 1. Develop the jQuery Program with the scripting tag. 2. Develop the jQuery Program with the event methods.	**20%**	**4**
4:Create CD Catalogue Table in XML and display it using XSL Style Sheet	**20%**	**6**
5: 1. Write a PHP script for Looping Structures 2. Write a PHP script for Switch Case statements 3. Write a PHP script for Class , objects and inheritance 4. Write a PHP script for Constructor and destructor	**20%**	**6**

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

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to: CO1: **Understand** the importance and need of client side scripting	Cognitive	Understand
CO2: **Analyze** and **Develop** static and dynamic web applications.		Analyse
CO3:**Develop** responsive websites		Create

CO4: **Apply** the jquery to enhance the creative web page.		Apply
CO5:**Apply** Bootstrap in real time web application development.		Apply

Learning Resources	
1.	Reference Books: 1. Eric Freeman, HTML 5 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**
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	

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**	**PSO2**
CO1	1	2	3
CO2	1	1	1
CO3	1	1	2
CO4	1	2	1
CO5	3	3	3

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

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

COURSE CODE BTCE204	COURSE NAME MATHEMATICS - II	SEMESTER II

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

Course Pre-requisites	Nil.
Course Category	Basic Science Courses/ Engineering Science Courses/ Mandatory courses
Course focus	-
Rationale	Mathematics-II is essential at the local, national, and international levels due to its wide-ranging applications and benefits**. Locally, it enables individuals to understand and 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 brief **idea** about distributions in mathematics. 3. To give brief **idea** about Statistical methodology.

Course Content (Theory)	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%**	**9**
Unit : 2 Distributions: Binomial, Poisson, Uniform, Exponential, Normal. Expectation and Variance (t and χ 2 excluded); Transformation of random variables (One variable); Che 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: (Max. 100 words) Visual Aids, Active Learning Strategies, Real-World Examples, Continuous Assessment

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

After successful completion of the above course, students will be able to: 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		Understand
CO3:**Apply** the statistics for testing the significance of the given large and small sample data and use time series analysis for predictions		Apply

Learning Resources	
1.	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, Schllier and Srinivasan, Schaum's Outline of Probability and Statistics, McGraw – Hill. 7. Hogg, Mckeain and Craig, Introduction to Mathematical Statistics, 7th

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**

Mapping of PSOs & COs

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

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

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

COURSE CODE BTCE205	COURSE NAME DIGITAL ELECTRONICS	SEMESTER II

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 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 aware students about number system, 2. To familiar student with Boolean algebra 3. To make student understand regarding combinational circuit 4. To elaborate sequential circuits 5. To provide knowledge about memory devices.

Course Content (Theory)	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%**	**9**
Unit 2: Binary arithmetic Boolean algebra, Venn diagram, logic gates and circuits, Minimization of logic expressions by algebraic method, Kmap method and QuineMcClauskey method	**20%**	**9**
Unit 3: Combinational circuits- adder, subtractor, encoder, decoder, comparator,multiplexer, de-multiplexer, parity generator, etc Design of combinational circuits- Programming logic devices and gate arrays	**20%**	**9**
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%**	**9**
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%**	**9**

List Of Practical	Weightage	Contact hours
1: Study of Digital Number System & Its Significance. Study of Logic Gates (Buffer, AND, OR, NOT EXOR, EXNOR, NAND & NOR) Study of Adder circuit	**25%**	**6**
2: Study of Subtrator circuit Study of Parity Bit Generator Study of Sequential logic & Flip Flops	**25%**	**6**
3:	**25%**	**6**

Study of CMOS Technology & Its Significance in Digital Electronics		
4: Project Canvas	**25%**	**8**

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

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to: CO1: **Understand** the number system	Cognitive	Understand
CO2: **Apply** Boolean algebra for K-maps		Apply
CO3:**Analyze**combinational circuits		Analyse
CO4: **Understand** working of sequential circuits**.**		Understand
CO5:Comprehend **understanding** of memory structure		Understand

Learning Resources	
1.	Reference Books: 1. Morris Mano, Digital Logic and Computer Design 2. Anandkumar, Fundamental of Digital Circuits 3. R. P. Jain, Digital Electronics
2.	Video Reference: https://www.youtube.com/playlist?list=PLBlnK6fEyqRjMH3mWf6kwqiTbT98eAOm
3.	NPTEL MOOC https://nptel.ac.in/courses/117106086/

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	

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**	**PSO2**
CO1	2	3	2
CO2	2	3	1
CO3	1	2	1
CO4	2	1	1
CO5	1	1	3

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

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				Evaluation Scheme					
			L	P	T	Total	L	P	T	Total	Theory: MS Marks	Theory: CEC Marks	Theory: ES Marks	Theory Marks	Practical Marks	Total Marks
1	BTCS301	Discrete Mathematics	3	0	1	4	3	0	1	4	20	40	40	100	0	100
2	BTCS302	Object Oriented Programming With JAVA	3	2	0	5	3	1	0	4	20	40	40	100	50	150
3	BTCS303	Operating System	3	2	0	5	3	1	0	4	20	40	40	100	50	150
4	BTCS304	Computer Organization	3	0	1	4	3	0	1	4	20	40	40	100	0	100
5	BTCS305	Specialized Track Elective-I-Python Programming	3	2	0	5	3	1	0	4	20	40	40	100	50	150
6	AECC301	Entrepreneurship Development	2	0	0	2	2	0	0	2	20	40	40	100	0	100
7	BTCS306	Industrial Internship	0	0	0	0	0	2	0	2	0	0	0	0	100	100
		Total	**17**	**06**	**02**	**25**	**17**	**06**	**01**	**24**						**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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	0	0	45	3	1	0	4

Course Pre-requisites	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 basics of set theory 2. To provide depth knowledge about propositional calculus 3. To make students familiar about recursion and recurrence relation. 4. To inculcate understanding of algebraic structure 5. To aware students about graph and functions

Course Content (Theory)	Weightage	Contact hours
Unit 1: Theory: Introduction to set theory, Setoperations, Algebra of sets, Duality,Finite and Infinite sets, Classes of sets,Power Sets, Multi sets, CartesianProduct, Representation of relations,Types of relation, Equivalence relationsand partitions Partial ordering relationsand lattices, Function and its types,Composition of function and relations,Cardinality and inverse relations.	**20%**	**09**
Unit 2: Propositional Calculus Basicoperations:AND(^), OR(v), NOT(~), Truth value ofa compound statement,	**20%**	**09**

propositions,tautologies, contradictions.		
Unit 3: Recursion and RecurrenceRelation:Polynomials and their evaluation,Sequences, Introduction to AP, GP andAG series, partial fractions, linearrecurrence relation with constantcoefficients, Homogeneous solutions,Particular solutions, Total solution of arecurrence 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

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to: CO1. **Understand** the concept of sets CO2. **Analyze** use of propositional theory in real timescenario CO3. **Apply** recurrence relations in other applications CO4. **Apply** generation of functions in algebraic structures CO5. **Comprehend** the use of graph theory in	Cognitive	Understand Analyze Apply Apply Comprehend

other domains		

Learning Resources	
1.	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.
2.	Journals & Periodicals:
3.	Other Electronic Resources:

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

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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	0	2	45	3	0	2	4

Course Pre-requisites	Basic C Programming
Course Category	Professional Subjects-Core (PC)
Course focus	Employability
Rationale	The C programming syllabus aims to provide students with a strong foundation in programming using the C 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 C for various applications.
Course Revision/ Approval Date:	24/1/2022
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1. To make students familiar about 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 layout handing and other GUI based commands. 5. To aware students about an advanced technologies of java programming.

Course Content (Theory)	Weightage	Contact hours
Unit 1: Basics of JAVA Features of Java, Byte Code and Java Virtual Machine, JDK, Data types, Operator, Control Statements – If , else, nested if, if-else ladders, Switch, while, do-while, for, for-each, break, continue. Array and String: Single and Multidimensional Array, String class, StringBuffer class, Operations on string, Command line argument, Use of	**20%**	**09**

Wrapper Class		
Unit 2:Objects,classes and Inheritance: Class, Object, Object reference, Constructor, Constructor Overloading, Method Overloading, Recursion, Passing and Returning object form Method, new operator, this and static keyword, finalize() method, Access control, modifiers, Nested class, Inner class, Anonymous inner class, Abstract class. Use of Inheritance, Inheriting Data members and Methods, constructor in inheritance, Multilevel Inheritance – method overriding Handle multilevel constructors – super keyword,Stop Inheritance - Final keywords, Creation and Implementation of an interface, Interface reference, instanceof operator, Interface inheritance, Dynamic method dispatch ,Understanding of Java Object Class,Comparison between Abstract Class and interface, Introduction to Lambda Expressions	**20%**	**09**
Unit 3: **Package, Exception handling, Multithreaded Programming:** Understanding of System.out.println statement Package: Use of Package, CLASSPATH, Import statement, Static import,Introduction to Modules, Access control Exception Handling: Exception and Error, Use of try, catch, throw, throws and finally, Built in Exception, Custom exception, Throwable Class.Multithreaded Programming: Use of Multi Thread programming, Thread class and Runnable interface , Thread priority, Thread synchronization, Thread communication, Deadlock	**20%**	**09**
Unit 4: I/O Programming & Collection Classes IO Programming: Introduction to Stream, Byte Stream, Character stream, Readers and Writers, File Class, File InputStream, File Output Stream, InputStreamReader, inputStreamWriter, FileReader, FileWriter, Bufferedreader Collection Classes :List, AbstractList, ArrayList, LinkedList, Enumeration, Vector, Properties, Introduction to Java.util package	**20%**	**09**
Unit 5: JAVAFX JAVAFX basics and Event driven programming JAVAFX basics and Event-driven programming and animations: Basic structure of JAVAFX program, Panes, UI control and shapes, Property binding, the Color and the Font class, the	**20%**	**09**

Image and Image-View class, layout panes and shapes, Events and Events sources, Registering Handlers and Handling		

List Of Practical	Weightage	Contact hours
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	**8%**	**2**
2. Write Program on a. Different array operations. b. Use string class for various string manipulations.	**8%**	**2**
3. Write Program a. Demonstrate working of class and objects b. Working of different types of constructor	**10%**	**2**
4. Write Program a. Show the importance of modifiers with different classes.	**8%**	**2**
5. Write Program a. Usage of this keyword b. Demonstrate simple inheritance	**8%**	**2**
6. Write Program a. Working of overriding b. Polymorphism execution with dynamic binding	**8%**	**2**
7. Write Program a. Usage of abstract class b. Working of casting object	**8%**	**2**
8. Write Program a. Show use of interface b. Demonstrate try catch finally	**10%**	**2**
9. Write Program a. Working of Input output b. Demonstrate file handling	**8%**	**2**
10. Write Program a. Usage of thread b. Create a JavaFx application to display "Hello World" messages	**8%**	**2**
11. Create a tic-tac-toe board in which a cell may be X, O, or empty. Randomly decide what to display at	**8%**	**2**

each cell. The X and O are images in the files X.gif and O.gif.		
12. Create a GUI application to move a circle up, down, left or right using arrow keys.	**8%**	**2**

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

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to: CO1. **Understand** the concept of sets CO2. **Analyze** use of propositional theory in real time Scenario CO3. **Apply** recurrence relations in other applications CO4. Apply generation of functions in algebraic structures. CO5. **Comprehend** the use of graph theory in other domains	Cognitive	Understand Analyze Apply Apply Comprehend

Learning Resources	
1.	Reference Books: 1. Introduction to Java Programming (Comprehensive Version), Daniel Liang, Seventh Edition, Pearson. 2. Programming in Java, SachinMalhotra&SaurabhChaudhary, 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. Text Books: 1. The Complete Reference, Java 2 (Fourth Edition), Herbert Schild, TMH. 4 Java Programming, D. S. Malik, Cengage Learning.
2.	Journals & Periodicals:
3.	Other Electronic Resources:

	http://nptel.ac.in

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	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	1	3	3
CO2	1	3	3
CO3	1	3	3
CO4	1	3	3
CO5	1	3	3

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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	2	0	45	3	2	0	4

Course Pre-requisites	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, and practical applications.
Course Revision/ Approval Date:	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	1. To aware student about different operating systems. 2. To make student 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 (Theory)	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	**20%**	**09**

states , Process State transitions , Process Control Block ,Context switching – Threads – Concept of multithreads , Benefits of threads – Types of threads		
Unit 2: Process Scheduling: Definition ,Scheduling objectives ,Types of Schedulers ,Scheduling criteria : CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time (Definition only) , Scheduling algorithms Pre emptive and Non , pre emptive , FCFS – SJF – RR , Multiprocessor scheduling : Types , Performance evaluation of the scheduling. (Definition only) , Scheduling algorithms : Preemptive and Non-Preemptive	**20%**	**09**
Unit 3: Interprocess Communication Race Conditions, Critical Section, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer ConsumerProblem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc., Scheduling , Scheduling Algorithms. Deadlocks: Definition, Deadlock characteristics, Deadlock Prevention , Deadlock Avoidance banker's algorithm, Deadlock detection and Recovery.	**20%**	**09**
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.	**20%**	**09**
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 & Function O Kernel, System Calls, Elementary Linux command & Shell Programming, Directory Structure, System Administration Case study: Linux, Windows Operating System	**20%**	**09**

List Of Practical	Weightage	Contact hours

1.	Basic Linux commands	**10%**	**2**
2.	Write a programming on working of following algorithm. a) FCFS b) SJF	**8%**	**2**
3.	Write a programming on working of Round Robin algorithm.	**8%**	**2**
4.	Working of kernel programming	**8%**	**2**
5.	Basic shell scripting	**8%**	**2**
6.	Demonstrate paging Working of page replacement algorithms	**8%**	**2**
7.	Demonstrate paging algorithms	**8%**	**2**
8.	Working of Page replacement algorithms.	**8%**	**2**
9.	Demonstrate Process Deadlock algorithms.	**8%**	**2**
10.	Demonstrate Producer consumer Problem	**8%**	**2**
11.	Demonstrate Lock for inter process communication	**8%**	**2**
12.	Demonstrate Semaphore	**10%**	**2**

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

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to: CO1: **Understand** basic technical differences between different operating systems. CO2: **Analyze** how command line argument works. CO3: **Able** to handle different processes at the same time. CO4: **Apply** memory management in real time applications. CO5: **Comprehend** scheduling of different processes basedon priority.	Cognitive	Understand Analyze Able Apply Comprehend

Learning Resources	
1.	Reference Books: 1. Operating Systems Concepts – Silberschatz, Galvin, Wiley Publications (2008)

	2. Modern Operating Systems - Andrew S. Tenenbaum, Pearson Education Asia / PHI (2005) 3. UNIX System Programming Using C++,by Terrence Chan: Prentice Hall India, 1999. 4. Advanced Programming in UNIX Environment, by W. Richard Stevens: 2nd Ed, Pearson Education, 2005. 5. Operating Systems – William Stallings, Pearson Education Asia (2002)

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

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

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

COURSE CODE BTCS304	COURSE NAME COMPUTER ORGANIZATION	SEMESTER III

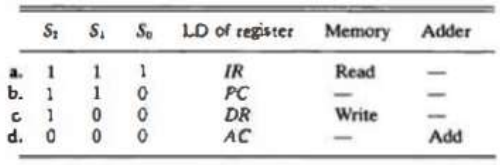
Teaching Scheme (Hours)				Teaching Credit			
Lecture	**Practical**	**Tutorial**	**Total Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	0	1	45	3	0	1	4

Course Pre-requisites	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)	1. To understand 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 (Theory)	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%**	**9**
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%**	**9**
Unit-3: Information representation, Floating point representation (IEEE 754), computer arithmetic and their	**20%**	**9**

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		
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 memorymanagement unit.	**20%**	**9**
Unit 5: 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 andtheir resolution, Parallel Processing	**20%**	**9**

List Of Practical Tutorial	Weightage	Contact hours
Unit 1: **Tutorial 1** 1. Explain the functioning of Control Unit with proper Diagram. **Tutorial 2** 1. Describe in detail the different types of Basic Registers available in a computer. 2. Describe Instruction Format in detail. Explain different types of Instructions with proper instruction formats.	**20%**	**2**
Unit 2: **Tutorial 3** 1. Consider a processor with 64 registers & an instruction set of size 12. Each instruction has 5 distinct fields: Opcode, 2 Source Registers, 1 destination register identifier & a 12 bit immediate value. Each instruction must	**20%**	**4**

be stores 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 _____ 2. A processor can support a max memory of 4GB where the memory is word addressable(a word= 2 bytes). The size of the address bus of the processor is atleast ___ bits. 3. What is the difference between a dired and an indirect address instruction? How many references to memory are needed for uch type oi instruction to bring an operand into a processor registet? 4. The foUowins 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.  5. The foUowing register transfers are to be executed in the system of Fig. H. For each transfer, specify: (I) the binary value that must be applied to bus select inputs S,.S,, and So; (2) the register whose I.D cont:tol input must be active (if any); (3) a memory read or write operation (if needed); and (4) the operation in the adder and logic clreuit (iJ any). a. A.R -PC b. /R -MIARI c. M(AR)-TR d. AC-DR, DR-AC (done simultaneously)		
Unit 3: **Tutorial 7** 1. Perform the arithmetic operations below with binary numbers and with negative number$ In slgned-2"s complement. Use seven bitsto accommodate each number together with its sign. In each cue, determine if there is an overflow by checking the carries Into and out ol the sign bit position. a. (+35) + (+40) b. (-35) + (-40) c. (-35) - (+40)	**30%**	**6**

	S_2	S_1	S_0	LD of register	Memory	Adder
a.	1	1	1	*IR*	Read	—
b.	1	1	0	*PC*	—	—
c.	1	0	0	*DR*	Write	—
d.	0	0	0	*AC*	—	Add

2. 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). Show that the overflow detection procedure of checking the inequality of the last twocarries fails in this case. b. Suggest a modified procedure for detecting an overflow when signed-l's complement numbers are used. **Tutorial 8 –** 1. 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. 2. 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.) **Tutorial 9** 1. Show the step-by-step multiplication process using 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)		
Unit 4: **Tutorial 10** 1. a. How many 128 x 8RAMchlpsare needed to provide a memory capldty or 2048 bytes? b. How many tines of the address bus must be used to access 2048 byte of memory? How many oJ these tines will be common 10 all chlps? c. How many lines must be decoded for chip select? Specify the size or the decoders. 2. A computer uses RAM chips or 1024 x I capacity. a. How many chlps are needed, and how should their address tines be connected to provide a memory capacity of 1024 bytes? b. How many cl\ips are needed to provide a memory	**30%**	**4**

capacity or 16k bytes? Explain In words how the chips are t0 be connected t0 the address bus. 3. A digital computer has a memory unit of 64K X 16 and 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? 4. 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? **5.** 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.

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to: CO1. **Understand** how fetch-decode and execute cycleworks. CO2. **Analyze** inside mechanism of computer CO3. **Apply** different information representation inintermediate code generation, CO4. **Able** to manage memory for different purposes.	**Cognitive**	**Understand** **Analyze** **Apply** **Able** **Comprehend**

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

Learning Resources	
1.	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 and Organization, by Hayes, J.P.1998,McGraw- Hill

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

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		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

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

COURSE CODE BTCS305	COURSE NAME PYTHON PROGRAMMING	SEMESTER III

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

Course Pre-requisites	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:	24/1/2022
Course Objectives (As per Blooms' Taxonomy)	1. To understand the nature of programming as human activity and learn and experiencemain components of programming process 2. To inculcate students about main control structures of procedural programminglanguages 3. To provide depth knowledge about List, Tuple & Dictionaries 4. To aware students about python utility and basic function 5. To make student familiar about function and its use in recent technologies of IOT

Course Content (Theory)	Weightage	Contact hours
Unit 1: Introduction & Control Statements: Installation and Working with Python, Essentials of a Python program, Program Structure of Python, Basic Syntax, Variables and Identifiers, Built- In Data Types. Variable definition, Operators And Expressions, Constants And Literals, Basic Input/output Statement. Control Loops and Array Decision	**20%**	**9**

Making - Conditions, Relational, Operators, Logical Connectives, If-Else , Nested If-Else Statement, Replacement of switch case Loops: While loop, Do-while, For loop, Nested loops , Break, Continue and pass Statements.		
Unit 2:Decision Making: Python Data Types Arrays –One dimensional and multidimensional array, Array processing. String Manipulation - accessing Strings, Basic Operations, String slices and Function and Methods, Lists: Introduction, accessing list, Operations, Working with lists, Function and Methods. Tuple: Introduction, accessing tuples, Operations,. Dictionaries:Introduction, Accessing values in dictionaries, Working with dictionaries, Properties	**20%**	**9**
Unit 3 : Lists: Introduction, accessing list, Operations, Working with lists, Function and Methods. Tuple: Introduction, accessing tuples, Operations, Working, Functions and Methods. Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties, Functions	**20%**	**9**
Unit 4: : Dates and Time: Basic date andtime classes, Different time formats,Converting between formats, Formattingdates and times, Parsing date/timeinformation, Binary Data: What is BinaryData? , Binary vs. text, Using the Structmodule. Defining a function, PythonBuilt-in Functions , Calling a function,Types of functions, Function Arguments, Default Argument, Anonymous functions,Global and local variables, CustomFunctions vs. Standard Functions,Refactoring, Making Functions Reusable,Functions as Data.	**20%**	**9**
Unit 5: An Introduction to libraries used for AIand ML: numpy, matplotlib, pandas,opencv, tinker, tensorflow, keras,tensorflow, Theano, Sci-kit learn,PyTorchAn Introduction to libraries used for IOT:numpy, matplotlib, pandas, opencv,tinker, tensorflow, mraa, sockets,mysqldb, requests, paho-mqtt	**20%**	**9**

List Of Practical	Weightage	Contact hours
1. a. Demonstrate installation of python b. Working of variables and identifierswith simple programs c. Create different variables to show d. Different types of data, operators andexpressions. e. Demonstrate working of constants. f. Usage of input output statements.	**20%**	**2**
2. a. Demonstrate practical's based onconditional statements. b. Working of decision statements c. Show replacement of switch statements d. Demonstrate working of different loops e. Usage of break , continue and pass f. Show working of array. g. Show different string manipulations	**20%**	**2**
3. a. Demonstrate List and accessing of list b. Working of tuples c. Show working of dictionaries	**20%**	
4. a. Demonstrate date and time functions b. Working of conversion of different date format manipulations. c. Create functions and its types	**20%**	**2**
5. a. Demonstrate working of above librariesfor realtime IOT applications	**20%**	**2**

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

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to: CO1: Able **to understand** basics of python programming	Cognitive	Understand

CO2: Understand the concepts of loops and control structures for different purposes. CO3: **Comprehend** about working of list and dictionaries. CO4: **Design** python application with the use of date-time and other functions. CO5: **Apply** in development of real time applications of IOT		Understand Comprehend Design Apply

Learning Resources	
1.	Reference Books: Textbooks: 1. John V Guttag. "Introduction to Computation and Programming Using Python", Prentice Hall of India 2. R. NageswaraRao, "Core Python Programming", dreamtech 3. Wesley J. Chun. "Core Python Programming - Second Edition", Prentice Hall 4. Kenneth A. Lambert, "Fundamentals of Python – First Programs", CENGAGE Publication 5. Luke Sneeringer, "Professional Python", Wrox

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	

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

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

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				Evaluation Scheme					
			L	P	T	Total	L	P	T	Total	Theory: MS Marks	Theory: CEC Marks	Theory: ES Marks	Theory Marks	Practical Marks	Total Marks
1	BTCS409	Numerical Methods in Computer Science & Engineering	3	0	1	4	3	0	1	4	20	40	40	100	0	100
2	BTCS402	Computer Networks	3	2	0	5	3	1	0	4	20	40	40	100	50	150
3	BTCS403	Microprocessor & Interfacing	3	2	0	5	3	1	0	4	20	40	40	100	50	150
4	BTCS404	Database Management Systems	3	2	0	5	3	1	0	4	20	40	40	100	50	150
5	BTCS405	Specialized Track Elective -I - Fundamentals of AI & ML	3	2	0	5	3	1	0	4	20	40	40	100	50	150
6	BTCS406	Specialized Track Elective -I - Fundamentals of IoT														
7	BTCS407	Specialized Track Elective -I - Fundamentals of Cyber Security														
8	AECC401	Environmental Studies	2	0	0	2	2	0	0	2	20	40	40	100	0	100
9	BTCS408	Industrial Internship	0	0	0	0	0	2	0	2	0	0	0	0	100	100
		Total	**17**	**08**	**01**	**26**	**17**	**6**	**1**	**24**						**900**

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

COURSE CODE BTCS409	COURSE NAME NUMERICAL METHODS IN COMPUTER SCIENCE ENGINEERING	SEMESTER IV

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

Course Pre-requisites	**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 **brief** idea about interpolation 3. **Comprehend** working of numerical calculus 4. Provide **information** regarding curve fitting 5. **Elaborate** linear programming

Course Content (Theory)	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. Eigen values and Eignvectors using MATLAB.	**20%**	**09**
Unit 2:Interpolation: Newton's forward and 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 equation**: Taylor's Series method, Euler's method, Runge Kutta forth ordered 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 formulae, 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

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to:		
CO1. **Organise** & present quantitative data and think critically with respect to quantitative information characterised by the centre, spread, and skewness of data.	Cognitive	Understand
CO2. **Develop** the concept of a sampling distribution and infer some characteristics of a population by examining a portion of the population and to make informed decision ina 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.	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. 3.Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007. 4. 4.Stuart Russel and Peter Norvig "AI – A Modern Approach", 2nd Edition, Pearson Education 2007. 5. 5. Deepak Khemani "Artificial Intelligence", Tata Mc Graw Hill Education 201
2.	Other Electronic Resources: 1. http://nptel.ac.in

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

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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	2	0	5	3	1	0	4

Course Pre-requisites	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, and 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 student **understand** regarding transportation among the different components. 5. **Familiarize**students about security aspects of network architecture

Course Content (Theory)	Weightage	Contact hours
Unit 1:Introduction -Hardware and software, Data communication, Networking, Protocols and Protocol architecture, standards. Data transmission concepts. Analog and digital transmission. Transmission impairments. Layered Architecture of Computer Networks, OSI and TCP/IP architectures Physical Layer- Guided transmission media and wireless transmission, Data encoding - Digital and analog data and signals, spread spectrum. Data communication interface asynchronous and synchronous transmission, line configuration and interfacing. Data link control - Flow control. Error detection and error control. HDLC and other data link protocols. Multiplexing – Frequency- division, synchronous time-division, and statistical time-division multiplexing	**20%**	**09**
Unit 2:Link Layer : Medium Access Control: CDMA, ALOHA, and Ethernet; Link Layer Addressing and Forwarding; 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. Control signaling. Packet switching principles. Routing and congestion control, x.25 protocol standard. LAN Technology - LAN architecture. Bus/tree, ring, star, and wireless LANs. LAN Systems - Ethernet and Fast Ethernet (CSMA/CD) Token ring and FDDI, ATM LANs, Fiber channel, wireless LANs. Bridges - Bridge operation and routing with bridges.	**20%**	**09**

Unit 3:Network Layer:Network layer design issues. Routing algorithms , Flooding, Shortest path routing, Link Sate routing, Hierarchical routing, Broadcast and multicast routings, Routing in the Internet, Path Vector routing, OSPF routing. The network layer in the Internet: IP protocol,ARP and RARP, BOOTP, ICMP, DHCP, Network-Address- Translation(NAT) Internetworking	**20%**	**09**
Unit 4:Transport Layer: TCP introduction, Reliable/UnReliableTransport ,TCP , UDP, Congestion Control,Intra-Domain Routing: Distance-Vector, Intra-Domain Routing: LinkState, Wireless networks: 802.11 MAC, Efficiencyconsiderations Module6: Application Layer: DNS-The Domain Name System,Electronic Mail, HTTP, FTP, Simple network management protocol (SNMP)	**20%**	**09**
Unit 5:Web and Multimedia: The World Wide Web – client and server side of www, HTML and webpage's, JAVA language, Locating on the web. Multimedia- Audio & Video, Data compression, Video on demand, multicast backbone. Security: Introduction, Cryptography and Cryptanalysis, Public Key Cryptography Algorithms, RSA Algorithm, DES, Authentication and Authorization.	**20%**	**09**

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

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**
8. Study of basic network command and Network configuration commands	**10%**	**03**
9. Configure a Network topology using packet tracer software	**10%**	**03**
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

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to:		
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	Apply
CO4: **Comprehend** the working of transport layer	Cognitive	Understand
CO5: **Apply** security encryption aspects in different technologies	Cognitive	Apply

Learning Resources	
1.	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. 3.Data Communications, Computer networking on OSI , by Fred Halsall, Addison Wesley Publishing Co.1998 5. 4.Computer Networking -A Top-Down Approach Featuring the Internet , James 5. Kurose and Keith W. Ross Addison Wesley Publishing Co. 2004 3.Computer Networks: Protocols standards

	and interfaces , by Uyless Black, Prentice Hall.2002 6. 6. Data communication &Networks , by Behrou A. Forouzan, Tata McGraw Hill. 2002
2.	Other Electronic Resources: 1. http://nptel.ac.in

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	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	1	3	3
CO2	1	3	3
CO3	1	3	3
CO4	1	3	3
CO5	1	3	3

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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	2	0	5	3	1	0	4

Course Pre-requisites	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:	19/8/2019

Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1. **Understand** about basic components of 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 (Theory)	**Weightage**	**Contact hours**
Unit1: Introduction to Microprocessor, Components of a Microprocessor: Registers, ALU and control & timing,System bus (data, address and controlbus), Microprocessor systems with bus organization. MicroprocessorArchitecture and Operations, Memory, I/O devices, Memory and I/O operations	**20%**	**09**
Unit 2: 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, 8085Instruction Set, Instruction And Data Formats, Writing, Assembling & Executing A Program, Debugging The Programs	**20%**	**09**
Unit 3: 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 4: 8086 logical block diagram and segments, 80286: Architecture, Registers 8 20% (Real/Protected mode), Privilege levels, descriptor cache, Memory access in GDT and LDT, multitasking, addressing modes, flag register	**20%**	**09**

80386: Architecture, Register organization, Memory access in protected mode, Paging 80486 : Only the technical features Pentium : Architecture and its versions		

List Of Practical	Weightage	Contact hours
1. Introduction to MASM, Arithmetic operations on 16- Bit unsigned numbers.	**10%**	03
2. Sorting of An Array Of Numbers	**10%**	03
3. Finding the median from list of numbers, length of a given string	**10%**	03
4. Reversing of given String	**10%**	03
5. Insertion and Deletion of a String.	**10%**	03
6. BCD Arithmetic	**10%**	03
7. Verifying the Password	**10%**	03
8. Unsigned Division	**10%**	03
9. Displaying the Character on Led Display	**10%**	03
10. Displaying the Number on 3.7-Segment DisplaySerial Communication	**10%**	03

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

Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to:		
CO1. **Understand** working of each components in microprocessor.	Cognitive	Understand
CO2. **Comprehend** architecture of 8085 with its instruction and addressing formats	Cognitive	Understand
CO3. Write assemble 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 processor in real time applications	Cognitive	Apply

Learning Resources

1.	1. Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh S. Gaonkar Pub: Penram International. 2. Microprocessors and Interfacing, N. Senthil Kumar, M. Saravanan, 3. S. Jeevanathan, S. K. Shah, Oxford 4. Microprocessor & Interfacing - Douglas Hall, TMH 5. 8086 Programming and Advance Processor Architecture, Savaliya M. T., WileyIndia 6. The 8088 and 8086 Microprocessors, Triebel& Singh, Pearson Education 7. Advanced Microprocessors, Daniel Tabak, McGrawHill
2.	Other Electronic Resources: 1. http://nptel.ac.in

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	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	2	3	2
CO2	2	3	3
CO3	2	2	2
CO4	2	3	3
CO5	2	2	3

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

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

COURSE CODE BTCS404	COURSE NAME DATABASE MANAGEMENT SYSTEMS	SEMESTER IV

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

Course Pre-requisites	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, and concurrency control, facilitating data consistency and reliability. It offers robust query capabilities, allowing users to extract meaningful insights from complex datasets. DBMS also supports data sharing and collaboration, enabling multiple users to access and 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:	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1. Gain **knowledge** about basic concepts of DBMS 2. **Aware** students about structure of DBMS 3. Give **brief** idea about transaction processing 4. **Understand** different rules to design database. 5. **Inculcate** understanding of MySql

Course Content (Theory)	Weightage	Contact hours
Unit 1: Introduction and applications of DBMS: Purpose of data base, 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, SavepointSavepoint. Cursors, Stored Procedures, Stored	**20%**	**09**

Function, Database Triggers		
Unit 5: Database with real time application: Introduction to MySQL Database, MySQL Connect, MySQL with Creation of Database, Table, Insert Data/Multiple Data, Get Last ID, MySQL Select Data, Where,Order By, Delete, Update and Limit Data with PHP Form handling	**20%**	**09**

List Of Practical	Weightage	Contact hours
1. **Create** tables in SQL and Inserting values in tables.	**10%**	03
2. **Demonstrate** use of DDL commands with an appropriate example of applying it on a table.	**10%**	03
3. **Describe** use of SQL constraint by applying it on an appropriate table	**10%**	03
4. **Demonstrate** use of DML commands	**10%**	03
5. **Create** view for SQL table.	**10%**	03
6. **Show** working of different view manipulation	**10%**	03
7. **Describe** the use of TCL command with appropriate examples	**10%**	03
8. **Describe** use of Oracle SQL Functions with appropriate examples.	**10%**	03
9. Working of different join operations Describe use of Null Value Handling Oracle, Creating Usersand DCL commands with appropriate example.	**10%**	03
10. 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

Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to:		
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	Cognitive	Apply

effective database management		
CO4. **Design** database with all necessary constraints	Cognitive	Create
CO5. **Evaluate** various storage and retrieval methods to correlate with relational model through appropriate indexing	Cognitive	Evaluate

Learning Resources	
1.	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:
2.	Journals & Periodicals: 1. ACM Transactions on Database Systems. 2. IEEE Transactions on Knowledge and Data Engineering
3.	Other Electronic Resources: 1. http://nptel.ac.in

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	

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	1	3	3
CO2	1	3	3
CO3	1	3	3
CO4	1	3	3
CO5	1	3	3

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

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

COURSE CODE BTCS405	COURSE NAME FUNDAMENTALS OF AI & ML	SEMESTER IV

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

Course Pre-requisites	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 (Theory)	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 (firstorder logic), logical reasoning, forward chaining, backward chaining; AI languages and tools- Lisp, Prolog, CLIPS Planning- Basic representation of plans, partial order planning, 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-mean clustering, hierarchical clustering, DBSCAN clustering, K-medoids clustering, Spectral clustering	**20%**	**09**

List Of Practical	Weightage	Contact hours
1. Implementation of search methodology	**10%**	05
2. Different Puzzle solving methodologies	**10%**	05
3. Write the Conceptual Dependency for following statements. a. John gives Mary a book b. John gave Mary the book yesterday	**10%**	05

4. Demonstration of classification problems	**10%**	05
5. Working of optimization techniques..	**10%**	05
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.

Course Objectives:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to:		
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 application 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 3. IEEE Transactions on Neural Networks and Learning Systems
3.	Other Electronic Resources: http://nptel.ac.in

<table>
<tr><th>Evaluation Scheme</th><th>Total Marks</th></tr>
<tr><td>Theory: Mid semester Marks</td><td>20 marks</td></tr>
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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

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

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

COURSE CODE BTCS406	COURSE NAME FUNDAMENTALS OF IOT	SEMESTER IV

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

Course Pre-requisites	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** student about basics of IOT 2. Make student **understand** about basic hardware components and its configurations 3. Provide **brief idea** 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 (Theory)	Weightage	Contact hours
Unit 1:Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and 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- ProgrammingAPI'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 and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation–	**20%**	**09**

List Of Practical	Weightage	Contact hours
1. To interface LED/Buzzer withArduino/Raspberry Pi and write a 2. program to turn ON LED	**10%**	03
3. 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
4. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.	**10%**	03
5. To interface OLED withArduino/Raspberry Pi and write a program to print temperature and humidity readings on it. thingspeak cloud.	**10%**	02
6. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to Smartphone	**10%**	03

using Bluetooth.		
7. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from Smartphone using Bluetooth.	**10%**	02
8. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data	**10%**	03
9. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.	**10%**	02
10. To install 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
11. Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.	**10%**	02
12. Write a program to create TCP server on Arduino/Raspberry Pi using GSM SIM cardwe and respond with humidity data to TCP client when requested.	**10%**	03
13. Write a program to create UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.	**10%**	02

Instructional Method and Pedagogy: Computer based learning, Chalk – Talk, Presentation

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to:		
CO1. **Understand** basics of IOT .	Cognitive	Understand
CO2. **Understand** basics of hardware components and its configurations	Cognitive	Understand
CO3. **Provide** brief idea about protocols used for IOT device communication.	Cognitive	Understand
CO4. **Elaborate** understanding of remote data monitoring	Cognitive	Evaluate
CO5. **Implement** real time application with IoT	Cognitive	Apply

Learning Resources	
1.	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
2.	Other Electronic Resources: 1. http://nptel.ac.in

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

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

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

COURSE CODE BTCS407	COURSE NAME FUNDAMENTALS OF CYBER SECURITY	SEMESTER IV

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

Course Pre-requisites	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 and secure digital systems from cyber threats. As technology advances, the risk of cyberattacks and data breaches increases. Understanding cybersecurity fundamentals equips individuals with the knowledge and skills to safeguard data, networks, and digital assets. It enables the identification and mitigation of vulnerabilities, implementation of robust security measures, and development of incident response strategies. By studying cybersecurity, individuals can contribute to safeguarding privacy, preventing financial losses, preserving reputation, and ensuring the integrity and availability of digital resources. The rationale lies in building a secure and resilient digital ecosystem that fosters trust, innovation, and the protection of individuals and organizations.
Course Revision/ Approval Date:	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1. **Identify** key concepts and terminology in cybersecurity 2. **Define** the key concepts, roles and domains of cybersecurity 3. **Identify** the various types of cybersecurity architecture 4. **Identify** the key components of securing networks, systems and

Course Content (Theory)	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.	**20%**	**09**
Unit 2:Cyber security Concepts: Risk, Common attack types and vectors, Policies and procedures, Cyber security controls, Investigations, legal holds, and preservation, Forensics, Disaster recovery and business continuity.	**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
1. Implement Caesar cipher encryption-decryption.	**10%**	03
2. Implement Monoalphabetic cipher encryption-decryption.	**10%**	02
3. Implement Polyalphabetic cipher encryption-decryption.	**10%**	03
4. Implement Playfair cipher encryption-decryption.	**10%**	02
5. Implement Hill cipher encryption-decryption	**10%**	03
6. To implement Simple DES or AES	**10%**	02
7. Implement Diffi-Hellman Key exchange Method	**10%**	03
8. Implement RSA encryption-decryption algorithm	**10%**	02
9. Write a program to generate SHA-1 hash	**10%**	03
10. Implement a digital signature algorithm	**10%**	02

11. Perform various encryption-decryption techniques with cryptool	**10%**	03
12. Study and 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

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to:		
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 network	Cognitive	Remember
CO5. **learn** about security implications.	Cognitive	Analyse

Learning Resources	
1.	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
2.	Other Electronic Resources: 1. http://nptel.ac.in

<table>
<tr><th>Evaluation Scheme</th><th>Total Marks</th></tr>
<tr><td>Theory: Mid semester Marks</td><td>20 marks</td></tr>
<tr><td>Theory: End Semester Marks</td><td>40 marks</td></tr>
<tr><td>Theory: Continuous Evaluation Component Marks</td><td><table><tr><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></table></td></tr>
<tr><td>Practical Marks</td><td><table><tr><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></table></td></tr>
</table>

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

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

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				Evaluation Scheme					
			L	P	T	Total	L	P	T	Total	Theory: MS Marks	Theory: CEC Marks	Theory: ES Marks	Theory Marks	Practical Marks	Total Marks
1	NOC01	NPTEL Elective	2	0	0	2	2	0	0	2	20	40	40	100	0	--
2	BTCS501	Design and Analysis of Algorithms	3	0	1	4	3	0	1	4	20	40	40	100	0	100
3	BTCS502	Software Engineering	3	2	0	5	3	1	0	4	20	40	40	100	50	150
4	BTCS503	Advanced Web Technologies	3	2	0	5	3	1	0	4	20	40	40	100	50	150
5	BTCS504	Specialized Track Elective-I -Data Science for Engineers	3	2	0	5	3	1	0	4	20	40	40	100	50	150
	BTCS505	Specialized Track Elective- II - IoT Architecture and Protocols														
	BTCS507	Specialized Track Elective -III -Network security and access control														
6	AECC502	Business Communication	2	0	0	2	2	0	0	2	20	40	40	100	0	100
7	BTCS506	Industrial Internship	0	0	0	0	0	2	0	2	0	0	0	0	100	100
		Total	**16**	**06**	**01**	**23**	**16**	**05**	**01**	**22**						**750**

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

COURSE CODE BTCS501	COURSE NAME DESIGN AND ANALYSIS OF ALGORITHMS	SEMESTER V

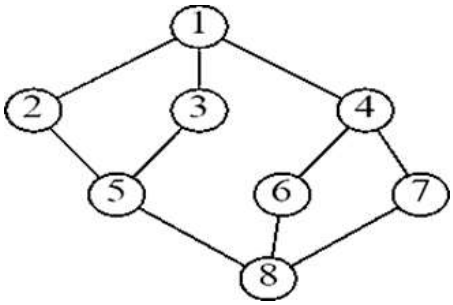
Teaching Scheme (Hours)				Teaching Credit			
Lecture	**Practical**	**Tutorial**	**Total Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	0	1	4	3	0	1	4

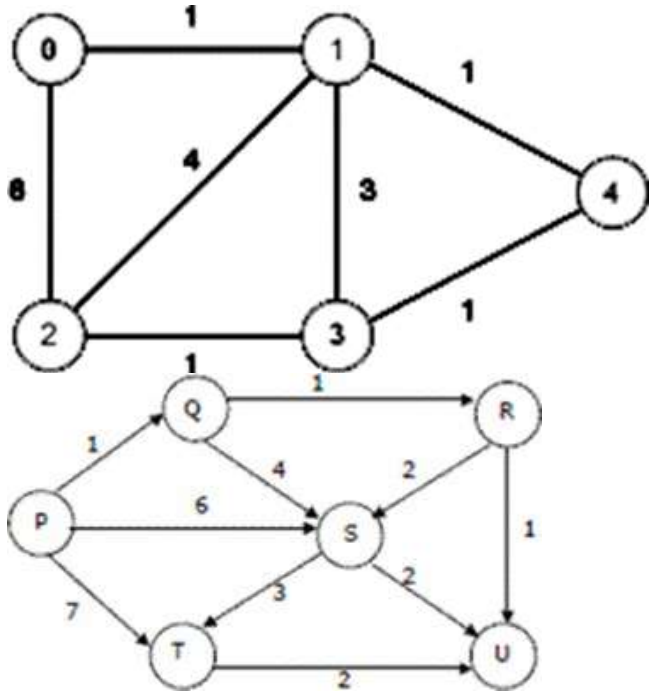
Course Pre-requisites	Discrete Mathematics - sets, functions, relations; proofs, and proofs by induction; Boolean logic.
Course Category	Professional course
Course focus	Employability
Rationale	Design and analysis of algorithms is important to study because it allows us to understand the efficiency and 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 andata structures. 4. To Apply important algorithmic design paradigms and methods of analysis. 5. To Synthesize efficient algorithms in common engineering design situations.

Course Content (Theory)	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- and 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 Tutorial	Weightage	Contact hours
Unit 1: If f(n)=5n2 + 6n + 4, then prove that f(n) is O(n2)	**10%**	**12**
Unit 2:	**20%**	**12**

1) Compute the average case time complexity of quick sort 2) Use step count method and analyze the time complexity when two n×n matrices are added 3) Explain quick sort algorithm and simulate it for the following data 20, 35, 10, 16, 54, 21, 25. 4) Sort the list of numbers using merge sort: 78, 32, 42, 62, 98, 12, 34, 83 5) 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) 6) 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). 7) 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 8) Find the shortest tour of traveling sales person for the following cost matrix using dynamic Programming ∞ 12 5 7 11 ∞ 13 6 4 9 ∞ 18 10 3 2 ∞		
Unit 3: 1) Solve BFS & DFS traversal of following graph  2) Construct minimum cost spanning tree using	**25%**	**12**

a) prims algorithm b) kruskal algorithm 3) Apply single source shortest path algorithm for the following graph  		
Unit 4: 1) Prove Hamiltonian cycle is in NP 2) Prove circuit-SAT is in NP	**20%**	**12**

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

Course Outcomes:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to:	Cognitive	
CO1. **Understand** notion of algorithmic complexity and logic of fundamental algorithm		Understand
CO2. **Apply** fundamental algorithms in real life problem solving		Apply
CO3. **Evaluate** suitable algorithmic strategies to solve a problem effectively and efficiently		Evaluate

CO4. **Evaluate** different algorithms with respect to time and space complexity CO5. **Create** algorithms to solve various computational problems		Evaluate Create

Learning Resources	
1.	**Textbooks:** 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.	**Other Electronic Resources**: MOOC platform.

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
Article Review	10 marks
Total	**40 Marks**

Mapping of PSOs & COs

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

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
CO1	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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	2	0	5	3	1	0	4

Course Pre-requisites	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 (Theory)	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. **1) Introduction to SRS** • What is Software? • What is software Engineering? • what is SRS • List out the Characteristics of SRS. • Define the Characteristics of SRS in brief.	**10%**	**05**
Unit 2: Process Models and Program Design Techniques: Software Development Process Models – Code & Fix model, Waterfall model, Incremental model, Rapid Prototyping model, Spiral (Evolutionary) model. Good Program Design Techniques – Structured Programming, Coupling and Cohesion, Abstraction and Information Hiding, Automated Programming, Defensive Programming, Redundant Programming, Aesthetics. Software Modelling Tools – Data flow Diagrams, UML	**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.	**25%**	**10**
Unit 4: Software Project Management: Management Functions and Processes, Project Planning and Control, Organization and Intra-team Communication, Risk Management. Software Cost Estimation underlying factors of critical concern. 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: Z notation, Hoare"s notation. Formalization of Functional Specifications – SPEC. Support environment for Development of Software Products. Representative	**20%**	**10**

Tools for Editors, Linkers, Interpreters, Code Generators, Debuggers. Tools for Decision Support and Synthesis, Configuration control and Engineering Databases, Project Management. Petrinets. Introduction to Design Patterns, Aspect-oriented Programming.		

List Of Practical	Weightage	Contact hours
Unit 2: 1) Define UML. give a brief introduction about UML diagrams with shapes. Also select a application to create various diagrams of UML 2) Draw a use diagram for selected application 3) Draw Class Diagram for selected application 4) Draw Activity Diagram for selected application 5) Draw Sequence Diagram for selected application 6) Explain What is DFD diagram and Its Importance. Compare DFD Level 0 and DFD Level 1. 7) Draw DFD Level 0 and DFD Level 1 8) Draw Deployment Diagram .	**25%**	**10**
Unit 3: 9) List out different test scenarios for selected Application (Min 10-15). Also create a Test case for each and every test scenario.	**25%**	**10**
Unit 4: 10) Understand and try to apply COCOMO model to calculate time and efforts of different projects.	**20%**	**12**

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

Course Outcomes:	Blooms' Taxonomy Domain	Blooms' Taxonomy Sub Domain
After successful completion of the above course, students will be able to: CO1. **Understand** SRS (Software Requirement	Cognitive	**Understand**

Specification) CO2. **Apply** the concept of Functional Oriented and Object Oriented Approach CO3. **Understand** and Recognize how to ensure the quality of software product. CO4. **Apply** various testing techniques and test plan. CO5. **Analyz**e the modern Agile Development for the Concept of Industry.		**Apply** **Understand** **Apply** **Analyze**

Learning Resources	
1.	**Textbooks:** 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. Journal of Software Engineering Research and Development. 2. ACM Transactions on Software Engineering and Methodology
4.	**Other Electronic Resources**: MOOC Platform

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
Article Review	10 marks
Total	**40 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	1	1
CO1	0	1	1
CO3	0	1	1
CO4	0	1	1
CO5	0	1	1

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
CO1	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

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

COURSE CODE BTCS503	COURSE NAME ADVANCED WEB ROGRAMMING	SEMESTER V

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

Course Pre-requisites	Basic web programming
Course Category	Professional course
Course focus	Employability
Rationale	It is important to learn Advanced web programmingasthis 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:	2/8/2022
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1. To provide basic knowledge of PHP & MySQL 2. To aware students about AngularJs 3. Provide overview of NodeJs 4. To give brief knowledge about MongoDB 5. To Describe the applications of Django framework

Course Content (Theory)	Weightage	Contact hours
Unit 1: Advanced PHP Concepts: Form Handling, Validation, Complete, Cookies, Session, Filters , Exception, XML Parsing, Expat & DOM Parser, PHP With AJAX , AJAX with Database	**20%**	**06**
Unit 2:INTRODUCTION TO ANGULARJS : Introduction – Features – AngularjsJSModel-View-Controller – Expression - Directives and Controllers – AngularJS Modules – Arrays – Working with ng-model – Working with Forms – Form Validation – Error Handling with Forms – Nested Forms with ng-form – Other Form Controls . Filters – Using Filters in	**25%**	**14**

Controllers and Services – AngularJS Services – Internal AngularJS Services – Custom AngularJS Services - Directives – Alternatives to Custom Directives – Understanding the Basic options – Interacting with Server – HTTP Services – Building Database, Frontend and BackEnd		
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%**	**09**
Unit 4: INTRODUCTION TO MONGODB: JSON and MongoDB – Adopting a Non-relational Approach – Opting for Performance vs. FeaturesRunning the Database Anywhere – Generating or Creating a Key – Using Keys and Values – Implementing Collections	**20%**	**06**
Unit 5: Advanced Django: Creating model , Converting the model into a table, Basic data access using Django shell, Saving, Retrieving & Modifying objects into database, Sorting, Filtering & Deleting objects , Creation and Customization of admin interface, Adding users, Data access and modification using admin panel, Giving permissions to users, Adding users , Uploading the information by user and Changing the administration interface title.	**20%**	**10**
List Of Practical	**Weightage**	**Contact hours**
Unit 1: 1) Creating a web form and validating it. 2) Creating a application using php an AJAX and connect it with database	**20%**	**06**
Unit 2: 3) Create a single web page with the model view controller& validate it. 4) Connect the developed form with the HTTP Services and connect it with a database.	**25%**	**14**
Unit 3: 5) Building a Single-page Application using a front-end framework (e.g. React, Angular, Vue.js) 6) Creating a custom Web Component that can be reused across multiple projects	**25%**	**09**

Unit 4: 7) Implementing data validation rules using MongoDB's schema validation feature. 8) Implementing transactions to maintain data consistency in MongoDB.	**20%**	**06**
Unit 5: 9) Building a real-time web application using Websockets and a server-side framework (e.g. Socket.io, Django Channels) 10) Designing a RESTful API& building a front-end application that consumes it	**20%**	**10**

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

Course Outcomes:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to: CO1. **Apply** the concept of php and ajax CO2. **Develop** web applications using AngularJs CO3. **Design** and develop interactive web applications using NodeJs CO4. **Connect** MongoDB with realtime web applications. CO5. **Develop** real time applications through the Django framework.	Cognitive	Apply Develop Design Connect Develop

Learning Resources	
1.	**Textbooks:** 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, brendandayley, 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.	**Other Electronic Resources**: MOOC Platform

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 Article Review: 10 marks **Total: 40 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	1	1	3
CO1	1	1	3
CO3	1	1	3
CO4	1	1	3
CO5	1	1	3

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
CO1	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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	2	0	5	3	1	0	4

Course Pre-requisites	Programming: Python
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:	2/8/2022
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1. To help students learn, understand, and practice basic of python and data structure 2. To aware students about various data preprocessing techniques 3. To give overview of visualization techniques 4. To brief students data warnling methodologies 5. To provide knowledge about statistical analysis.

Course Content (Theory)	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	**10%**	**05**

including String, Array, List, Tuple, Set, Dictionary and operations them.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 Coxre Philosophy, Contributing to data science, Discovering present and future develop men goals, Working with Python, Getting a taste of the language, Understanding the need for indentation, Working at the command line or in the IDE		
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	**25%**	**10**

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		
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 and 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
Unit 1: 1) Implement basic data type manipulation functions using Python 2) Implement python list and tuple manipulation commands using various examples.	**10%**	**05**

Unit 2: 3) Implement Matrix functions and Identify getting Palindrome for a given input text/number using Python. 4) Perform various data frame manipulation operations as well as dealing with missing values in the dataframe in python.	**20%**	**10**
Unit 3: 5) Perform time series visualization for given data set through line plots, histograms, density plot, scatter plots, heat maps and auto-correlation plot. 6) Perform geospatial visualization for a given data set in python.	**25%**	**10**
Unit 4: 7) Perform data wrangling for given dataset using python	**25%**	**10**
Unit 5: 8) Perform statistical data analysis as well as visualization for Exploratory data analysis through box plots 9) 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

Course Outcomes:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to: CO1. **Understand** and manipulate basic of python and data structure CO2. **Implement** various data preprocessing techniques CO3. **Visualize** the real time data CO4. **Ablility** to warangl the data. CO5. **Remember** to do statistical analysis.	Cognitive	**Understand** **Implement** **Visualize** **Ablility** **Remember**

Learning Resources	
1.	**Textbooks:**

	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. AnandRajaraman 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.	**Other Electronic Resources**: MOOC Platform

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 Article Review: 10 marks **Total: 40 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	3	0
CO1	3	0	3
CO3	3	0	3
CO4	3	0	0
CO5	3	0	0

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
CO1	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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	2	0	5	3	1	0	4

Course Pre-requisites	Programming: Python
Course Category	Engineering Specific Elective
Course focus	Employability
Rationale	The course teaches the systematicuse 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:	19/8/2019
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 (Theory)	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 and IoT Analytics, Knowledge Management	**20%**	**09**

Unit 2: Reference Architecture IoT Reference Architecture: Architecture, Functional, information, deployment and operation views; SOA based Architecture, API-based Architecture, OPENIoT Architecture for IoT/Cloud Convergence	**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.	**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: 3) (3)Creating a RESTful API to expose IoT data to external applications. 4) (4)Implementing edge computing in an IoT system to process data closer to the source and reduce latency.	**20%**	**09**
Unit 3: 5) (5)Using MQTT as a lightweight messaging protocol to publish and subscribe to data in an IoT system. 6) (6) Implementing security measures for IoT systems, including data encryption, access control, and secure communication protocols (e.g. TLS).	**20%**	**09**
Unit 4: 7) Designing an IoT architecture that includes sensors, gateways, and cloud services such as AWS IoT	**20%**	**09**

Unit 5: 8) 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

Course Outcomes:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to: CO1. **Explore** the interconnection and integration of various machines. CO2. **Ability** to design and develop IOT Devices. CO3. **Understand** the application protocols of IOT CO4. **Implemen**t and connect the IoT devices with AWS Cloud CO5. **Apply** the knowledge of IoT in various real time projects as case study.	Cognitive	**Explore** **Ability** **Understand** **Implement** **Apply**

Learning Resources	
1.	Textbooks: 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. 4. http://nptel.ac.in

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
Article Review	10 marks
Total	**40 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	1	2	1
CO1	1	2	2
CO3	1	2	1
CO4	1	2	1
CO5	1	1	2

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
CO1	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

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

COURSE CODE BTCS507	COURSE NAME NETWORK SECURITY AND ACCESS CONTROL	SEMESTER V

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

Course Pre-requisites	Basics of computer networks
Course Category	Engineering Specific Elective
Course focus	Employability
Rationale	Network security and access control subject is important because it keeps sensitive data safe from cyber attacks and ensures the network is usable and trustworthy.
Course Revision/ Approval Date:	19/8/2019
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. Identify access control for information systems

Course Content (Theory)	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	**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	**20%**	**09**

system design principles		
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%**	**09**
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%**	**09**
List Of Practical	**Weightage**	**Contact hours**
Unit 1: 1) Installation of Kali Linux or Parrot Security Operating System in Virtual Box. i. Kali OS:Click here ii. Parrot Security OS:Click here iii. Download Kali Linux OS:Click here iv. Download Parrot Security OSClick here **2)** Practical approach to implement Footprinting: Gathering Target Information making use of following tools:· Dmitry – DeepmagicReferencehttps://www.youtube.com/watch?v= zd3goGLM7Q·UA TesterReference :https://www.youtube.com/watch?v=WsTupi32ZYEWhatwebReference :https://www.youtube.com/watch?v=Fx9sIgxcNwU	**20%**	**09**
Unit 2: 3) Study practical approach to implement scanning and enumeration techniques using Nmap. 4) To identify anomalies in your network using Network anomaly detection engines (ADE).	**20%**	**09**
Unit 3: 5) Study practical approach to implement system hacking and learn 6) Trace the origin of Email using any Tool (e.g. emailTackerPro) 7) Trace the path of website using Tracert Utility.	**20%**	**09**

Unit 4: 8) Study practical approach to combine access control with the admission control mechanisms used to provide quality of service guaranteed in multimedia operating systems. 9) Study practical approach to implement and manage access control efficiently in large complex systems	**20%**	**09**
Unit 5: 10) 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%**	**09**

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

Course Outcomes:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to:		
CO1. Discuss major issues concerning network security.	Cognitive	Understand
CO2. Understand risk involved in access control	Cognitive	Understand
CO3. Explore different Procedure, and 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.	Textbooks: 1. Network Security Essentials, Prentice-Hall by William Stallings
2.	Reference Books: 2. "Network Security Essentials: Applications and Standards" by William

	Stallings. 3. "Computer Networking: A Top-Down Approach" by James F. Kurose and Keith W. Ross

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 Article Review: 10 marks **Total: 40 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	1	2	1
CO1	1	2	1
CO3	3	0	3
CO4	1	2	1
CO5	1	1	2

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
CO1	1	0	0	0	0	0	0	0	0	0	0	0
CO3	0	0	2	3	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

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				Evaluation Scheme					
			L	P	T	Total	L	P	T	Total	Theory: MS Marks	Theory: CEC Marks	Theory: ES Marks	Theory Marks	Practical Marks	Total Marks
1	BTCS601	Professional Elective -I	3	2	0	5	3	1	0	4	20	40	40	100	50	150
2	BTCS602	Theory of Computation	3	0	1	4	3	0	1	4	20	40	40	100	0	100
3	BTCS603	Advanced Java Technology	3	2	0	5	3	1	0	4	20	40	40	100	50	150
4	BTCS604	Specialized Track Elective I - Deep Learning	3	2	0	5	3	1	0	4	20	40	40	100	50	150
	BTCS605	Specialized Track Elective-II - IoT Network, Signal & Signal processing														
	BTCS608	Specialized Track Elctive-III - Platform & Application security principles														
5	BTCS606	Specialized Track Elective-I -Big Data Architecture and Programming	3	2	0	5	3	1	0	4	20	40	40	100	50	150
	BTCS607	Specialized Track Elective-II - Data Analytics for IoT														
	BTCS609	Specialized Track Elctive -III - Wireless and Mobile Device security principles														
6	AECC601	Disaster Risk Management	2	0	0	2	2	0	0	2	20	40	40	100	0	100
7	BTCS610	Minor Project – I	0	6	0	6	0	3	0	3	0	0	0	0	100	100
8	BTCS611	Industrial Internship	0	0	0	0	0	2	0	2	0	0	0	0	100	100
		Total	**17**	**14**	**01**	**32**	**17**	**09**	**01**	**27**						**1000**

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

Semester

PEC-I

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

COURSE CODE BTCS601B	COURSE NAME CYBER SECURITY	SEMESTER VI

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	Basic Computer knowledge
Course Category	Professional core courses
Course focus	Skill development
Rationale	The Cybersecurity subject holds local, national, and international relevance due to the escalating threats and vulnerabilities in the digital landscape. Locally, it equips individuals with the knowledge and skills to protect local organizations and individuals from cyber threats, ensuring data privacy and information security. Nationally, expertise in this subject contributes to safeguarding critical infrastructure, defending against cyberattacks, and preserving national security. Internationally, proficiency in cybersecurity facilitates collaboration, information sharing, and coordinated efforts to combat cybercrime on a global scale. The subject's relevance lies in its ability to fortify digital resilience, protect economic interests, and ensure the trust and integrity of digital systems in the face of growing cybersecurity challenges.
Course Revision/ Approval Date:	24/01/22
Course Objectives (As per Blooms' Taxonomy)	1. To make student 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 (Theory)	Weightage	Contact hours

Unit 1 :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 Welfare 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: 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 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:Block chain, Bit coin&Crypto currency: Block chain- Public Ledgers, Block chain as Public Ledgers - Bit coin, Block chain 2.0, Smart Contracts, Block in a Block chain, Transactions-Distributed Consensus, The Chain and the Longest Chain - Crypto currency to Block chain 2.0 -A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bit coin scripting, Bit coin Scripts , Bit coin P2P Network, Transaction in Bit coin Network, Block Mining, Block propagation and block relay, Consensus introduction, Distributed consensus in open environments-Consensus in a Bit coin network	**20%**	**09**

List Of Practical	Weightage	Contact hours
Unit 1: 1. Introduction to Information Security and Cyber Security 2. Installation and Configuration of VM WARE Workstation Pro , VM Windows 10 and VM UBUNTU Linux	**20%**	**3**
Unit 2: 1. Installation and Configuration of ACCUNETIX Vulnerability Scanner on VM Windows 10 and VM UBUNTU Linux- Perform Scan on Websites and Download Reports	**20%**	**3**
Unit 3: **1.** Installation and Configuration of GFI Languard Network Scanner on VM Windows 10 and VM UBUNTU Linux- Perform Scan on Websites and Download Reports	**20%**	**3**
Unit 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%**	**3**
Unit 5: **1.** Installation and Configuration of NIKTO Vulnerability Scanner on VM Windows 10 and VM UBUNTU Linux- Perform Scan on Websites and Download Reports	**20%**	**3**

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

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to:		
CO1 : Able to **understand** fundamental blocks of Cyber security	Cognitive	Understand
CO2: **Analyze** security threats and vulnerabilities.	Cognitive	Analyze
CO3: Able to **analyze** network security	Cognitive	Analyze
CO4: **Comprehend** system and application security.	Cognitive	Understand
CO5: Able to **explore** in the area of blockchain technology.	Cognitive	-

Learning Resources	
1.	Reference Books: 1. Cybersecurity - Attack and Defence Strategies: Infrastructure security with Red Team and Blue Team tactics by Yuri Diogenes, ErdalOzkaya. 2. Cyber Law LawOf Information Technology And Internet (LexixNexis) AnirudhRastogi 3. Understanding Laws–Cyber Laws And Cyber Crimes(LexixNexis) 4. Cyber Crime Manual by Bibhas Chatterjee, Lawman Publication
3.	Other Electronic Resources: **http://nptel.ac.in/**

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	

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	1	2	2
CO2	1	2	2
CO3	1	2	2
CO4	1	2	2
CO5	1	2	2

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

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

COURSE CODE BTCS601E	COURSE NAME CONCEPTS OF AR / VR	SEMESTER VI

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	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 and 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)	1. To analyse the hardware and 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 (Theory)	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, interactionsimple, 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 5Virtual Reality Applications Engineering, architecture, education, medicine, entertainment, science, training	**20%**	**09**

List Of Practical	Weightage	Contact hours
Unit 1: 1) Create an employee table. Access data of employee table using SQL query in R. 2) Use the undergraduate survey data from http://becomingvisual.com/rfundamentals/undergrad .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%**	**3**
Unit 2: 3) Installation of unity for AR/VR models. 4) Learn the fundamental aspects of designing and implementing rigorous empirical experiments using VR. 5) Study technology for managing VR environment in real time for software and hardware inputs.	**20%**	**3**
Unit 3: 6) Develop the affinity transforms. 7) Develop the image processing techniques in 3D	**20%**	**3**

Unit 4: 8) To design 3D User Interfaces. 9) Create the Object and shapes anddevelop the movementsof the objects. (i) To design theinterface for Augmented Reality. (ii) To design theinterface for Virtual Reality	**20%**	**3**
Unit 5: 10) Develop a scene in Unity that includes: a cube , plane and sphere, apply transformations on the 3 objects. Add a video and audio source. 11) Develop a simple UI menu with images, canvas, sprites and button. Write a C# program to interact with UI menu through VR trigger button such that on each successful trigger interaction display a score on the scene.	**20%**	**3**

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

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to:		
CO1. To **analyse** the hardware and software requirements.	Cognitive	Analyze
CO2. To **use** the different intersection techniques.	Cognitive	Apply
CO3. **Developing** Big Data metadata management.	Cognitive	Apply
CO4. **Evaluating** Wireless Access in Vehicular Environment Technology	Cognitive	Understand
CO5. **Understand** sustainability of cloud data	Cognitive	Evaluate

Learning Resources

1.	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**
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	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	1	0	2
CO2	1	0	2
CO3	1	0	2
CO4	1	0	2
CO5	1	0	2

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

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

Course Pre-requisites	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)	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 (Theory)	Weightage	Contact hours
Unit 1: Finite Autometa Introduction- Basic Mathematical Notation and techniques- Finite State systems – Basic Definitions – Finite Automaton – DFA & NDFA – Finite Automaton with €-moves – Regular Languages- Regular Expression – Equivalence of NFA and DFA – Equivalence of NDFA"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 – Greiback Normal form – Chomskynormal 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

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to:		
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.	Cognitive	Analyse

Learning Resources	
1.	Reference Books: 1. Hopcroft 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)

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**

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

Mapping of POs & COs

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**
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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	2	0	5	3	1	0	4

Course Pre-requisites	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)	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 network.

Course Content (Theory)	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, URLConnection,	**20%**	**09**
Unit 2:JDBCProgramming The JDBC Connectivity Model, Database Programming: Connecting to the Database, Creating a SQL Query, Getting the Results, Updating Database Data, Error Checking and the SQLException Class, The SQLWarning Class, The Statement Interface, PreparedStatement, CallableStatement The ResellSet Interface, Updatable Result Sets, JDBC Types, Executing SQL Queries, ResultSetMetaData, Executing SQL Updates, Transaction Management.	**20%**	**09**
Unit 3: J2EE architecture, Servlet API and Overview J2EE architecture, Enterprise application concepts, n-tier application concepts, J2EE platformServlet Model: Overview of Servlet, Servlet Life Cycle, HTTP Methods Structure and Deployment descriptor ServletContext and ServletConfig interface, Attributes in Servlet, Request Dispacher interface The Filter API: Filter, FilterChain, Filter Config Cookies and Session Management: Understanding state and session, Understanding Session Timeout and Session Tracking, URL Rewriting. JSP Directives, JSP Action, JSP Implicit Objects JSP Form Processing, JSP Session and Cookies Handling, JSP Session Tracking JSP Database Access, JSP Standard Tag Libraries, JSP Custom Tag, JSP Expression Language, JSP Exception Handling, JSP XML Processing	**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%**	**09**

List Of Practical Tutorial	**Weightage**	**Contact hours**

Unit 1: 1. Create a chat application using either TCP or UDP protocol. 2. Implement TCP Server for transferring files using Socket and ServerSocket 3. 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. 4. 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 of client		
Unit 2: 5. Write an RMI application where client supplies two numbers and server response by summing it. Provide your custom security policy for this application. 6. Implement Student information systems using JDBC and RMI		
Unit 3: 7. 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. 8. 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 9. Create a Servlet file and study web descriptor files. 10. Create login form and perform state management using Cookies, Http Session and URL Rewriting. 11. Implement Authentication filter using filter API		

Unit 4: 12. 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: (Max. 100 words) Lecture-based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to:		
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 application using Java Servlet and 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.	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.

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**

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

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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	2	0	5	3	1	0	4

Course Pre-requisites	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)	1. To Gain a historical perspective of AI and its foundations 2. To become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning 3. To get experience with AI development tools such as an 'AI language', expert system shell, and/or data mining tool. 4. To explore the current scope, potential, limitations, and implications of intelligent systems 5. To experiment with a machine learning model for simulation and analysis.

Course Content (Theory)	Weightage	Contact hours
Unit 1: Introduction to Deep Learning and Neural Networks History of Deep Learning, Deep Learning Success Stories, McCulloch Pitts Neuron, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Feed Forward Neural Networks, Back propagation	**20%**	**09**
Unit 2:Optimization & Encoding Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, Principal Component Analysis and its interpretations, Singular Value Decomposition, Auto encoders and relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparse autoencoders	**20%**	**09**
Unit 3: Improving Deep Neural Networks: Hyper parameter tuning and Regularization Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout, Greedy Layer wise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization, Learning Victorian Representations Of Words	**20%**	**09**

Unit 4: Convolution Neural Network Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Eigenvalues and eigenvectors, Eigenvalue Decomposition, Basis, Principal Component Analysis and its interpretations, Singular Value Decomposition, Autoencoders and relation to PCA, Regularization in autoencoders, Denoisingautoencoders, Sparse autoencoders.	**20%**	**09**
Unit 5: Applications of Deep Learning Images segmentation – Object Detection – Automatic Image Captioning – Image generation with Generative adversarial networks – Video to Text with LSTM models – Attention models for Computer Vision – Case Study: Named Entity Recognition – Opinion Mining using Recurrent Neural Networks – Parsing and Sentiment Analysis using Recursive Neural Networks – Sentence Classification using Convolutional Neural Networks – Dialogue Generation with LSTMs	**20%**	**09**

List Of Practical	Weightage	Contact hours
Unit 1: 1. Implementing a basic neural network with a single layer, activation function, and softmax output layer for image classification.	**20%**	**3**
Unit 2: 2. Implementing an autoencoder architecture for image denoising, image compression, or feature extraction.	**20%**	**3**
Unit 3: 3. Implementing bias variance decomposition and analysis to understand the tradeoff between model complexity and generalization performance. 4. L2 Regularization: Implementing L2 regularization to control overfitting by adding a penalty term to the loss function. 5. Early Stopping: Implementing early stopping to prevent overfitting by monitoring validation loss and stopping training when performance plateaus. 6. Implementing dataset augmentation techniques like image rotation, translation, and scaling to improve model generalization.	**20%**	**3**

Unit 4: 7. Implementing batch gradient descent to optimize a simple linear regression model. 8. Momentum Based GD: Implementing momentum-based gradient descent to optimize a multivariate regression model. 9. Nesterov Accelerated GD: Implementing Nesterov accelerated gradient descent to optimize a convolutional neural network. 10. Stochastic GD: Implementing stochastic gradient descent to optimize a deep neural network on a large dataset.	**20%**	**3**
Unit 5: 11. Object Detection: Implementing object detection algorithms like YOLO or RCNN to detect objects in images or videos. 12. Time Series Analysis: Implementing time series analysis techniques like forecasting or anomaly detection using deep learning architectures like LSTM or GRU.	**20%**	**3**

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

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to:		
CO1: **Demonstrate** fundamental understanding of the history of artificial intelligence (AI) and its foundations	Cognitive	Understand
CO2: **Apply** basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.	Cognitive	Apply
	Cognitive	Analyse
	Cognitive	Create

CO3: **Demonstrate** awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models. CO4: **Demonstrate** proficiency developing applications in an 'AI language', expert system shell, or data mining tool. CO5: Demonstrate proficiency in applying scientific method to models of machine learning.	Cognitive	Apply

Learning Resources	
1.	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.

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	

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

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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	2	0	5	3	1	0	4

Course Pre-requisites	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)	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.

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

Unit 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..		
Unit 2: 3. Analog Signals & Digital Signals: Implementing a simple signal generator to generate analog and digital signals, and comparing their properties. 4. Signal Conditioning: Implementing signal conditioning techniques like amplification, attenuation, and filtering to preprocess analog signals.		
Unit 3: 5. Z-transform & Inverse z-transform: Implementing the z-transform and inverse z-transform to analyze and synthesize discrete-time signals and systems. 6. Linear Convolution and its Properties: Implementing linear convolution to process discrete-time signals and analyzing its properties like commutativity, associativity, and distributivity.		
Unit 4: 7. Implementing digital carrier systems like ASK, QASK, FSK, BPSK, DPSK, DEPSK, QPSK, MSK, GMSK, and analyzing their performance under different channel conditions.		
Unit 5: 8. TCP/IP (Transmission Control Protocol / Internet Protocol): Implementing a simple client-server communication using TCP/IP and analyzing its performance under different network conditions. 9. 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

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

After successful completion of the above course, students will be able to: CO1. To **aware** students about various types of signals and its processing CO2. To give a **brief overview** of signal conditioning. CO3. To make student **understand** about the processing of digital signal CO4. To **provide a knowledge** of digital signal transmission. CO5. To give fundamental **knowledge** about protocol conversion.	Cognitive	Understand Analyse Apply Apply Create

Learning Resources	
1.	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

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

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

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

COURSE CODE BTCS606	COURSE NAME BIG DATA ARCHITECTURE AND PROGRAMMING	SEMESTER VI

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	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)	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 (Theory)	Weightage	Contact hours
Unit 1Introduction What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.	**20%**	**09**
Unit 2:NoSQL Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.	**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 Hbase, data model and implementations, Hbase clients, Hbase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration. Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts.Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries	**20%**	**09**

List Of Practical	Weightage	Contact hours
Unit 1: 1. Case Study on Big Data and its 2. applications in following sectors 3. Banking and Security 4. Healthcare 5. Finance and trading	**20%**	**3**
Unit 2: 6. Installation of MongoDB 7. Implement CRUD operations on MONGODB 8. Implementing Advance CRUD 9. Operations on MONGO-DB	**20%**	**3**
Unit 3: 10. Install Hadoop 11. Implement Hadoop commands	**20%**	**3**
Unit 4: 12. Implement Hadoop and mapreduce commands. 13. Implement basic commands of Apache Cassandra with Python. 14. Implement simple queries of data management using Apache Kafka	**20%**	**3**
Unit 5: 15. Implement Word count program With Hadoop 16. Extract, Transform, and Load Hive Data in Python 17. Implement User Defined functions in Pig with Python	**20%**	**3**

Instructional Method and Pedagogy: (Max. 100 words) Computer based learning, Chalk – Talk, Presentation

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to: CO1. **Explain** the motivation for big data systems and identify the main sources of Big Data in the real world CO2. **Demonstrate** an ability to use frameworks	Cognitive	 Understand Analyse Apply Apply

like Hadoop, NOSQL to efficiently store, retrieve and process Big Data for Analytics. CO3. CO3:**Implemen**t several Data Intensive tasks using the Map Reduce Paradigm CO4. CO4: **Apply** several newer algorithms for Clustering Classifying and finding associations in Big Data . CO5. CO5: **Design** algorithms to analyze Big data like streams, Web Graphs and Social Media data.	Cognitive	Create

Learning Resources	
1.	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

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

Mapping of POs & COs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	2	0	5	3	1	0	4

Course Pre-requisites	Big data Frameworks, Internet of Things (IoT) Architecture
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:	24/1/2022
Course Objectives (As per Blooms' Taxonomy)	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 (Theory)	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 –energysaving in smart building- Intelligent Transportation Systems and Wireless Access in Vehicular Environment Technology for Developing Smart Cities: advantages andachievements- Emerging Technologies in Health Information Systems: GenomicsDriven 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 – potentialstakeholders and their complex relationships to data and analytics applications – SocialNetworking 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
Unit 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 platform	**20%**	**3**
Unit 2: 3. Develop an IoT application based on geographical concept. 4. Develop an IoT application based on geographical concept and embed the spatial	**20%**	**3**
Unit 3: 5. Case study on Fog Computing: Healthcare Applications.	**20%**	**3**
Unit 4: 6. Case Study on building Intelligent Transportation Systems and Wireless Access in Vehicular Environment Technology. 7. Develop an IoT application for smart city.	**20%**	**3**
Unit 5: 8. Perform the analytics on dataset of Social Networking.	**20%**	**3**

Instructional Method and Pedagogy: (Max. 100 words)
Lecture-based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning

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

After successful completion of the above course, students will be able to: CO1. **Exploring** several Big Data platforms for IOT. CO2. **Examine** self-healing systems and role of neural networks.. CO3. Developing Big Data metadata management. CO4. **Evaluating** Wireless Access in Vehicular Environment Technology CO5. **Understand** sustainability of cloud data	Cognitive	 Understand Analyse Understand Apply Create

Learning Resources	
1.	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

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

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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	2	0	5	3	1	0	4

Course Pre-requisites	
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:	24/1/2022
Course Objectives (As per Blooms' Taxonomy)	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 (Theory)	Weightage	Contact hours
Unit 1: Security Issues in Mobile Communication: Mobile Communication History, Security – Wired Vs Wireless, Security Issues in Wireless and Mobile Communications, Security Requirements in Wireless and Mobile Communications, Security for Mobile Applications, Advantages and Disadvantages of Application – level Security	**20%**	**09**

Unit 2: Security of Device, Network, and Server Levels: Mobile Devices Security Requirements, Mobile Wireless network level Security, Server Level Security. Application Level Security in Wireless Networks: Application of WLANs, Wireless Threats, Some Vulnerabilities and Attach Methods over WLANs, Security for 1G Wi-Fi Applications, Security for 2G Wi-Fi Applications, Recent Security Schemes for Wi-Fi Applications	**20%**	**09**
Unit 3: Application Level Security in Cellular Networks: Generations of Cellular Networks, Security Issues and attacks in cellular networks, GSM Security for applications, GPRS Security for applications, UMTS security for applications, 3G security for applications, Some of Security and authentication Solutions	**20%**	**09**
Unit 4:. Application Level Security in MANETs: MANETs, Some applications of MANETs, MANET Features, Security Challenges in MANETs, Security Attacks on MANETs, External Threats for MANET applications, Internal threats for MANET Applications, Some of the Security Solutions. Ubiquitous Computing, Need for Novel Security Schemes for UC, Security Challenges for UC, and Security Attacks on UC networks, Some of the security solutions for UC	**20%**	**09**
Unit 5: Data Center Operations - Security challenge, implement "Five Principal Characteristics of Cloud Computing, Data center Security Recommendations Encryption for Confidentiality and Integrity, Encrypting data at rest, Key Management Lifecycle, Cloud Encryption Standards	**20%**	**09**

List Of Practical	Weightage	Contact hours
Unit 1: 1. Configure Wi-Fi and Bluetooth settings securely on a mobile device. 2. Implement screen lock methods (password, PIN, biometrics) and explore their effectiveness	**20%**	**3**

Unit 2: 3. Implement two-factor authentication (2FA) for device login or account access. 4. Test the effectiveness of different authentication methods. 5. Implement password policies (complexity, expiration) on mobile devices. i.	**20%**	**3**
Unit 3: 6. Analyze and compare the security features of different mobile applications. 7. Perform a security review of a mobile app to identify vulnerabilities**.**	**20%**	**3**
Unit 4: 8. Set up a secure Wi-Fi network with strong encryption and a robust password. 9. Conduct a penetration test on a Wi-Fi network to identify weaknesses.	**20%**	**3**
Unit 5: 10. Explore Bluetooth pairing methods and their security implications. 11. Investigate Bluetooth vulnerabilities and attacks (e.g., BlueBorne) and ways to mitigate them.	**20%**	**3**

Instructional Method and Pedagogy: (Max. 100 words)
Lecture-based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to:	Cognitive Cognitive	
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		Analyse
CO3. Design secured network application considering all possible threats		Understand

Learning Resources

1.	**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.

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	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	1	2	1
CO2	0	2	2
CO3	0	2	2

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

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

COURSE CODE BTCS701A	COURSE NAME SERVICE ORIENTED ARCHITECTURE	SEMESTER VII

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

Course Pre-requisites	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) is a design approach that promotes modularity, reusability, and flexibility in software development. By decomposing applications into smaller, loosely-coupled services, SOA enables organizations to achieve several benefits. Firstly, it enhances interoperability, as services can be easily integrated across different platforms and technologies. Secondly, it promotes scalability, allowing organizations to adapt and grow their systems efficiently. Additionally, SOA encourages service reuse, reducing development time and costs. Furthermore, SOA improves fault tolerance and resilience, as services can be independently updated or replaced without impacting the entire system. Overall, SOA enables organizations to build agile, scalable, and adaptable software solutions that align 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 (Theory)	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 – servicelevel 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 and web services - .net and j2ee interoperability – service-enabling legacy systems – enterprise service bus pattern	**20%**	**09**
Unit 4: Process management Multi-channel access – business benefits – soa for multi channel access – tiers – business process management – concepts – bpm, soa and web services – wsbpel – web services compositio	**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
1. Study different architecture and the technique of the services.	**10%**	**2**
2. To configure the Emerging techniques for addressing challenges that are unique to services.	**10%**	**2**
3. To discuss the basic concepts, and techniques for service-oriented computing, standards related to Web services, with the help of models.	**10%**	**2**
4. Formulate the foundational concepts of services, to evaluate existing approaches of service.	**10%**	**2**
5. To develop student detail using .Net ,Create addition web service in ASP.Net invoke it in using C#.	**10%**	**2**
6. Construct the inter programming interfaces comprised of J2EE for building such systems.	**10%**	**2**
7. Integrating mobile devices into an SOA presents Connected Computing for multiple channel access	**10%**	**2**
8. Study JAXP(Java API for XML Processing) with example	**5%**	**2**
9. Configure the running samples using the java API	**10%**	**2**
10. Study and analyze the Services Security.	**5%**	**2**

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

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to:	Cognitive domain	
CO1. Able to **design, develop and test** Web services.		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).		Understand Apply
CO3. **Develop** and Conceptually model Web services and **formulate** specifications of them in the Resource Description Framework (RDF) and the Web Ontology Language (OWL).		
CO4. **Analyze** approaches to compose services		Analyze
CO5. **Evaluate** emerging and proposed standards for		

	the main components of Web services architectures.		

Learning Resources	
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.

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	Attendance	05 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	05 marks
	Total	**50 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/Universitymentor's feedback on the Project/Industrial.	30 marks

		Attendance	10 marks
		Total	**100 Marks**

Mapping of PSOs& COs

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

Mapping of POs& COs

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

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				Evaluation Scheme					
			L	P	T	Total	L	P	T	Total	Theory: MS Marks	Theory: CEC Marks	Theory: ES Marks	Theory Marks	Practical Marks	Total Marks
1	BTCS701	Professional Elective – II	3	2	0	5	3	1	0	4	20	40	40	100	50	150
2	BTCS702	Mobile Application Development	2	4	0	6	2	2	0	4	20	40	40	100	50	150
3	BTCS703	Specialized Track Elective-I -Natural Language Processing	3	2	0	5	3	1	0	4	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	3	2	0	5	3	1	0	4	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	6	0	3	0	3	0	3	0	0	0	0	100	100
6	BTCS710	Industrial Internship	0	0	0	0	0	2	0	2	0	0	0	0	100	100
		Total	**11**	**16**	**0**	**27**	**11**	**10**		**21**						**800**

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

PEC– II

Course Code	Course Name
BTCS701A	Service oriented architecture
BTCS701B	Compiler construction
BTCS701C	Distributed computing systems
BTCS701D	Soft computing
BTCS701E	Computer vision

COURSE CODE BTCS701B	COURSE NAME COMPILER CONSTRUCTION	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	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 and inherited attributes and develop syntax directed translation schemes. 5. **Develop** algorithms to generate code for a target machine

Course Content (Theory)	Weightage	Contact hours
Unit 1: **Overview of the Translation Processand Lexical Analyser** Difference between interpreter, assembler and compiler.Phases of compilation, Analysis and	**15%**	**6**

SynthesismodelLexical Analysis (scanner),Input Buffering,Recognition of tokens, Regular languages, finite automata, regular expressions, from regularexpressions to finite automata, scanner generator(lex, flex)		
Unit 2:Syntax Analyser Context-free languages and grammars, LL(1) grammars and top-down parsing, operator grammars, LR(O), SLR(1), LR(1), LALR(1)grammars and bottom up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc, bison)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 andError Recovery Different Intermediate Forms, Syntax DirectedTranslation Mechanisms And AttributedMechanisms And Attributed DefinitionError Detection & Recovery	**15%**	**6**
Unit 4: Symbol Table and Run-Time Memory Management Symbol Table Its structure, symbol attributes and management. Run-time environment: Procedure activation, parameter passing, value return, memory allocation, and scope.	**10%**	**6**
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%**	**6**
Unit 6: 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%**	**6**

List Of Practical	Weightage	Contact hours
1. Study of Flex	**5%**	**2**
2. Implement following programs using Lex. a. Write a lex program to print hello world b. Write a lex program to recognize tokens	**10%**	**2**

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 printout 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 separate file.		
3. Implement a lexical analyzer in Clanguage	**5%**	**2**
4. Write a C program to identify whether a given line is a comment or not	**5%**	**2**
5. Write a C program to test whether a given identifier is valid or not.	**5%**	**2**
6. Write a C program to simulate lexical analyzer for validating operators	**5%**	**2**
7. Write a program for Left Factoring	**5%**	**2**
8. Write a program for left recursion	**5%**	**2**
9. Write a C program for constructing of LL (1) parsing.	**10%**	**2**
10. Write a C program for constructing recursive descent parsing	**5%**	**2**
11. a. 1To Study about Yet Another Compiler-Compiler(YACC). b. Write a Yacc Program to identify weather a identifier is valid or not.	**10%**	**2**
12. a. 1)Write a C program to generate Quadruple, triple and Indirect triple b. 2)Write a C program for Parameter passing techniques c. 3)Write a program to generate Directed acyclic graph for given number of edges	**30%**	**2**

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

Course Outcome	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**

After successful completion of the above course, students will be able to: CO1. **Understand** the basic concepts and application of CompilerDesign CO2. **Apply** their basic knowledge Data Structure to design Symbol Table, Lexical Analyser , Intermediate Code Generation, Parser (Top Down and Bottom Up Design) and will able to **understand** strength of Grammar and Programming Language. CO3. **Understand and Implement** a parser. CO4. **Understand and Analyze** various code optimization Techniques CO5. **Understand and implement** various code Generation methods for compilation process	Cognitive	Understand Apply Understand Analyze Create

Learning Resources	
1.	Reference Books: 1. Compilers: Principles, Techniques and Tools By Aho, Lam, Sethi, and Ullman,Second Edition, Pearson, 2014 2. Compilers: Principles, Techniques and Tools By Aho, Sethi, and Ullman,Addison-Wesley, 1986 3. Compiler Design in C By Allen I. Holub, Prentice-Hall/Pearson. 4. Advanced Compiler Design and Implementation By Muchnick, Morgan andKaufmann, 1998.
2.	Video Tutorial https://www.classcentral.com/course/compilers-328(Coursera Course)
3.	NPTEL MOOC https://nptel.ac.in/courses/106/105/106105190/

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	

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

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

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

COURSE CODE BTCS701C	COURSE NAME DISTRIBUTED COMPUTING SYSTEM	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	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 provides 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 Systems and Distributed Shared Memory.

Course Content (Theory)	Weightage	Contact hours
Unit 1: Introduction to Distributed Systems Characterization of Distributed Systems: Introduction, Examples of distributed Systems, Issues in Distributes 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 dead lock detection, distributed dead lock detection, path pushing algorithms, edge chasing algorithms. Agreement Protocols: Introduction, System models, classification of Agreement Problem Interactive consistency Problem, Applications of Agreement algorithms	**20%**	**6**
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 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%**	**5**

List Of Practical	Weightage	Contact hours
1. Study architectural models of distributed systems	**10%**	**2**

2. Implement a system model for distributed deadlock detection	**10%**	**2**
3. Implementation of RPC (Remote Procedure Call) Mechanism for echo server.	**10%**	**2**
4. Implementation of RPC Mechanism (Remote Procedure Call) for calculator.	**10%**	**2**
5. Write a program in C to implement Domain Name System	**10%**	**2**
6. Create a Java Program to demonstrate the concept of concurrency.	**10%**	**2**
7. Create a java Program to generate threads from Runnable Objects.	**10%**	**2**
8. Create a java Program to generate threads and implement sleep method.	**10%**	**2**
9. Create a java Program to demonstrate thread priorities with one having maximum priority and one having minimum priority.	**10%**	**2**
10.10 Use synchronization method to avoid interference.	**10%**	**2**

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

Course Outcomes:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to: CO1. **Describe** the problems and challenges associated with these principles. CO2. **Understand and Analyse** Distributed Computing techniques, Synchronous and Processes. CO3. **Apply** Distributed web-based system. CO4. **Understand t**he importance of security in distributed systems CO5. **Understand and Implement** Distributed File Systems and Distributed Shared Memory.	Cognitive	Understand Analyse Apply Understand Apply

Learning Resources	
1.	Text Books: 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) Reference Books: 1. A.Tanenbaum S , "Distributed Operating Systems", Pearson Education (2005). 2. B. P K Sinha, ""Distributed System: Concepts and Design", PHI (2004).

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

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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	2	0	5	3	1	0	4

Course Pre-requisites	Basic knowledge of mathematics.
Course Category	Professional Elective courses
Course focus	Employability
Rationale	The conventional methods of computing relying on analytical or empirical relations becometime consuming and labor intensive to solve some complex problem. Soft computing techniques likeGenetic Algorithms, Fuzzy logic and Artificial Neural Network can be applied effectively to solve complexproblem. 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:	24/1/2022
Course Objectives (As per Blooms' Taxonomy)	To enable students 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. 2. Be **exposed** to neuro-fuzzy hybrid systems and its applications. 3. **Develop** some familiarity with current research problems and research methods inSoft Computing Techniques

Course Content (Theory)	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 interface systems - Classification and Regression Trees - Data clustering algorithms - Rule based structure identification - Neuro-Fuzzy controls - Simulated annealing – Evolutionary computation	**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
1. (1) Create a perception with appropriate number of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights	**10%**	**2**
2. (2) Implementation of De-Morgan's Law	**10%**	**2**
3. (3) Implementation of Fuzzy Operations	**10%**	**2**
4. (4) Implementation of Fuzzy Relations (Max-min Composition)	**10%**	**2**
5. (5) Implementation of Fuzzy Inference System	**10%**	**2**
6. (6) Implementation of Fuzzy Controller (Washing Machine) Implementation of Simple Neural Network	**10%**	**2**
7. (7) Implementation of Simple Genetic Application	**10%**	**2**
8. (8) Implement travelling salesperson problem (tsp) using genetic algorithms.	**10%**	**2**
9. (9) Implement Soft computing based hybrid fuzzy controller	**10%**	**2**
10. (10) Study of MATLAB	**10%**	**2**

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

Course Outcomes:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to:	Cognitive	
CO1. **Apply** various soft computing concepts for practical applications.		Apply
CO2. Use fuzzy rules and reasoning to **develop** decision making and an expert system.		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.		Apply
CO4. **Explain** the importance of optimization techniques and genetic programming.		Understand
CO5. **Review** the various hybrid soft computing techniques and apply in real time problems		Analyze

Learning Resources	
1.	**Textbooks:** 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

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	

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

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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	2	0	5	3	1	0	4

Course Pre-requisites	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 andrecognition from single or multiple images (video). This course emphasizes the core vision tasks of sceneunderstanding and recognition. Applications to object recognition, image analysis, image retrieval and objecttracking 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 task from given images. 2. 3.**Understand** how machine can accomplish recognition, reorganization and 3D reconstruction of objects of the scenes from the images. 3. 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. 4. 5.To **study** applications of computer vision algorithms

Course Content (Theory)	Weightage	Contact hours
Unit 1: IntroductionComputer Vision and Computer Graphics , What is Computer Vision - Low-level, Mid-level, Highlevel , 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%**	**8**
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 and Segmentation Contour based representation, Region based representation, Deformable curves and surfaces , Snakes and active contours, Level set representations , Fourier and wavelet descriptors , Medial representations , Multiresolution analysis. 6. Image segmentation using Region based representation and Contour based representation	**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 Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: Invehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.	**10%**	**5**
List Of Practical	**Weightage**	**Contact hours**
1. Literature Review on the state-of-the-art Computer Vision Applications	**10%**	**2**
2. Write a program to perform following image	**10%**	**2**

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		
3. Apply various Linear Filters and MedianFilter on the given image	**10%**	**2**
4. Detection of Edges using Edge Detection algorithms like Canny, Sobel and Prewitt	**10%**	**2**
5. Feature Extraction using Harris corner detector, SIFT, HoG descriptor	**10%**	**2**
6. Image segmentation using Region based representation and Contour based representation	**10%**	**2**
7. Motion Estimation using Motion field and optical flow	**10%**	**2**
8. Develop an application using Motion Tracking	**10%**	**2**
9. Develop an application using Face Detection and Recognition	**10%**	**2**
10. Develop an application for Surveillance System	**5%**	**2**
11. Develop an application for locating roadways, Road markings, Identifying Road Signs, Locating pedestrians.	**5%**	**2**

Instructional Method and Pedagogy: (Max. 100 words)
Visual Aids, Active Learning Strategies, Real-World Examples, Continuous Assessment

Course Outcomes:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to:	Cognitive	
CO1. To **implement** fundamental image processing techniques required for computer vision		Design
CO2. To **Implement** the shape Analysis		Apply
CO3. To **develop** applications using computer vision techniques		Apply
CO4. Extract features form Images and do **analysis** of Images		Analyze
CO5. **Understand** video processing, motion computation and 3D vision and geometry		Understand

Learning Resources	
1.	**Textbooks:** 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. **Reference Books:** 1. Y. Shirai: Three-Dimensional Computer Vision, Springer-Verlag Berlin, 1988. 2. B. K. P. Horn: Robot Vision, MIT Press, Cambridge, 1986
2.	**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
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**

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

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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
2	4	0	6	2	2	0	4

Course Pre-requisites	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, and 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 netwok. 2. To analyze different security techniques for Mobile Computing. 3. Learn to setup 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 (Theory)	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, Global Mobile Satellite Systems	**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, The LinearLayout Layout, The RelativeLayout Layout, The ScrollView Layout, The TableLayout Layout, The FrameLayout Layout, Using the TextView, EditText View, Button View, RadioButton, CheckBox, ImageButton, RatingBar, The options Menu, The Context Menu	**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. And remote database	**25%**	**08**
Unit 4: Web services & JSON Web services and Parsing, JSON Parsing, Access web data with JSON, Connect to Web Services, Using Async Task & Third Party Library : Retrofit, Google Map, Creating Google Map, Working with Location, Location service with Location Manager, Find Current Location, Geo coding	**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
1:Understand the basic concept of GSM and MANET.	**10%**	**4**

2:Installation and configuration and **Develop**of android studio along with all SDK components and AVD. 2.1Write a java program to print multiplication table of given number. 2.2**.**Aim: Write a java program to implement inheritance. 2.3 Aim: Write a java program to implement Interface. 2.4 Aim: Write a java program to demonstrate concept of functions. (2) Create an android application that displays custom message. (3) Create an android application that displays sample toast message. (4) Design a single screen application, which adds two values inputted by the user. (5) Design an application to demonstrate a concept of radio group and radio buttons. (Uselinear layout) (6) Create an android application that converts KG into Pound. (Import image to enhancelook and feel of UI, Image could be conversion logo or anything relevant) (7) Create a simple Application, which shows the use of Rating Bar. (8) Create an android application to demonstrate Autocompletetextview. (9) Create an application which demonstrate implicate type of Intent calls. (10) Create an application, which demonstrates explicit intents. (11) Create a multiscreen application with three activities (Login, Registration, and Display). Main activity(Login) check for login, if entered data not match then open registration activity, fill data and submit button click will transfer data to third(display) activity which display registration data (12) Create an application to demonstrate option and context menu.	**30%**	**4**

(13) Create an Android Application where user will enter the destination email address, subject and a message. On clicking Send button, it will prompt email client only and email will compose. Also put some logic over Edit Text field that no one fields are empty otherwise notify with toast.		
3:14) **Create** the MP3 player like application (this should also include playing music Through the web). (15) Create the Video player like application. (16) Create sample application that draws the circle, oval shape and square. (17) Create a sample application of frame-by-frame animation. (18) Create sample application that rotates an object, doubles size of that object and then Again shrinks back to original size (19) Create an application to make Insert, update, Delete and retrieve Operation on the sqlite database.	**30%**	**4**
4:20) Installation of flutter for hybrid applications. (21) **Create** a flutter application that will display "Custom Message" in the middle of the screen. (22) Create a flutter application to implement calculator	**20%**	**4**
5: Develop an application using flutter.	**10%**	**4**

Instructional Method and Pedagogy: (Max. 100 words) Lecture-based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning

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

After successful completion of the above course, students will be able to: CO1. **Understanding** algorithm/protocols, environments and communication systems in mobile computing CO2. **Evaluate** the performance of GSM, GPRS and other technologies CO3. **Apply** methods in storing, sharing and retrieving data in Android applications CO4. **Implement** different Android applications CO5. **Implement** IOS applications	Cognitive Domain	Understand Evaluate Apply Create Create

Learning Resources	
1.	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.	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.	Other Electronic Resources: 1. http://www.codelearn.org/android-tutorial/android-introduction 3. http://pl.cs.jhu.edu/oose/resources/android/Android-Tutorial.pdf 1. 3.developer.android.com/training/basics/firstapp

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	Attendance	05 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	05 marks
	Total	**50 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/Universitymentor's feedback on the Project/Industrial.	30 marks
	Attendance	10 marks
	Total	**100 Marks**

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

Mapping of POs& COs

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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	2	0	5	3	1	0	4

Course Pre-requisites	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 (Theory)	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 Recognitio	**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 and 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 mt 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

1: (1)**exploring** the features of nltk – • Word tokenization • Sentence tokenization • Stopword understanding • Wordcloud • Frequency distribution and plotting (2) wordnet exercises • Synonym • Antonym • Porter stemming • Snowball stemming • Lemmatization (3)parts of speech tagging	**20%**	**3**
2:demonstarte (4)regular expressions in detail (5)text processing a. Noise removal b. Lexicon normalization c. Object standardization (6).bag of words understanding	**20%**	**3**
3:understand 7)program to understand tf-idf (8)text summarization using tf-idf (9)feature extraction from text	**20%**	**3**
4:understand and create 10)understanding 1-gram, 2-gram and 3-gram (11)predating next word using n-grams (12)predicting sentence using n-gram (13)part of speech tagging using algorithm	**20%**	**3**
5: create **(**14)tagging using named entity recognition (15)poetry generation using n-gram (16)continuous bag of words for next wordprediction Cbow to fill in the blanks 1. Understanding word disambiguation 2. Understanding lstm 3. Text classification using lstm 4. Poetry generation using lstm Word embedding using gensim.	**20%**	**3**

Instructional Method and Pedagogy: (Max. 100 words) Lecture-based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning**.**

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to: CO1. **Understand** and comprehend the key concepts of NLP and identify NLP challenges and issues CO2. **Develop** language modelling for various text across the different languages CO3. **Apply** computational methods to understand language phenomena of word sense disambiguation CO4. **Design** and develop applications for text or information extraction and classification CO5. **Apply** different Machine translation techniques for translating a source to target languages	Cognitive Domain	Understand Create Apply Create Apply

Learning Resources	
1.	**Textbooks:** 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
4.	Other electronic resources: 1. Https://www.udacity.com/course/natural-language-processing-nanodegree--nd892 2. Https://www.coursera.org/learn/language-processing

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<tr><td>Attendance</td><td>05 marks</td></tr>
<tr><td>Practical Exam</td><td>20 marks</td></tr>
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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

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

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

COURSE CODE BTCS704	COURSE NAME FUNDAMENTALS OF ROBOTICS & AUTOMATION	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	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 idea about drive systems and end effectors. 3. **Provide** knowledge about sensors and machine. 4. **4.Apply** hands-on experience of robotic programming 5. **Elaborate** bot creation process.

Course Content (Theory)	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 LoadRobot Parts and 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: : sensorsand machine vision Requirements of a sensor, principles and applications of the following types of sensors- position sensors - piezoelectric sensor, lvdt, resolvers, optical encoders, pneumatic positionsensors, 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	**20%**	**09**

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		

List Of Practical	Weightage	Contact hours
1: (1)Study and **Understand** of fundamentals mechanics of robotics.	**5%**	**1**
2: 2) **Demonstratio**n of Pneumatic Drive (3) Demonstration of Hydraulic drive and its application (4) Demonstration of Servo Motor Drives and its application	**10%**	**3**
3: (5)**Demonstration** Of Gripper Servo Drives and its application.6 (6) Understand the concept of DSO as signals analyzer in robotics (7) Demonstration of LVDT Sensor (8) Demonstration of Resolvers & Encoder Sensor (9) Demonstration of Fluid Flow Sensor kit (10)Demonstration of Piezoelectric Sensor	**35%**	**5**
4:(11) Demonstration of 6 Axis Robotics arm Trainer	**25%**	**3**
5: 12) Developing a bot.	**25%**	**3**

Instructional Method and Pedagogy: (Max. 100 words)
Lecture-based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning**.**

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to:		

CO1:Acquiring the basics knowledge robotics .	Cognitive Domain	Remember
CO2:Provide a brief understanding of drive systems and end effectors		Understand
CO3:Acquire knowledge about sensors and machine		Understand
CO4:Provide practical experience in robotic programming		Apply
CO5:Analyse the process for creating bot.		Analyse

Learning Resources	
1.	**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.,gonzalz 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
2.	**Textbooks:** 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 2. 3. Groover M.P., "Industrial Robotics -Technology Programming and Applications", mcgraw Hill, 2001.

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	Attendance	05 marks
	Practical Exam	20 marks
	Viva	10 marks
	Journal	10 marks
	Discipline	05 marks
	Total	**50 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/Universitymentor's feedback on the Project/Industrial.	30 marks
	Attendance	10 marks
	Total	**100 Marks**

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

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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	2	0	5	3	1	0	4

Course Pre-requisites	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** and debug it. 4. **Understand** various kernel methods and able to create the own kernals. 5. Get better **understanding** about deep learning& ANN

Course Content (Theory)	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 model 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**
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
1: (1) **Implement** Machine learning model(linear Regression) to predict if a patient is having diabetes or not. (2) Implement Machine learning model(Linear Regression) to predict house price based on input attributes. (3) Explain K-Nearest Neighbor Classification Algorithm. (4) Implement a machine learning model to classify Iris flower data through K nearest Neighbor Classifier in Python. (6) Implement Radial basis function of instance based learning in python.	**30%**	**4**

2: (7) **Implemen**t linear Programming for optimization in Python. (8) Implement lane selection optimizing Pulp.	**10%**	**2**
3: (9) Perform medical Image analysis using learning in python	**10%**	**2**
4: (10) Perform sentiment analysis of Amazon fine food reviews data. (11) Perform Text analysis using python.	**25%**	**3**
5: (12) 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. (13) Implement RPA process for stock price collection and analysis.	**25%**	**2**

Instructional Method and Pedagogy: (Max. 100 words)
Lecture-based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning**.**

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to:	Cognitive	
CO1. **Acquiring** the basics knowledge robotics .		Remember
CO2. Provide a brief **understanding** of drive systems and end effectors		Understand
CO3. **Acquire** knowledge about sensors and machine		Understand
CO4. **Provide** practical experience in robotic programming		Apply
CO5. **Analyse** the process for creating bot.		Analyse

Learning Resources	
1.	**Textbooks:** **1.** Machine Learning A Probabilistic Perspective by Kevin P. Murpi. .

2.	**Reference Books:** 1. Hastie, Tibshirani, Friedman **The Elements of Statistical Learning.**

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<tr><td>Practical understanding of the subject on the Project/Industrial.</td><td>30 marks</td></tr>
<tr><td>Industry/Universitymentor'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>
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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

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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	2	0	5	3	1	0	4

Course Pre-requisites	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 &**Desig**n 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

Course Content (Theory)	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 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, and Cognitive Architecture for Cyber-Physical Robotics, Industrial Robotic Applications-Manufacturing, Maintenance and 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 and Software Defined Networks: SDN in IIoT-Part I, Part II,Data Center Networks, Industrial IoTSecurity and 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**

industry, Applications of UAVs in Industries, Real case studies		

List of practical	Weightage	Contact hours
1. case study on how is india preparing for industry 4.0. 2. preparing and publishing the article on manufacturing units driving the solution based on industry 4.0.	**20%**	**3**
3. Developing and demonstrating the model based on CPS	**20%**	**3**
4. developing and demonstrating the model based on cps	**20%**	**3**
5. case study on iiot-business models. 6. case study on big data analytics and software defined networks	**20%**	**3**
7. case study on automobile manufacturing unit 8. case study on implementation of iot in petroleum industry	**20%**	**3**

Instructional Method and Pedagogy: (Max. 100 words)
Lecture-based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning**.**

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to: CO1. **Understand** the basic concepts of Industry 4.0 CO2. Learn **Design** thinking principles and its usage. CO3. **Develop** the skills to use Visualization software CO4. **Understand** how industry 4.0 works and product development. 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	Remember Understand Apply Understand Apply

Learning Resources	
1.	**Textbooks:** 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.	Other Electronic Resources: https://nptel.ac.in/courses/106105195/

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	Attendance: 05 marks Practical Exam: 20 marks Viva: 10 marks Journal: 10 marks Discipline: 05 marks **Total: 50 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/Universitymentor's feedback on the Project/Industrial. — 30 marks Attendance — 10 marks **Total** — **100 Marks**

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

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

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 Hours**	**Lecture**	**Practical**	**Tutorial**	**Total Credit**
3	2	0	5	3	1	0	4

Course Pre-requisites	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, and mitigation of risks to protect organizations and their stakeholders. By implementing robust risk management processes, businesses can minimize potential threats, seize opportunities, and enhance decision-making. Effective risk management enables the identification of potential risks, evaluation of their potential impact, and 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:	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1. **Understand** and Differentiate between vulnerability assessment, management, and mitigation 2. **Emplo**y 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** shortfalls of many vulnerability assessment programs

Course Content (Theory)	Weightage	Contact hours
Unit 1 Introduction to IT-security, Risk and Vulnerability IT-security: a. Standards, b. Requirements, c. Risk, d. Threat, e. Vulnerability; Risk: a. Identification, b. Analysis, c. Evaluation, d. Management models; Impact of vulnerabilities, Types of attacks on Confidentiality, Integrity and Availability; Malware: Viruses, Worms, Trojan horsessecurity Counter Measures; Intrusion Detection, Antivirus Software	**20%**	**09**
Unit 2: : Intrusion Detection & Prevention systemintrusion 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 and Information Sharing; Containment, Eradication, and Recovery	**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, PCIDSS, SOC2, GDPR, FISMA, HIPPA etc.	**20%**	**09**

List Of Practical	Weightage	Contact hours
1: (1) **Define** risk and vulnerability in the context of energy production, environmental disaster and business sustainability relevant to commercial management . (2) Study of the different requirements and standards for	**20%**	**3**

risk management (3) Employ the Vulnerability Assessment Framework (4) Identify Threats and Vulnerabilities in an IT Infrastructure.		
2: (5) Implement and monitor appropriate management techniques relevant to specific situations. **(6)** Implement the Intrusion Prevention System with Wireless Network Analysis, Packet Analysis.	**20%**	**3**
3: (7) Use the output of various tools to make recommendations and remediate vulnerabilities programs. **Study** and carry out the Industry-standard security tools to carry out a vulnerability assessment.	**20%**	**3**
4: (8) **Identifying**, analyzing, evaluating, and prioritizing various risks and vulnerabilities . (9) Identify and implement the actions required to prevent the incident or event from spreading across the network.	**20%**	**3**
5: (10) Study and analysis of IT-security risk treatment methods(11) Develop a Risk Mitigation Plan Outline for an IT Infrastructure	**20%**	**3**

Instructional Method and Pedagogy: (Max. 100 words)
Lecture-based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning**.**

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to: CO1. **Understand** risk and vulnerability in the context of energy production, environmental disaster to commercial management projects. CO2. **Analyse** risk assessment and mitigation strategies in specific situations. CO3. Understand risk transference and vulnerability driven management decisions. CO4. Implement and monitor appropriate management techniques relevant to specific situations. CO5. Understand the shortfalls of many vulnerability assessment programs	Cognitive	Understand Analyze Understand Apply Understand

Learning Resources	
1.	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

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	Attendance: 05 marks Practical Exam: 20 marks Viva: 10 marks Journal: 10 marks Discipline: 05 marks **Total: 50 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/Universitymentor's feedback on the Project/Industrial.: 30 marks Attendance: 10 marks **Total: 100 Marks**

Mapping of PSOs& COs

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

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

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

COURSE CODE BTCS708	COURSE NAME DIGITAL FORENSICS, INVESTIGATION AND RESPONSE	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	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 and digital misconduct.
Course Revision/ Approval Date:	19/8/2019
Course Objectives (As per Blooms' Taxonomy)	To enable the student to: 1. **Define** Digital forensics. 2. **Understand** Web Attacks. 3. **Understand** report writing 4. **4: Understand** benefits of digital forensics 5. 5:**Understand** Incident response and Incident handling

Course Content (Theory)	Weightage	Contact hours
Unit 1:: Introduction to Digital Forensic Understand computer forensics, objective of digital forensics, Forensics readiness, Computer forensics	**20%**	**09**

investigation process, Digital evidence and first responder, Types of evidence, Types of investigation, Understanding hard disks and file systems, Data acquisition and duplication, Defeating anti-forensics technique.		
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 and 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 and mobile incident handling, Malware incident handing, Cloud incident handing, Insider incident handling	**20%**	**09**

List Of Practical	Weightage	Contact hours
1. **Study** of Computer Forensics and different tools used for forensic investigation **2.** (1) How to recover deleted files using Forensic tool	**20%**	**3**
2: 2) Comparison of two Files for forensics investigation by Compare IT software (3) How to **Collect** Email Evidence in Victim PC **1.** Find Last Connected USB on your system (USB Forensics) **2.** How to make the forensic image of the hard drive using EnCase Forensics **3.** How to Restoring the Evidence Image using EnCase Forensics Extract Browser Artifacts	**20%**	**3**

3: (3) How to Extract Exchangeable image file format (EXIF) Data from Image Files using Exif Reader Software **(4) Create well** formatted Forensic report **(5)** Create and publish Computer Network Defense guidance and reports on incident findings to appropriate constituencies	**20%**	**3**
4: (6) Access a sample incident response plan (7) **Explore** various Anti Forensics tools	**20%**	**3**
5:Implement Live Forensics Case Investigation using Autopsy	**20%**	**3**

Instructional Method and Pedagogy: (Max. 100 words) Lecture-based instruction, Project based learning, Flipped Classroom, Case Studies, Problem based learning, Collaborative Learning**.**

Course Objectives:	**Blooms' Taxonomy Domain**	**Blooms' Taxonomy Sub Domain**
After successful completion of the above course, students will be able to: **CO1:Acquire** knowledge of various digital forensic tools **CO2:Interpret** security issues in the Information Communication Technology (ICT) world, and apply digital forensic tools for security and investigations **CO3:Achieve** adequate perspectives of digital forensic investigation in various applications /devices like Windows/Unix system, mobile, email etc **CO4:Generate** legal evidence and supporting investigation reports. **CO5:Acquire** knowledge of various digital forensic tools	Cognitive	Understand Understand Apply Create

Learning Resources	
1.	**Textbooks:** 1. Handbook of Digital Forensics and Investigation, Academic Press. 2. Digital evidence and computer crime: Forensic science, computers and the internet. Academic Press. 3. John Sammons, "The Basics of Digital Forensics, The Primer for Getting Started in Digital Forensics", Syngress, 2012.

2.	**Reference Books:** 1. Cory Altheide and Harlan Carvey, "Digital Forensics with Open Source Tools", Elsevier, 2011. 2. Bill Nelson, Amelia Philips, Chris Steuart, "Guide to Computer Forensics and Investigations", 5th Edition, CENGAGE Learning, 2015.

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

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

Teaching Scheme
Semester – VIII B. Tech. Computer Science & Engineering

Sr. No.	Course Code	Course Name	Teaching Scheme (Hours/week)				Teaching Credit				Evaluation Scheme					
			L	P	T	Total	L	P	T	Total	Theory: MS Marks	Theory: CEC Marks	Theory: ES Marks	Theory Marks	Practical Marks	Total Marks
1	BTCS801	Major Project/ Industry Internship	0	20	0	20	0	10	0	10	0	0	0	0	100	100
		Total	**0**	**20**	**0**	**20**	**0**	**10**	**0**	**10**	**0**	**0**	**0**	**0**	**100**	**100**

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