GALGOTIAS UNIVERSITY

Syllabus of

B. Tech -CSE in Artificial Intelligence & Machine Learning

Name of School: Computing Science and Engineering

Department: Computer Science and Engineering

Year: 2021 – 2025

B.Tech Curriculum

SEM-I						
Sl.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	BBS01T1001	Multi Variable Calculus	3	0	2	4
2	BLL01T1003	Communication Skills	2	0	0	2
3	BCS01T1003	Programming for Problem Solving - C	1	0	4	3
4	BBS01T1002	Semi-conductor Physics / Biology for Engineers	2	0	2	3
5	BME01T1001	Engineering Graphics & Introduction to Digital Fabrication	1	0	2	2
6	BEE01T1003	Basic Electrical & Electronics Engineering	2	0	2	3
7	BCS01T1002	AI Fundamental	2	0	0	2
8	BCS01T1001	Data Analytics Excel Tableau	0	1	2	2
9	BLEUCP1004	(MC) – YOGA	0	0	0	0

SEM-II						
Sl.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	BEE01T1004	Embedded system & IOT	1	0	2	2
2	BBS01T1003	Linear Algebra & Differential Equations	3	0	0	3
3	BBS01T1002	Semi conductor Physics / Biology for Engineers	2	0	2	3
4	BEE01T1005	Introduction to Digital Systems	2	0	2	3
5	BBS01T1009	Discrete Mathematics	2	0	2	3
6	BCS01T1006	OOPS	1	0	2	2
7	BLEUCT1003	Creativity, Innovation & Entrepreneurship	1	0	2	2
8	BLEUCT1002	Creative & Liberal Arts	0	0	2	1
9	BBSUCT1004	(MC) Environmental Science	2	0	0	0
10	BCS01T1004	Computer Workshop	1	0	2	2
11	BCS01T1007	Alexa Skilling	0	0	2	0

SEM-III						
Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	BCSE2361	Data Structures and Algorithms	2	0	2	3
2	BCSE2370	Data Communication and Networking	2	0	2	3
3	BCSE2073	Data Base management System	2	0	2	3
4	MATH2300	Maths(Elective)	3	1	0	4
5	BCSE2333	Java Programming	0	0	4	2
Program Elective - I						
6	BCSE2350	Cryptographic Fundamentals	2	0	2	3
	BCSE2351	Software Project Management	2	0	2	3
	BSCS2380	Cyber Security	2	0	2	3
	BCSE2353	Optimization Techniques	2	0	2	3
	BCSE2354	Artificial Intelligence	2	0	2	3
Practical/Training						
7	SLBT2021	English Proficiency and Aptitude Building -2	0	0	4	2
8	BCSE2390	Technical Training-I	0	0	4	2
9	BCSE2391	Project-I	0	0	0	1
10	BCSE2392	Industrial/Summer Training -I	0	0	0	2

SEM-IV						
Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	BTCS2400	Operating System	2	0	2	3
2	BTCS2401	Computer Graphics	2	0	2	3
3	BTCS2402	Analysis and Design of Algorithms	2	0	2	3
4	BTCS2403	Maths(Elective)	3	0	0	3
5	BTCS2404	Python Programming	0	0	4	2
Program Elective - II						
6	BTCS9201	Internet of Things	2	0	2	3
	BTCS9202	Data Sciences	2	0	2	3
	BTCS9203	Data Mining and Warehousing	2	0	2	3
	BTCS9204	Bio Informatics	2	0	2	3
	BTCS9205	Network Design and Management	2	0	2	3
Practical/Training						
7	SLBT2022	English Proficiency and Aptitude Building -4	0	0	4	2
8	BTCS2451	Technical Training-II	0	0	4	2
9	BTCS2452	Project-II	0	0	0	3

SEM-V						
Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	MATH2300	Math (elective)	3	0	0	3
2	BTCS3501	Theory of Computation	3	0	0	3
3	BTCS3502	Software Engineering & Testing Methodologies	2	0	4	4
		Program Elective - III				
4	BTCS9301	Microprocessor & Interfacing	2	0	2	3
	BTCS9302	Quantum Computing	2	0	2	3
	BTCS9303	Soft Computing	2	0	2	3
	BTCS9304	Machine Learning	2	0	2	3
	BTCS9305	Modeling and Simulation	2	0	2	3
		Program Elective - IV				
5	BTCS9401	Cloud Application Development	2	0	2	3
	BTCS9402	Adhoc & Sensors Networks	2	0	2	3
	BTCS9403	Statistical Analysis using R	2	0	2	3
	BTCS9404	Block Chain (Infosys)	2	0	2	3
	BTCS9405	Software Defined Network	2	0	2	3
		Practical/Training				
6	BTCS3550	Technical Training-III	0	0	4	2
7	BTCS3551	Project-III	0	0	0	1
8	SLBT3031	English Proficiency and Aptitude Building -5	0	0	4	2
9	BTCS3553	Industrial/Summer Training -II	0	0	0	2

SEM-VI						
Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	BTCS3601	Web Technology	2	0	2	3
2	BTCS3602	Compiler Design	3	0	0	3
		Program Elective - V				
3	BTCS9501	Digital Signal Processing	2	0	2	3
	BTCS9502	Object Oriented Analysis & Design	2	0	2	3
	BTCS9503	Software Project Management	2	0	2	3
	BTCS9504	Network Operating System	2	0	2	3
	BTCS9505	Robotics Process automation	2	0	2	3
		University Elective - I				
4	BTCS8101	Entrepreneurship	3	0	0	3
	BTCS8102	Project Management	3	0	0	3
	BTCS8103	Managerial Economics	3	0	0	3
	BTCS8104	Equity & Portfolio Management	3	0	0	3
		Practical/Training				
5	BTCS3653	Project-II	0	0	0	3
6	SLBT3002	Campus to Corporate	0	0	4	2
7	BTCS3651	Industry Oriented Python-IV	0	0	2	1
8	BTCS3652	Industry Oriented Java-IV	0	0	2	1

SEM-VII						
Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
Program Elective -VI						
1	BTCS9603	Enterprise Resource Planning	2	0	2	3
	BTCS9604	Deep Learning	2	0	2	3
	BTCS9605	UI&UX	2	0	2	3
University Elective-II						
2	BTCS8201	Banking system	3	0	0	3
	BTCS8203	Export and Import Policy	3	0	0	3
	BTCS8204	E-Commerce & M-Commerce	3	0	0	3
Practical/Training						
3	BTCS9997	Industrial Internship	0	0	8	4
4	BTCS9998	Capstone Design -Phase 1	0	0	12	6
SEM-VIII						
Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
Practical/Training						
1	BCSE9992	Industrial Internship	0	0	12	6
2	BCSE4881	Capstone Design -Phase 2	0	0	16	9

Artificial Intelligence and Machine Learning Buckets (AIML)						
Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	CSAI2030	Predictive Analysis	2	0	2	3
2	CSAI2040	Computer Vision	2	0	2	3
3	CSAI3050	ANN & Deep Learning	2	0	2	3
4	CSAI3060	Data Science application of NLP & Vision	2	0	2	3
5	CSAI4070	Game Theory for AI & Data Science	2	0	2	3
6	CSAI4071	AI for Robotics	2	0	2	3

SEMESTER – I

Name of TheCourse	Multivariable Calculus	L	T	P	C
Course Code	BBS01T1001	3	0	2	4
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

1. To present the fundamental concepts of multivariable calculus and to develop student understanding and skills in the topic necessary for its applications to science and engineering.
2. An understanding of a parametric curve as a trajectory described by a position vector; the ability to find parametric equations of a curve and to compute its velocity andacceleration vectors.
3. A comprehensive understanding of the gradient, including its relationship tolevel curves (or surfaces), directional derivatives, and linear approximation.
4. The ability to compute derivatives using the chain rule or total differentials.
5. The ability to set up and solve optimization problems involving several variables,with or without constraints.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	To show the convergence of a sequence, series and compute some important seriesexpansions of a single variable function.
CO2	examine mean value theorems for real-valued functions, show the convergence of the improper integral and apply curvature to find evolutes & involutes.
CO3	use methods to find limit, continuity, derivatives of multivariable scalar functions and relate derivatives to solve the problems of optimization.
CO4	apply methods to find integrals of multivariable scalar functions and relate it to solve the problems finding areas and volumes.
CO5	explain the three elements of vector differential calculus, apply these elements for evaluation of integrals of vector valued functions and relate the three important theorems to evaluate the problems of integrations.
CO6	Gain understanding of latest trends and research areas in the course.

Text Books

1. Robert T. Smith and Roland B. Minton, Calculus, 4th Edition, McGraw Hill Education.
2. George B. Thomas and Ross L. Finney, Calculus, 9th Edition, Pearson Edition

Reference Books

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 4th Edition, Narosa publishers.
2. Michael D. Greenberg, Advanced Engineering Mathematics, 2nd Edition, Pearson Education

Course Content

Unit 1	**Module 1**	**6 hours**
Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Half range Fourier sine and Fourier cosine series.		
Unit II	**Module 2**	**8 hours**
Evolutes and involutes, Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorem with remainders; indeterminate forms and, Evaluation of definite and improper integrals; Beta and Gamma functions and their properties.		
Unit III	**Module 3**	**9 hours**
Functions of several variables, Limits and continuity, Partial derivatives, Total differential, Derivatives of composite and implicit functions, Extreme values and saddle points, Lagrange's method of undetermined multipliers.		
Unit-IV	**Module 4**	**9 hours**
Double integrals in Cartesian and Polar coordinates, change of order of integration, change of variables (Cartesian to polar), Applications of double integrals to find area and volume, Triple integrals in Cartesian, Applications of triple integral to find volume.		
Unit-V	**Module 5**	**10 hours**
Scalar and vector fields, Differentiation of Vector functions, Gradient, divergence, curl, line integrals, path independence, potential functions and conservative fields, surface integrals,Green's theorem, Stokes's theorem and Gauss's divergence theorem (without proof& simple problems).		
Unit-VI	**Module 6**	**6 hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussionof some latest papers published in IEEE transactions and ACM transactions, Web of Science andSCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of The Course	Communication Skills				
Course Code	BCS01T1005				
Prerequisite					
Corequisite					
Antirequisite					
		L	T	P	C
		2	0	0	2

Course Objectives:

1. This course helps to provide students with an introduction to programming
2. It also explains the fundamental concepts of packages and data types
3. Introduce the concept of data visualisation using matplotlib and seaborn

Course Outcomes:

After successful completion of the course, students will be able to:

CO1	Construct grammatically correct sentences for effective communication.
CO2	Build confidence in public speaking.
CO3	Enhance self-awareness for the purpose of self-improvement.
CO4	Demonstrate effective writing skills for a variety of professional and corporate settings.
CO5	Be creative and integrate essential elements for a better personality.

Course Content:

Unit-I
Communication – Definition, Importance, Features- 7Cs and ABCs Basics of Grammar -Noun Pronoun, Subject Verb Agreement, Article, Prepositions, Punctuation Sentence Structure Vocabulary Building -The concept of Word Formation, Synonyms, antonyms, and standard abbreviations. Basic Writing Skills -Brainstorming, Structure, Organisation, Outline, Precision, Coherence (Connectedness) Paragraph writing: Types and Constituents, practice Essay Writing Précis (Selected Essays)
Unit II:
Introduction of self and Goal Setting Extempore Role Play Movie Review Phonetics (Sounds)- Voice Modulation Phonetics (Transcription) Listening Skills Clear Pronunciation Tense Buster Group Discussion Group Presentation by Students
Unit III:
Technical writing style and language Official Communication: Notice, Agenda, Minutes of Meeting, Memo, Official Note, Formal Letters, Brochure, Newsletter, Resume writing

Name of the Course	Programming for Problem Solving - C	L	T	P	C
Course Code	BCS01T1003	1	0	4	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

- Provide an overview of computers and problem-solving methods using 'C' language
- Serve as a foundation for the study of programming languages.
- Learn to develop program using 'C' language.
- To develop the software using the concept of 'C' Language.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	The student would learn the basic concepts of Computer and acquire variousproblem-solving techniques such as algorithms and flowchart.
CO2	To understand the basic terminology used in programming and able to write, compileand debug programs in 'C' programming language and to develop program logics using decision structures and loop structures.
CO3	To develop program logics using the concept of arrays and arrays of characters.
CO4	To understand the modular techniques such as functions and difference between callby value and call by reference methods.
CO5	Implement and develop small projects using the concept Structures in Cprogramming language.
CO6	Algorithms and Advanced Programming development in different field.

Text Books

1. Alexis Leon and Mathews Leon (2001), Introduction to Information Technology, Tata McGraw-Hill.
2. R.G. Dromey (2001), How to Solve it by Computer, Prentice Hall of India.
3. Al Kelley and Ira Pohl (1998), A Book on C Programming in C, 4th Edition, Pearson Education.

Reference Books

1. E. Balagurusamy 7th Edition, Programming ANSI C, McGraw-Hill
2. Brian W. Kernighan and Dennis M. Ritchie, The C programming Language, Prentice-Hallin 1988
3. Byron Gottfried, Programming with C, Schaum's Outline

Course Content

Unit-1 Introduction Module-I	**Hours: 6**
Parts of a computer – Overview of operating systems, assembler, compilers, interpreters and programming languages. Algorithms for exchanging the values of two variables, counting, summation of a set of numbers, factorial computation, sine function computation, generation of the Fibonacci sequence, reversing the digits of aninteger, flowchart.	
Unit-2 Module-II	**Hours: 8**
Lexical elements – Operators - data types – I/O statements – format specifications –control statements – decision making and Loop control structure: while loop, for loop, do-while loop, nested loop, break, continue, case control structure, go to, exit statement	
Unit-3 Module-III	**Hours: 9**
Array handling in C – declaration – single dimensional arrays, two – dimensional arrays,multi-dimensional arrays, sorting and searching on single and two dimensional arrays. Array order reversal, string handling function, manipulation on strings.	
Unit-4 Module-IV	**Hours: 9**
Prototype – declaration - arguments (formal and actual) – return types – types offunctions difference between built-in and user-defined functions.	
Unit-5 Module-V	**Hours: 10**
Declarations - nested structures- array of structures - structure to functions - unions-difference between structure and union. Declarations-nestedstructures-arrayofstructures-structuretofunctions-unions-differencebetween structureand union.	

Name of the Course	Semi-conductor Physics	L	T	P	C
Course Code	BBS01T1002	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

This course is designed to provide the knowledge of quantum and band theory for the explanation of semiconductors. The students will also learn about the application of semiconductors in optoelectronic devices. The topics on low dimension /nanomaterial enable the students to think of new applications in semiconductor areas

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Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Identify the energy band in solids and electron occupation probability
CO2	Understand the physics of semiconductor and develop the ability to choose the appropriate semiconductor for engineering applications
CO3	Apply the knowledge of diode to the development of new and novel optoelectronic devices
CO4	Utilize the knowledge of the low dimensional/ nano materials for engineering applications and understand the basic characterization techniques
CO5	Apply the knowledge of physics to determine the physical quantities/ constants, diode characteristics using experimental set up and analyses the results with maximum accuracy.
CO6	Gain understanding of latest trends and research areas in the course

Text Book (s)

1. J. Singh, Semiconductor optoelectronics, Physics and Technology, Mc-Graw –Hill Inc. 1995.
2. S.M. Sze, Semiconductor Devices: Physics and Technology, Wiley 2008.
3. Introduction to Nanotechnology C P Poole, Frank J. Owens, John Wiley & Sons, 2011, ISBN 978-81-265-1099-3.
4. B.Sc. Practical Physics by C.L Arora , S. Chand Limited.

Reference Books

1) B.E.A. Saleh and M.C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., 2007.
2) Introduction to Nanoscience and Nanotechnology, KK Chattopadhyay, A N Banerjee, Phi Learning Pvt Ltd., New Delhi, 2012, ISBN-978-81-203-3608-7.
3) Nanotechnology Science Innovation & Opportunity, Lynn E Foster, Pearson publication, 2008, ISBN-9788131711187.
4) NouredineZettili, Quantum Mechanics: concepts and applications, 2nd Edition, Wiley, UK, 2009
5) Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House

Course Content

Unit 1	Quantum and Band Theory of electron	6 Hours
Fermi Dirac distribution function and Fermi level, quantum free electron theory, density of states, Energy band in solids, E-K diagram and Brillouin zone, effective mass, concept of holes.		
Unit II	**Semiconductor**	**8 Hours**
Types of semiconductor, Fermi level in semiconductor, effect of carrier concentration and temperature on fermi level, direct-indirect band gap semiconductors, compound semiconductors, Conductivity and mobility, recombination process, Hall effect and applications.		
Unit III	**Applications of Diodes**	**8 Hours**
Concept in optical transitions in bulk semiconductors- absorption process, recombination process, explanation for spontaneous emission-stimulated emission-transition rate, theory of p-n junction, p-n junction diode and its I-V characteristics, optoelectronics devices-LEDs, laser diode, Basics of Photovoltaics- photovoltaic effect, Determination of efficiency of PV cell		
Unit-IV	**Low Dimension Physics and Nanomaterials**	**8 Hours**
Density of states in 0D, 1 D and 2D –Low dimensional systems: Quantum well, Quantum wire, Quantum dots, Nanomaterials and its properties, Classification of Nanomaterials, Carbon nanowires and nanotubes, Semiconductor nanomaterials, Graphene, Characterization techniques (basic ideas): Scanning Electron Microscopy and Transmission Scanning Electron microscopy		
Unit-V	**Advancements and Research**	**6 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of the Course	Engineering Graphics & Introduction to Digital Fabrication	L	T	P	C
Course Code	BME01T1001	1	0	2	2
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

1. To establish the usage of basics of engineering graphics in product design.
2. To introduce the concept of product design.
3. To introduce graphics software and apply graphics software for devloping product model.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Sketch orthographic projection of points and lines.
CO2	Draw orthographic projection of two-dimensional planes and surfaces.
CO3	Draw orthographic views from pictorial drawings.
CO4	Develop a solid model using solid works
CO5	Define and demonstrate the use of techniques for processing of CAD models forrapid prototyping

Text Book (s)

1. K C John (2009), Engineering Graphics for Degree, Prentice Hall of India. ISBN: 978-8-120-33788-3.
2. P N Rao (2010), CAD/CAM Principles and Applications, 3rd Edition, Tata McGraw-Hill Education, ISBN: 978-0-070-68193-4.
3. Chee Kai Chua, Kah Fai Leong(2016), 3D Printing And Additive Manufacturing: Principles And Applications, WSPC
4. Ben Redwood, FilemonSchöffer& Brian Garret(2017), The 3D Printing Handbook: Technologies, design and applications, 3D Hubs B.V

Reference Book (s):

1. Course material uploaded on LMS

Course Content

UNIT I Projection of Points, Lines And Plane Surface **8** hours
Orthographic projection - First angle projection - projection of points and Projection of straight lines inclined to one principal plane –Projection of planes inclined to one principal plane.
Unit II: Projection of Solids **8 hours**
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.
Unit III: Conversion of Pictorial drawings into Orthographic views 8 hours
Representation of Three Dimensional objects – Layout of views- Sketching of multiple views from pictorial view of object.
Unit IV: Solid Modeling **8 hours**
Modeling of simple solids in Polyhedra, Regular and Irregular polyhedra, solids of revolution. 3D Modelling on Solidworks– To prepare part model using 2 D drawing and with basic extrusion and revolve commands.
Unit V: Exercises on 3D Printing **8 hours**
Introduction to 3 D printing, Slicing / Pre-processing, Fused deposition modelling technique, design and print 3D models like stepped shaft model and flange coupling model.

Name of The Course	Basic Electrical & Electronics Engineering	L	T	P	C
Course Code	**BEE01T1003**	**2**	**0**	**2**	**3**
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

1. To understand the basic concepts of magnetic circuits, electro magnetism and electrostatics.
2. To understand and analyses AC & DC circuits.
3. To understand the Network Theorem and Semiconductor Devices.
4. To understand basic semiconductor devises
5. To understands sensors and transducers

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Understand relationship between different electrical parameters.
CO2	Students will develop an ability to analyze DC and AC Circuits of different configurations.
CO3	Understand magnetic aspects of electric current.
CO4	Understand BJT and its characteristics, connections, diode biasing.
CO5	Understand the sensor and transducer.
CO6	Demonstrate the applications of network theorems and semiconductor devices

Reference Book (s):

1. Textbook of Electrical Engineering, B.L. Theraja, Vol. I & II, Twenty, S. Chand & Co 1997 Second.
2. Basic Electrical Engineering, D C.Kulkshreshtha, McGraw,2012 , First.
3. Introduction to Electrical Engineering, Naidu, Kamakshaia, Tata McGraw Hill, 2000, Third
4. Basic Electrical Engineering, H. Cotton, CBC, 2005, Seventh
5. Laboratory courses in Electrical Engg, S G Tarnekar, P K Kharbanda, S B Bodkhe, S D Naik, S. Chand
6. & Co, 2010, Second.
7. Brian R Eggins - Biosensors an Introduction , First edition, John Wiley & Sons Publishers, 1996.
8. Loic J Blum, Pierre R Coulet - Biosensors Principles and Applications, First edition, Marcel
9. Dekker,Inc, 1991.
10. Donald G. Buerk - Biosensors Theory and Applications, First Edition Technomic Publishing.
11. Co, Inc, 1993.

Course Content

Unit I: D.C. Circuits
Circuits Elements (R, L, C), Kirchhoff's Laws, Superposition Principle and theorem, Norton's theorem, Thevenin's Theorem, Voltage source, (definition, characteristics of practical source, equivalent current source) Star-Delta transformation.
Unit II: Magnetic circuits
Flux, mmf, reluctance, analogous electric circuits, simple calculations for composite magnetic circuits.
Unit III: AC Circuits
Periodic functions, average &rms values, Steady state behaviors with sinusoidal excitation, phasor representation, reactance and impedance, Series and Parallel A.C. circuits, resonance, power in A. C. circuits, power factor.
Unit IV: Bipolar Junction Transistors
Basic diode concept, different types of rectifier circuits, zener diode voltage regulation concept Bipolar junction transistors, CB, CE and CC configurations and characteristics.
Unit V: Transducers and Sensors
Sensor and Transducer Definitions, Criteria to Choose a Sensor, Basic Requirements of a Sensor or Transducer, Classification of Sensors, Analog and Digital Sensors, Biosensors- Advantages and limitations, biosensors for environmental monitoring, biosensors in healthcare applications
Unit VI: Applications
Application of network theorem, Application of Diodes, Application of Bipolar Junction Transistor
List of Experiments (At least 6 Experiments)
• To familiarize with Electrical and Electronics Lab Equipment and basic Electronics Components • To verify (i) Kirchhoff's Current law (ii) Kirchhoff's Voltage law. • To verify Thevinin's theorem. • To verify Norton's theorem. • To verify maximum power transform theorem. • Observe the given waveform (Sinusoidal/Square/Triangular) and calculate it's Frequency, Peak Value, Average Value, RMS Value and Form factor. • To plot the V-I Characteristics of P-N Junction Diode and calculate the forward and reverse resistance of the Diode. • Verification of Regulation action of ZENER Diode. • To connect the Wave Shaping Circuits (Clipper Circuit) and observe and sketch the Wave form. • To verify the working of Full Wave Rectifier Circuit (Bridge Rectifier) and calculate it's efficiency. • To plot the input and output characteristics of a Bipolar Junction Transistor (BJT) in Common Emitter (CE) connection. • To verify the working of Full Wave Rectifier Circuit (using Centre tapped transformer) and calculate it's efficiency. • Project – Students should be encouraged to make a working model/Project to demonstrate any Transducer/Sensor action or any related field

Name of The Course	AI Fundamental	L	T	P	C
Course Code	BCS01T1002	2	0	0	2
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

1. Provide an overview of Artificial Intelligence and its applications
2. Develop the ability to understand and apply data analysis on real world data
3. Provide an overview of Machine Learning
4. Introduce the cutting-edge technologies and the ethical guidelines.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Understand the basic concepts of Artificial Intelligence
CO2	Understand the principles of AI and its lifecycle
CO3	Apply the concepts of data analysis in real world scenario
CO4	Identify the characteristics of machine learning that makes it useful to solve real-world problems
CO5	Identify applications of AI in relevant disciplines
CO6	Understand the latest trends in AI and ethical issues

Text Book (s)

1. Norvig, Peter, and Russell, Stuart Jonathan. Artificial intelligence: a modern approach. United Kingdom, Pearson, 2016.
2. Bishop, Christopher M.. Pattern Recognition and Machine Learning. Switzerland, Springer New York, 2016.

Reference Book (s):

1. Rich, Elaine. Artificial Intelligence 3E (Sie). India, Tata McGraw-Hill Publ., 2019.
2. MehryarMohri, Afshin Rostamizadeh, AmeetTalwalkar ”Foundations of Machine Learning,
3. Linoff, Gordon S. Data analysis using SQL and Excel. John Wiley & Sons, 2015.

Course Content

Unit-1 Introduction to AI	**4 hours**
Introduction to Artificial Intelligence, Foundations of AI, History of AI, AI Games, Agents and Environment, Risk and Benefits of AI	
Unit-2Principles of AI	**6 hours**
Knowledge Representation, Problem Solving, Searching and its Strategies, Heuristic Search, AI Project Cycle, Problem Scoping, Data Acquisition, Data Exploration, Modelling.	
Unit-3 Data Analysis	**6 hours**
Sort, Filter, Conditional Formatting, Charts, Pivot Tables, Tables, What if Analysis, Solver, Descriptive Statistics, Correlation, Regression, Introduction to Programming Languages for AI.	
Unit-4 Introduction to Machine Learning	**5 hours**
Introduction to Machine Learning, Types of Learning, Use of Probability and Statistics in AI, Data Mining and Analysis Techniques	
Unit-5 Applications of AI	**5 hours**
AI applications in Agriculture, Climate, Healthcare, Transport, Automotive Industry, Civil Engineering, Education, Robotics, Finance, Law and Legal practice, Media and Entertainment, Data Security, Tourism	
Unit-6 AI in Practice	**4 hours**
Visualizing Statistical Relationships, Plotting with Categorical Data, Visualizing the Distribution of a Dataset.	

Name of the Course	Data Analytics Excel Tableau	L	T	P	C
Course Code	BCS01T1001	0	1	2	2
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

1. This course helps to understand data and usage of data in solving real time problems.
2. It also explains the fundamental concepts of big data analytics and data visualization.
3. Introduce the concept of Tableau and data analysis.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Understand data and usage of data in data analytics.
CO2	Apply data analytics techniques for visualization through Excel.
CO3	Visualize trends and discover insights of data analysis using tableau
CO4	apply methods to find various trends on data
CO5	Create data analysis techniques having better efficiencies.
CO6	Gain understanding of latest trends and research areas in the course.

Course Content:

Unit I: Introduction to Data Analytics	**2 hours**
Installing Data Analysis Tool in Excel, sort, Filter, Conditional Formatting, Pivot Table	
Unit 2: Manipulation of Excel Data	**3 hours**
Working with Formula: Data Filtering, Sorting, Use of Range, Functions: SUM(), AVERAGE(), MAX() & MIN(), COUNT() & COUNTA(), IF(), Data Representation using Charts & Graphs, Creation of Pivot table, Create a Chart, Change Chart Type, Switch Row/Column, labels and legends, Print Area	
Unit 3: Exploring Analysis Toolpack	**2 hours**
Histogram, Descriptive Statistics, Moving Average, Exponential, Correlation, Regression	
Unit 4: Introduction to Tableau	**3 hours**
Introduction about Tableau, Installing Tableau Public, Getting Data, visualizing data on maps, tableau worksheets, Scatter plot and graphs, Applying filter, Data highlighters, predictions,	

SEMESTER-II

Name of The Course	Embedded System & IOT	L	T	P	C
Course Code	BEE01T1004	1	0	2	2
Version No					
Prerequisite	Basic programming Languages				
Co requisite					
Anti- requisite					

Course Objectives

1. To provide the awareness of major embedded devices and interfacing devices
2. To understand key technologies in Internet of Things.
3. To analyze, design or develop parts of an Internet of Things solution for IoT applications.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Understand the concept of embedded system, microcontroller, different components of microcontroller and their interactions.
CO2	Recognize and analyze given embedded system design and its performance.
CO3	Identify the programming environment to develop embedded solutions.
CO4	Demonstrate application-based competencies in Embedded Programming
CO5	Identify and adopt knowledge of the terminology, requirements and constraints for IoT system development.
CO6	Demonstrate IoT system for smaller applications

Course Content

UNIT I INTODUCTION TO EMBEDDED SYSTEM
Basic components of Embedded system, Programming Language Classification of Embedded system, Advantage & Disadvantage, Difference between Microprocessor & Microcontroller, Classification based on architecture, Memory Classification, Description of RAM, Description of CPU Registers, Introduction to Embedded C, Difference between C & Embedded C.
UNIT II CONTROL STATEMENTS AND FUNCTIONS
Decision making with if statement, If….else statement, Switch statement, GOTO statement, The While and Do – While statements, For statement, Why Functions, Types of Functions, Multi-functional program, Return values & their types
UNIT III EMBEDDED SOFTWARE AND HARDWARE INTERFACING
Kiel Compiler, Proteus, Interfacing of LED, Seven segment display, , LCD, Switches, Keyboard, Serial Communication, Sensors.
UNIT IV INTRODUCTION TO IoT
Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates
List of Experiments (At least SIX experiments needs to be performed) • Getting started with the Arduino IDE: Serial Communication between Arduino board and PC:- character send and received, Read and display voltage • Experiments using single and multiple LEDs: Experiments on digital input and digital output on Arduino Uno board and using LED and Buzzer • Hands on experiments on Interfacing of the LDR, LCD: Experiment on LCD display:-Print numbers, Name, Time etc. • Experiments using Seven Segment display. • Experiments using Temperature, IR, Finger print sensors. • Experiments with Raspberry Pi using LED. • Experiments on the applications of Buzzer, potentiometer. • Experiments on Interfacing with Bluetooth devices. • Design and development of Arduino/Raspberry Pi based system for defined application/ projects. • Getting started with the Arduino IDE: Serial Communication between Arduino board and PC:- character send and received, Read and display voltage . • Experiments using single and multiple LEDs: Experiments on digital input and digital output on Arduino Uno board and using LED and Buzzer. • Hands on experiments on Interfacing of the LDR, LCD: Experiment on LCD display:-Print numbers, Name, Time etc. • Experiments using Seven Segment display. • Experiments using Temperature, IR, Finger print sensors. • Experiments with Raspberry Pi using LED. • Interfacing of the LDR, IR sensors. • Experiments on the applications of Buzzer, potentiometer. • Design and development of Arduino/Raspberry Pi based system for defined application/ projects

Name of The Course	Linear Algebra & Differential Equations	L	T	P	C
Course Code	BBS01T1003	3	0	0	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

It aims to equip the students with standard concepts and tools at an intermediate to advance level that will serve them well towards tackling more advanced level of Mathematics and application that they would find useful in their discipline.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Apply appropriate method to find inverse of a matrix and to solve system of linear equations.
CO2	Understand and apply vector space and linear transformation and its matrix representation.
CO3	Apply the knowledge of eigen value and eigen vector, diagonalization, inner product spaces and orthogonalization for solving various problems.
CO4	Apply appropriate methods to solve nth order linear ordinary differential equations
CO5	Classify partial differential equations and apply method of separation of variables to solve PDE.
CO6	Gain understanding of latest trends and research areas in the course

Text Books:

1. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
2. Erwin Kreyszig,Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons.
3. Peter V. O'Neil,Advanced Engineering Mathematics, 7thEdition,Cengage Learning.

Reference Books:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 4th Edition, Narosa Publishers.
2. Robert T. Smith and Roland B. Minton,Calculus, 4thEdition,McGraw Hill Education.
3. David C Lay,Linear Algebra and its application, 3rd Edition, Pearson Education

Course Content

Unit-1	**Contact Hours:6**
Basic Operations on matrices and vectors, Determinants, Cramer Rule, Inverse of matrix using Gauss Jordan elimination, Rank of a matrix, Solution of system of linear equations: Gauss elimination.	
Unit-2	**Contact Hours:10**
Vector Space, Linear Independence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank, nullity, rank-nullity theorem, Inverse of a linear transformation, composition of linear maps, Matrix associated with a linear map.	
Unit-3	**Contact Hours: 9**
Eigen values, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigen-bases, Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	
Unit-4	**Contact Hours: 9**
Basic concepts, Exact differential equations, Linear differential equations of second and higher order with constant coefficients, Method of variation of parameters, Cauchy-Euler equation, System of linear differential equations with constant coefficients, applications of linear differential equations.	
Unit-5	**Contact Hours: 8**
Basic concepts, Classification of second order linear PDE, Method of separation of variables and its application in solving Wave equation (one dimension), heat equation (one dimension) and Laplace equation (two dimension steady state only).	

Name of The Course	Introduction to Digital Systems	L	T	P	C
Course Code	BEE01T1005	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

1. To familiarize with various Digital IC
2. To understand basic fundamentals of Digital circuits.
3. To prepare for various engineering applications.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Solve the problems on Number system codes and their conversions.
CO2	Identify Digital IC and implement in the circuits.
CO3	Create, design and simulate canonical logic forms
CO4	Demonstrate the application of combinational and sequential logic circuits
CO5	Implement the basic circuits on embedded platform
CO6	Gain understanding of latest trends and research areas in the course

Text Book (s)

Sr. No.	Title	Author Name	Publisher	Year of Publication	Edition
1	Digital Electronics	R P Jain	McGraw Hill	2017	Second
2	Digital Logic and Computer Design	Morris Mano	PHI	2017 review	Second
3	Digital Electronic Principles-	Malvino	PHI	2011-13	Seventh

Course Content

Unit-I: Number Systems & Boolean Algebra
Decimal, binary, octal, hexadecimal number system and conversion, binary weighted & non-weighted codes & code conversion, signed numbers, 1s and 2s complement codes, Binary arithmetic, Binary logic functions, Boolean laws, truth tables, associative and distributive properties, De-Morgan's theorems, realization of switching functions using logic gates. Logic families: TTL, ECL, CMOS.
Unit-II: Combinational Logic:
Switching equations(Mathematical operations), canonical logic forms, sum of product & product of sums, Karnaugh maps, two, three and four variable Karnaugh maps, simplification of expressions, mixed logic combinational circuits, multiple output functions, QuineMcluskey Methods for 5 variables. Introduction to combinational circuits, code conversions, decoder, encoder, priority encoder, multiplexers & De-multiplexer, binary adder, Subtractor, BCD adder, carry look ahead adder, Binary comparator, Arithmetic Logic Units.
Unit-III: Sequential Logic & Circuits:
Latch, flip-flops, clocked and edge triggered flip-flops, timing specifications, asynchronous and synchronous counters counter design, Registers, types of registers. Analysis of simple synchronous sequential circuits

List of Experiment
• To study the basic logic gates
  • Verify their truth table.
  • Verification of De Morgan's Theorem.
• Verification Of SOP & POS Given Algebraic Expression Using Universal Gates.
• Designing of HALF and Full adder using basic logic gates.
• Design of 4:1 MULTIPLEXER USING GATES.
• Design and Implementation of 1-bit Magnitude Comparator using basic logic gates.
• Design and Verification of S-R Flip-Flop Circuits.
• Realization of 3-bit synchronous counter design For Various Application.
  • Frequency counters
  • Digital clock
  • Time measurement
• Project based learning: Building of LED Series / Seven Segment LED / Display unit.

Name of The Course	Discrete Mathematics	L	T	P	C
Course Code	BBS01T1009	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

The objective of this course is to familiarize the prospective computer scientists with the techniques of mathematical reasoning, logical thinking, abstract mathematical discrete structures so that they may apply a particular set of mathematical facts in relevant situations.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Apply rule of inference for connecting and validating logical statements and use proof techniques.
CO2	Use counting techniques to solve various counting problems.
CO3	Apply the concepts of sets, relation, functions and mathematical induction.
CO4	Classify the algebraic structures as Group, Ring, field.
CO5	Classify the structures of graph and tree and use them to simplify various problems.
CO6	Gain understanding of latest trends and research areas in the course

Text Book:

1. 1.Kenneth H. Rosen, Discrete Mathematics and Its Applications, McGraw-Hill.
2. Susanna S Epp, Discrete Mathematics with Applications, 4th edition, Wadsworth Publishing Co. Inc
3. C L Liu and Mohapatra, "Elements of Distcrete Mathematics", a computer oriented approach, 3rd edition, McGraw Hill.

Reference Books:

1. J P Trembley, R Manohar,Discrete Mathematical Structures and it's Application to Computer Science, TMG Edition, Tata McGraw-Hill.
2. Norman L Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press.
3. SemyourLipschutz and Marc Lipson , Schaum's Outlines Series.

Course Content

Unit-1	**Contact Hours:8**
Syntax, Semantics, Validity and Satisfiability, Basic connectives and Truth Tables, Logical Equivalance, ,the laws of logic, Logical implication, Rules of inference,Normal form(CNF,DNF), Predicate logic, Universal and Existantial quantifiers, skolemization. Proof Techniques: Some terminologies, Proof methods and strategies, Forward proof, Proof by contradiction, Proof by contraposition, Proof of necessity and sufficiency.	
Unit-2	**Contact Hours:6**
Counting Techniques: Basic counting techniques, inclusion and exclusion, pigeon-hole principle, permutation and combination	
Unit-3	**Contact Hours: 12**
Operations and laws of sets**,** Cartesian product, binary relation, partial order relation, Equivalence relation, Functions, Bijective function, inverse and composition of function, size of a set, countable and uncountable set, Cantor's diagonal argument and the power set theorem, Schroeder-Bernstein theorem. Principles of Mathematical Induction: The well -Ordering principle, Recursive definition, prime numbers, greatest common divisor, Euclidean algorithm, the fundamental theorem of arithmetic.	
Unit-4	**Contact Hours: 10**
Algebraic structures with one binary operation: Semi Group, Monoid, Groups, Subgroups, Congruence relation and quotient structures, Free and Cyclic Monoid and Groups, Cosets, Lagrange's theorem, Normal Subgroups, Permutation and Symmetric groups, Group Homomorphism, Algebraic structures with two binary operation: Ring ,Integral domain and Field.	
Unit-5	**Contact Hours: 6**
Graphs and their properties, degree, connectivity, path cycle, sub graphs, isomorphism, Eulerian and Hamiltonian walks, Graph coloring, coloring maps and planer graphs, coloring vertices and edges, list coloring, perfect graph. Trees: Definitions, properties and examples, rooted trees, trees and sorting, weighted trees and prefix codes, bi-connected components and articulation points, shortest distances.	

Name of The Course	OOPS	L	T	P	C
Course Code	BCS01T1006	1	0	2	2
Version No					
Prerequisite	Basic programming Languages				
Co requisite					
Anti- requisite					

Course Objectives

The purpose of this course is to provide basic concepts of Object-oriented programming with C++. The main goal of the course is to teach the students how to Apply the OOPS concepts in various applications that are appropriate for problems that they might encounter. This course is also to teach constructors, destructors, inheritances, polymorphism, virtual function and control structures. This also provides knowledge of input output stream functions.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Understand an Object-Oriented Programming Features.
CO2	Analyze and apply the role of constructors &destructors in program design.
CO3	Understand the concept of Exception Handling.
CO4	Apply the concept of inheritances, polymorphism and virtual function for problem solution
CO5	Apply the different input output streams for problem solution.
CO6	Understanding of latest advances and its applications in Computer Programming and Problem Solving.

Text Book (s)

1. Object Oriented Programming with C++ - Rajiv Sahay, Oxford Mastering C++ - Venugopal, McGraw-Hill Education (India)
2. Herbert Schildt, C++ - The Complete Reference, Third Edition -Tata McGraw Hill - 1999.
3. Bruce Eckel, Thinking in C++, Second Edition, Volume One, Pearson Education Asia, 2000.

Reference Book (s):

1. Object Oriented Programming in C++ by Robert LaforeTechmedia Publication.
2. Object Oriented Programming in C++ SauravSahay Oxford University Press.
3. Object Oriented Programming in C++ R Rajaram New Age International Publishers 2nd.
4. OOPS C++ Big C++ Cay Horstmann Wiley Publication.
5. C++: The Complete Reference- Schildt, McGraw-Hill Education (India)
6. C++ and Object-Oriented Programming – Jana, PHI Learning.

Course Content

Unit I: Introduction: Basic Terminology	**8 lecture hours**
Object oriented programming concepts – objects – classes – methods and messages – abstraction and encapsulation – inheritance – abstract classes – polymorphism. Introduction to C++ – classes – access specifiers – function and data members – default arguments – function overloading – friend functions – const and volatile functions - static members – Objects – pointers and objects – constant objects – nested classes – local classes.	
Unit II: Constructor & Destructor	**8 lecture hours**
Constructors – default constructor – Parameterized constructors – Constructor with dynamic allocation – copy constructor – destructors – operator overloading – overloading through friend functions – overloading the assignment operator – type conversion – explicit constructor.	
Unit III: Exception Handling	**8 lecture hours**
Function and class templates - Exception handling – try-catch-throw paradigm – exception specification – terminate and unexpected functions – Uncaught exception.	
Unit IV: Inheritance	**8 lecture hours**
Inheritance – public, private, and protected derivations – multiple inheritance - virtual base class – abstract class – composite objects Runtime polymorphism – virtual functions – pure virtual functions – RTTI – typeid – dynamic casting – RTTI and templates – cross casting – down casting	
Unit V: I/O STREAMS	**8 lecture hours**
Streams and formatted I/O – I/O manipulators - file handling – random access – object serialization – namespaces - std namespace – ANSI String Objects – standard template library	
Unit-6: Advances in C++ Programming	**7 hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Name of The Course	Computer Workshop	L	T	P	C
Course Code	BCS01T1004	1	0	2	2
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

Students of Computer Engineering have to work with various hardware and software not only during academia but also in company. Thus, students should get familiar with various hardware, software, operating systems and networking.

This course will provide student a much-needed knowledge of computer hardware and networking, enabling them to identify and rectify the onboard computer hardware, software and network related problems. With the help of this course the student will be able to understand the hardware specifications that are required to run operating system and various application programs.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Understand the basic concept and structure of computer hardware and networking.
CO2	Identify the existing configuration of the computers and peripherals.
CO3	Upgrading the system as and when required.
CO4	Apply their knowledge about computer peripherals to identify / rectify problems onboard.
CO5	Integrate the PCs into local area network and re-install operating system and various application programs.
CO6	Manage data backup and restore operations on computer and update application software.

Reference Book (s)

1. Hardware Bible by Winn L. Rosch
2. Hardware and Software of Personal Computers by Sanjay K. Bose
3. Fundamentals of Computers by V. Rajaraman
4. Computer Studies - A first course by John Shelley and Roger Hunt
5. Computer Fundamentals, MS Office and Internet & Web Technology by Dinesh Maidasani
6. Modern Computer Hardware Course by M Lotia, P Nair, P Lotia

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Course Content

Assembly of Computer:	**6 Hour**
Introduction to hardware peripherals like RAM, ROM, keyboard, Mouse, processors, etc. Generation of processors. Working of SMPS. Study of various ports. Steps and precautions to assemble computer.	
Assembly of Laptop:	**4 Hours**
laptop hardware peripherals like RAM, ROM, keyboard, Mouse, processors, etc. Generation of processors. Study of various ports. Steps and precautions to assemble laptop.	
Computer Network Tools:	**4 Hours**
Introduction to computer network. Study of various topologies. Preparing the network cable using crimping tools and connectors. Study of various network environments.	
Operating System and Software Installations:	**6 Hours**
Introduction to operating system. Types of operating system (Windows and Linux). Window: -Evolution of operating system. Introduction to software. Types of software (MS office, VLC media player, Win rar), etc. Linux: - Evolution of operating system. Introduction to software. Types of software (open office, web browser, etc.) Case study of Installations step for operating system and application software's.	
Internet:	**4 Hours**
Introduction and evolution of internet. Study of various internet-based services like email, social network, chat, etc. Introduction to cyber security and cyber laws.	
Server:	**4 Hours**
Introduction to server. Difference between server and normal desktop. Evolution of servers. Study of various servers like email, data, domain, etc.	
List of Experiments: The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills so that students are able to acquire the competency. Following is the list of experiments for guidance. As it is laboratory course list is as per content given above	

Name of The Course	Alexa Skilling	L	T	P	C
Course Code	BCS01T1007	0	0	2	0
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

1. To introduce the student to the idea of voice assistant devices
2. To provide a foundation to create Alexa skills

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Understand the basic concepts of Alexa
CO2	Understand Alexa Skill Set
CO3	Design an engaging Voice User Interface
CO4	Setting Up AWS
CO5	Create Alexa skills.

Text Book (s)

1. Build your own Alexa skill by Andrew Odewahn, Brian Jepson Publisher(s): O'Reilly Media, Inc.ISBN: 9781491974650
2. Alexa Skills Projects, By Madhur Bhargava, Packt

Reference Book (s):

1. Hands-On Chatbot Development with Alexa Skills and Amazon Lex,Sam Williams ,Packt

Course Content

Unit 1: Introduction to Alexa
Intro to Alexa , The future of voice-based experiences , Overview of Echo, Alexa.
Unit 2: Alexa Skill Set
Build Alexa Skills, Why you should build Alexa skills, What type of Alexa skills you can create, How an Alexa skill works, The steps to build a skill, The requirements to build a skill.
Unit 3: Design an Engaging Voice User Interface
How users interact with Alexa, Voice design concepts: utterances, intents, slots, interaction model and situational design, Characteristics of a well-designed voice user interface (VUI), Key challenges of voice design.
UNIT4: Setting up AWS
Setting Up Your Alexa Skill in the Developer Portal , Setting Up A Lambda Function Using Amazon Web Services, Connecting Your Voice User Interface To Your Lambda Function.
Unit 5 : Creating alexa skills
Fact Skill,Quiz Skill & Project on Alexa Skill
Unit-6 AI in Practice
Visualizing Statistical Relationships, Plotting with Categorical Data, Visualizing the Distribution of a Dataset.

SEMESTER - III

Name of The Course	Data Structures and Algorithms	L	T	P	C
Course Code	BCSE2361	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

1. Introduce the fundamentals and abstract concepts of Data Structures.
2. Introduce searching, sorting techniques
3. Learn how concepts of data structures are useful in problem solving.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Understand the comparison and use of Recursion and Loops
CO2	Understand the application of linear data structure(s) to solve various problems
CO3	Understand the application of non linear data structure(s) to solve various problems
CO4	Understand the shortest path algorithms involving complicated data structures like Graphs.
CO5	Become expert in calculating and comparing complexities of various searching and sorting algorithms.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Horowitz and Sahani, “Fundamentals of Data Structures”, Galgotias Publication

Reference Books

1. Aaron M. Tanenbaum, Yedidyah Langsam and Moshe J. Augenstein “Data Structures Using C and C++” , PHI
2. Jean Paul Trembley and Paul G. Sorenson, “An Introduction to Data Structures with applications”, McGraw Hill
3. R. Kruse etal, “Data Structures and Program Design in C”, Pearson Education
4. Lipschutz, “Data Structures” Schaum’s Outline Series, TMH
5. G A V Pai, “Data Structures and Algorithms”, TMH

Course Content

Unit 1	Module 1	9 Hours
Elementary Data Organization, Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations: Big-Oh, Time-Space trade-off. Abstract Data Types (ADT)Arrays: Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Application of arrays, Sparse Matrices and their representations. Linked lists: Array Implementation and Dynamic Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition, Generalized Linked List		
Unit II	**Module 2**	**8 Hours**
Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Recursion, Tower of Hanoi Problem, Simulating Recursion, Principles of recursion, Tail recursion, Removal of recursion		
Unit III	**Module 3**	**8 Hours**
Binary Trees, Binary Tree Representation: Array Representation and Dynamic Representation, Complete Binary Tree, Algebraic Expressions, Extended Binary Trees, Array and Linked Representation of Binary trees, Tree Traversal algorithms: Inorder, Preorder and Post order, Threaded Binary trees, Traversing Threaded Binary trees, Huffman algorithm.		
Unit-IV	**Module 4**	**7 Hours**
Terminology, Sequential and linked Representations of Graphs: Adjacency Matrices, Adjacency List, Adjacency Multi list, Graph Traversal : Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm. Transitive Closure and Shortest Path algorithm: Dijikstra Algorithm		
Unit-V	**Module 5**	**8 Hours**
Sequential search, Binary Search, Comparison and Analysis Internal Sorting: Insertion Sort, Selection, Bubble Sort, Shell sort.		
Unit-VI	**Advancements and Research**	**6 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of The Course	Data Communication and Networking	L	T	P	C
Course Code	BCSE2370	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

1. Understand the fundamental concepts of data communications and networking.
2. Identify the basic components/instrument/equipment and their respective roles in data communication system
3. Understand the structure of computer networks, factors affecting computer network deployment.
4. Describe emerging technology in the net-centric computing area and assess their current capabilities, limitations and potential applications.
5. Program and analyze network protocols, architecture, algorithms and other safety critical issues in real-life scenario.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Understand the different networking sub-systems and their functions in a telecommunication system.
CO2	Understand and configure the different types of network topologies and protocols.
CO3	Understand the different protocols layers of the OSI model.
CO4	Examine and analyze the network-layer concepts like Network-Layer services – Routing -IP protocol -IP addressing
CO5	Examine and analyze the different link-layer and local area network concepts like Link-Layer services –Ethernet -Token Ring -Error detection and correction -ARP protocol
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Forouzan, Data Communications and Networking, McGraw Hill, 4th ed.

Reference Books

1. Tannenbaum, Computer Networks, Pearsoned Education.

Course Content

Unit 1	Introduction Concepts	8 hours
Data and Signal fundamentals, Ana log Signals, Digital Signals, Transmission Media: Guided and Unguided Media, Transmission Impairments, Categories of Networks, Network Topology Design - Delay Analysis, Switching methods, ISDN, The OSI reference model ,TCP/IP Protocol Suite, Comparison of OSI and TCP/IP.		
Unit II	**Digital and Analog Transmission**	**8 hours**
Digital Transmission: Digital-to-Digital Conversion, Analog-to-Digital Conversion, Pulse Code Modulation, Delta Modulation, Digital-to-Analog Conversion, ASK,FSK,PSK, Analog- to-Analog Conversion, Modulation Techniques.		
Unit III	**Medium Access sub layer**	**8 hours**
Medium Access sub layer - Channel Allocations, LAN protocols -ALOHA protocols - Overview of IEEE standards - FDDI. Data Link Layer - Elementary Data Link Protocols, Sliding Window protocols, Error Detection and Correction: Block coding, cyclic codes, Linear block codes, checksum.		
Unit-IV	**Network and Transport Layer**	**8 hours**
Network Layer - Point - to Pont Networks, routing, Congestion control, Internetworking -TCP / IP, IP packet, IP address, IPv6. Transport Layer - Design issues, connection management, session Layer-Design issues, remote procedure call. Presentation Layer-Design issues, Data compression techniques, cryptography - TCP - Window Management.		
Unit-V	**Application Layer**	**8 hours**
Electronic mail, WWW, HTTP, SMTP, POP3, IMAP, FTP, SSH..		
Unit-VI	**Advancements and Research**	**3 hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of The Course	Data Base management System	L	T	P	C
Course Code	BCSE2073	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

1. Develop the ability to design, implement and manipulate databases.
2. Introduce students to build data base management systems.
3. Able to store and analyze data into normalized format.
4. Apply DBMS concepts to various examples and real life applications

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Learn knowledge of ER Modeling.
CO2	Apply programming concepts using DDL and DML commands in SQL.
CO3	Understand the storage system in Relational Database and imposing security.
CO4	Able to remove various anomalies from databases.
CO5	Understanding of transaction process.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. "Database system concepts" Henry F Korth, Abraham Silberschatz, S. Sudurshan, McGraw- Hill

Reference Books

1. Date C J, " An Introduction to Database Systems", Addision Wesley
2. Elmasri, Navathe, " Fundamentals of Database Systems", Addision Wesley
3. O'Neil, Databases, Elsevier Pub.
4. Leon &Leon,"Database Management Systems", Vikas Publishing House
5. Bipin C. Desai, " An Introduction to Database Systems", Gagotia Publications
6. Majumdar & Bhattacharya, "Database Management System", TMH (14)
7. Ramkrishnan, Gehrke, " Database Management System", McGraw Hill

Course Content

Unit 1	Introduction	9 hours
Introduction: An overview of database management system, database system Vs file system, Database system concept and architecture, data model schema and instances, data independence and database language and interfaces, data definitions language, DML, Overall Database Structure.		
Unit II	**Relational data Model and Language**	**9 hours**
Relational data model concepts, integrity constraints, entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra, relational calculus, tuple and domain calculus. Introduction on SQL: Characteristics of SQL, advantage of SQL. SQl data type and literals. Types of SQL commands. SQL operators and their procedure. Tables, views and indexes. Queries and sub queries. Aggregate functions. Insert, update and delete operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PL SQL		
Unit III	**Data Base Design & Normalization**	**10 hours**
Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design..		
Unit-IV	**Transaction Processing Concept**	**6 hours**
Transaction system, Testing of serializability, serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures, log based recovery, checkpoints, deadlock handling. Distributed Database: distributed data storage, concurrency control, directory system.		
Unit-V	**Concurrency Control Techniques**	**6 hours**
Concurrency control, Locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation-based protocol, multiple granularities, Multi version schemes, Recovery with concurrent transaction, case study of Oracle.		
Unit-VI	**Advancements and Research**	**6 hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of The Course	Java Programming	L	T	P	C
Course Code	BCSE2333	0	0	4	2
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Outline the fundamentals of object-oriented programming in Java
CO2	Create applications using thread and exception handling
CO3	Understand I/O streams and applet programming in Java
CO4	Experiment with Java packages and collections.
CO5	Construct the GUI based application with AWT controls
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. 1. Schildt, Herbert. ―Java: The Complete Reference‖, 9th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2014.

Reference Books

1. Buyya Rajkumar., Thamarai Selvi S. and Xingchen Chu., ―Object Oriented Programming with Java Essentials and Applications‖, Tata McGraw Hill, 2009.
2. Deitel, Paul and Deitel, Harvey. ―Java How to Program‖, 8th Edition, Eastern Economy Edition, 2009.
3. www.javatpoint.com
4. https://www.w3schools.in/java-tutorial/

Course Content

LIST OF EXPERIMENTS / EXERCISES:
1. Simple java programs using operators, arrays and control statements
2. Develop a stack data structure using class and object
3. Program to demonstrate inheritance & polymorphism
4. Develop an application using interfaces and packages
5. Program to illustrate exception handling in java and creation of user defined exception
6. Program to illustrate multithreads and Inter thread Communication
7. Program to copy the contents of one file into another file.
8. Develop and configure a simple banner applet
9. Program to demonstrate the features of generics types
10. Program to demonstrate the use of Array List, Linked List, Hash Set and Map classes.
11. Program to capture the various keyboard and mouse events.
12. Develop a scientific calculator using event-driven programming paradigm of Java
13. Develop a simple text editor with basic file and edit functionalities

Program Elective – I

Name of The Course	Cryptographic Fundamentals	L	T	P	C
Course Code	BCSE2350	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

The primary objective of this course is to understand Cryptography Theories, Algorithms and Systems. To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Understand the fundamentals of networks security, security architecture, threats and vulnerabilities.
CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms.
CO3	Apply the different cryptographic operations of public key cryptography.
CO4	ApplythevariousAuthenticationschemestosimulatedifferentapplications.
CO5	Understand various Security practices and System security standards.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI3rdEdition, 2006.

Reference Books

1. CK Shyamala , N Harini and Dr. TR Padmanabhan: Cryptography and Network Security, Wiley India Pvt. Ltd.
2. Behrouz A.Foruzan, Cryptography and Network Security, Tata Mc GrawHill-2007.
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN0-13-046019-2

Course Content

Unit 1	**Introduction**	**5 hours**
Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, Steganography.		
Unit II	**Symmetric key cryptography**	**5 hours**
Algebraic structures - Modular arithmetic-Euclid's algorithm- Congruence and matrices -Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher - Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher mode of operation – Advanced Encryption Standard -RC4– Key distribution.		
Unit III	**Public key cryptography**	**5 hours**
Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler'sTheorem-ChineseRemainderTheorem–Exponentiationandlogarithm-ASYMMETRICKEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange – El Gamal cryptosystem –Elliptic curve arithmetic-Elliptic curve cryptography.		
Unit-IV	**Message authentication**	**5 hours**
Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS-Entity Authentication: Biometrics, Passwords, Challenge Response protocols-Authentication applications– Kerberos.		
Unit-V	**Security practice**	**5 hours**
Electronic Mail security – PGP, S/MIME – IP security – Web Security – SYSTEM SECURITY: Intruders–Malicious software–viruses –Firewalls.		
Unit-VI		**4 hours**
The advances and the latest trends in the course as well as the latest applications of the are as covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of The Course	Software Project Management	L	T	P	C
Course Code	BCSE2351	3	0	0	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

Define and highlight importance of software project management. Describe the software project management activities. Trains of software project managers and other individuals involved in software project. Planning and tracking and oversight in the implementation of the software project management process.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Describeanddeterminethepurposeandimportanceofprojectmanagementfromtheperspectives of planning, tracking and completion of project.
CO2	Compare and differentiate organization structures and project structures.
CO3	Implement a project to manage project schedule, expenses and resources with the Application of suitable project management tools.
CO4	Gain understanding of latest trends and research areas in the course

Text Books

1. Clifford F.Gray, Erik W. Larson, “Project Management: The Managerial Process with MS”, Mc Graw Hill.

Reference Books

1. M.Cotterell, Software Project Management, Tata Mc Graw-Hill Publication.
2. Royce, Software Project -Management, Pearson Education.
3. Kieron Conway, Software Project Management, Dream tech Press.
4. S. A. Kelkar, Software Project Management, PHI Publication.

Course Content

Unit 1	Introduction and Software Project Planning	5 hours
Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope document, Project Management Cycle, SPM Objectives, Management Spectrum, SPM Framework, Software Project Planning, Planning Objectives, Project Plan, Types of project plan, Structure of a Software Project Management Plan, Software project estimation, Estimation methods, Estimation models, Decision process.		
Unit II	**Project Organization and Scheduling**	**5 hours**
Project Elements, Work Breakdown Structure (WBS), Types of WBS, Functions, Activities andTasks,ProjectLifeCycleandProductLifeCycle,WaystoOrganizePersonnel,Projectschedule, Scheduling Objectives, Building the project schedule, Scheduling terminology and techniques, Network Diagrams: PERT,CPM, Bar Charts: Milestone Charts, Gantt Charts.		
Unit III	**Project Monitoring and Control**	**5 hours**
DimensionsofProjectMonitoring&Control,EarnedValueAnalysis,EarnedValueIndicators: 23BudgetedCostfor Work Scheduled(BCWS),Cost Variance(CV),Schedule Variance(SV), CostPerformanceIndex(CPI),SchedulePerformanceIndex(SPI),InterpretationofEarnedValueIndicators,ErrorTracking,SoftwareReviews,TypesofReview:Inspections, Desk checks, Walk through, Code Reviews ,Pair Programming.		
Unit-IV	**Software Quality Assurance and Testing**	**5 hours**
Testing Objectives, Testing Principles, Test Plans, Test Cases, Types of Testing, Levels ofTesting,TestStrategies,ProgramCorrectness,ProgramVerification&validation,TestingAutomation&TestingTools,ConceptofSoftwareQuality,SoftwareQualityAttributes,Software Quality Metrics and Indicators, The SEI Capability Maturity Model CMM), SQAActivities,FormalSQAApproaches:Proofofcorrectness,Statisticalqualityassurance,Clean room process.		
Unit-V	**Project Management and Project Management Tools**	**5 hours**
Software Configuration Management: Software Configuration Items and tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control, Risk Management: Risks and risk types, Risk Break down Structure(RBS),RiskManagementProcess:Riskidentification,Riskanalysis,Riskplanning,Riskmonitoring,CostBenefitAnalysis,SoftwareProjectManagementTools:CASETools,PlanningandSchedulingTools, MS-Project.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applications of the are as covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

List of Experiments
1. Preparation of requirement document for standard application problems in standard format. (e.g. Library Management System, Railway Reservation system, Hospital management System, University Admission system) .DFD of standard application problems.
2. Project Schedule preparation. Software Requirement Analysis: Describe the individual Phases/ modules of the project, Identify deliverables
3. Use Case diagram, Class Diagram, Sequence Diagram, Activity Diagram and prepare Software Design Document using tools like Rational Rose.(For standard application problems)
4. Software Development and Debugging. Estimation of project size using Function Point(FP) for calculation.
5. Design Test Script/Test Plan (both Black box and White Box approach) 6. Compute Process and Product Metrics (e.g. Defect Density, Defect Age, Productivity, Cost etc.) Cost Estimation models. COCOMO

Name of The Course	CYBER SECURITY	L	T	P	C
Course Code	BCSE2380	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

Define the area of cybercrime and forensics. Explain the motive and causes for cyber crime, detection and handling. Investigate Areas affected by cyber crime. Illustrate tools used in cyber forensic. Infer legal Perspectives in cyber security.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Define cyber security, cyber law and their roles
CO2	Identify cyber security cybercrime and forensics.
CO3	Apply tools and methods used in cyber-crime.
CO4	Integrate the tools and methods used in Cyber Forensics.
CO5	Comprehend the Security Policies and Cyber Laws.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. SunitBelapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81-265- 21791, Publish Date 2013
2. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, KLSI. "Introduction to information security and cyber laws". Dream tech Press. ISBN: 9789351194736, 2015

Reference Books

1. Thomas J. Mowbray, "Cyber security: Managing Systems, Conducting Testing, and Investigating Intrusions", Copyright © 2014 by John Wiley & Sons, Inc, ISBN: 978 -1- 118 - 84965 -1
2. James Graham, Ryan Olson, Rick Howard, "Cyber Security Essentials", CRC Press, 15- Dec 2010.
3. Anti- Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw Hill.

Course Content

Unit 1	INTRODUCTION TO CYBERCRIME	5 hours
Cybercrime- Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. Cyber offenses: How Criminals Plan Them: How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cybercafé and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.		
Unit II	**CYBERCRIME**	**5 hours**
Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.		
Unit III	**TOOLS AND METHODS USED IN CYBERCRIME**	**5 hours**
Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan-horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. Phishing and Identity Theft: Introduction to Phishing, Identity Theft (ID Theft).		
Unit-IV	**UNDERSTANDING COMPUTER FORENSICS**	**5 hours**
Introduction, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Anti forensics.		
Unit-V	**SECURITY POLICIES AND CYBER LAWS**	**5 hours**
Need for An Information Security Policy, Information Security Standards – ISO, Introducing Various Security Policies and Their Review Process, Introduction to Indian Cyber Law, Objective and Scope of the IT Act, 2000, Intellectual Property Issues, Overview of Intellectual - Property – Related Legislation in India, Patent, Copyright, Law Related to Semiconductor Layout and Design, Software License.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applications of the are as covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

LIST OF PRACTICALS:
1.ImplementationtogatherinformationfromanyPC'sconnectedtotheLANusingwhois,portscanners, network scanning, Angry IP scanners etc.
2. Implementation of Symmetric and Asymmetric cryptography.
3. Implementation of Steganography.
4.ImplementationofMITM-attackusingwireshark/network sniffers
5.ImplementationofWindowssecurity using firewall and other tools
6.Implementationtoidentifywebvulnerabilities,usingOWASP project
7. Implementation of IT Audit, malware analysis and Vulnerability assessment and generate the report.
8. Implementation of OS hardening and RAM dump analysis to collect the Artifacts and other information's.
9.Implementation of Mobile Audit and generate the report of the existing Artiacts.
10.ImplementationofCyberForensicstoolsforDiskImaging,Dataacquisition,Dataextractionand Data Analysis and recovery

Name of The Course	Optimization Techniques	L	T	P	C
Course Code	BCSE2353	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

The primary objective of this course is to introduce the topic of optimization techniques as a precise mathematical concept, and study how to apply in engineering design, establish their correctness, and study their efficiency and performance analysis. The course consists of a strong mathematical component in addition to the design of various techniques for constrained and un constrained problems.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Study and analyze different techniques of optimization and its applications
CO2	Formulate the design problem in mathematical form which can be solved by suitable optimization algorithm
CO3	Optimize the constrained and unconstrained design problem
CO4	Compare the efficiency of different optimization techniques
CO5	Formulate and solve constrained optimization problems of linear and non-linear programming
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Raju, N.V.S. (2014) Optimization methods for Engineers, PHI Publications, ISBN-978-81-203-4744-1.

Reference Books

1. Bhavikatti S.S. (2010), Fundamental of Optimum Design IN Engineering, New Age International Publishers, ISBN-978-81-224-2591-8
2. Deb Kalyanmoy (2012) Optimization for Engineering Design, PHI Publications, ISBN-978-81-203-4678-9

Rao S. S. (2013) Engineering Optimization Theory and Practice, ISBN: 978-81-265-4044-0

Course Content

Unit 1	**Overview of Cloud Computing**	**5 hours**
Brief history and evolution - History of Cloud Computing, Evolution of Cloud Computing, Traditional vs. Cloud Computing. Why Cloud Computing, Cloud service models (IaaS, PaaS&SaaS). Cloud deployment models (Public, Private, Hybrid and Community Cloud), Benefits and Challenges of Cloud Computing. Introduction to AWS Public Cloud Vendor ; Overview of Cloud Computing Architecture: Working Model; Role of N/Ws and Web Services in Cloud Computing Architecture.		
Unit II	**Introduction to Virtualization**	**5 hours**
Traditional IT Infrastructure, Benefits of Virtualization, Types of Virtualization, History of Virtualization. Types of Server Virtualization, Hypervisors, Anatomy of Server Virtualization, Benefits of Storage Virtualization, Types of Storage Virtualization, VPN, VLAN, Benefits of Application Virtualization ; Virtualization for Enterprises : VMware, Hyper-V.		
Unit III	**Cloud Deployment & Delivery Models**	**5 hours**
Decision Factors for Cloud Implementations, Public, Private and Hybrid Cloud, Private Cloud Definition, Characteristics of Private Cloud, Private Cloud deployment models, Private Cloud Vendors – Cloud Stack, Eucalyptus and Microsoft, Private Cloud – Benefits and Challenges. Private Cloud implementation in Amazon EC2 service. What is Public Cloud, Why Public Cloud, When to opt for Public Cloud, Public Cloud Service Models, and Public Cloud Vendors and offerings (IaaS, PaaS, SaaS). Demonstrating public cloud with AWS, Introduction to EC2 and Storage services of AWS.Private vs. Public Cloud – When to choose.		
Unit-IV	**Overview of Cloud Security**	**5 hours**
Explain the security concerns in Traditional IT, Introduce challenges in Cloud Computing in terms of Application Security, Server Security, and Network Security. Security reference model, Abuse and Nefarious Use of Cloud Computing, Insecure Interfaces and APIs, Malicious Insiders, Shared Technology Issues, Data Loss or Leakage, Account or Service Hijacking, Unknown Risk Profile, Shared security model between vendor and customer in IAAS/PAAS/SAAS, Implementing security in AWS.		
Unit-V	**Migration path to Cloud**	**5 hours**
When and not to migrate to Cloud, Migration paths for cloud, Selection criteria for cloud deployment, Issues/risks in cloud computing, Future technology trends in Cloud Computing. Cloud workload Overview, Workloads most suitable for Cloud, Workloads not suitable for Cloud.		
Unit-VI	**Advancements and Research**	**4 hours**
Open source Vs. Proprietary Cloud Computing Platforms, Introduction to Open Source Cloud Computing Platform. AWS Cloud Concepts Essentials ,AWS Core Services Essentials, Compute in the Cloud, Global Infrastructure and Reliability Storage and Databases, AWS Security Essentials, AWS Architecting Essentials, AWS Pricing and Support Essentials, Identify future services and developments built on the cloud.		

Name of The Course	Artificial Intelligence	L	T	P	C
Course Code	BCSE2354	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

Develop the ability to design and implement agents. Introduce students to search concepts for complex AI problem. Apply AI concepts to various real life applications exploration of research problems.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Analyze the dimensions along which agents and environments.
CO2	Implement agents using search algorithms
CO3	Develop strategies for agents in games of perfect and imperfect information
CO4	Ability to handle knowledge representation.
CO5	Understand Bayesian network to make quantitative (probabilistic) and qualitative inferences
CO6	Understanding of Pattern Recognition and network.

Text Books

1. ElaineRichandKevin Knight,“ArtificialIntelligence”,McGraw-Hill

Reference Books

1. StuartRussell,PeterNorvig,“ArtificialIntelligence–AModernApproach”,PearsonEducation.
2. ECharniakandDMcDermott,“IntroductiontoArtificial Intelligence”, Pearson Education.
3. Dan W. Patterson, “Artificial Intelligence and Expert Systems”, Prentice Hall of India

Course Content

Unit 1	**Scope of AI**	**5 hours**
Introduction to AI Foundations and History. Intelligent Agents- application domains - natural language processing, vision and speech processing, robotics, expert systems, AI techniques- Agent types.		
Unit II	**Problem solving State space search**	**5 hours**
Production systems, search space control: depth first, breadth-first search, heuristic search - hill climbing, best-first search, branch and bound. Problem Reduction, Constraint Satisfaction End.		
Unit III	**Knowledge Representation & Logical Agents**	**5 hours**
Knowledge-Based Agents, Wumpus World,etc, Propositional Logic, Propositional Theorem, Propositional Model Checking, Agents Based on Propositional Logic. First-Order Logic: Representation, Syntax and Semantics, Using First-Order Logic and Knowledge Engineering. Inference in First- Order Logic: Unification and Lifting, Forward and Backward Chaining, Resolution.		
Unit-IV	**Uncertain Knowledge and Reasoning**	**5 hours**
Acting under Uncertainty, Probability Notation, Inference, Independence and Bayes'Rule. Probabilistic Reasoning: Semantics and Inference of Bayesian Networks, Relational and First-Order Probability Models, Probabilistic Reasoning over Time: Inference, Hidden Markov Models, Kalman Filters and Dynamic Bayesian Networks. Making Simple Decisions: Utility Theory and Functions and Decision Networks.		
Unit-V	**Learning from Examples**	**5 hours**
Forms, Decision Trees, Theory of Learning, Linear Models, Artificial Neural Networks, Nonparametric Models, Support Vector Machines, Ensemble Learning. Knowledge in Learning: Logical Formulation, Explanation-Based Learning, Reinforcement Learning: Passive and Active Reinforcement Learning and Generalization.		
Unit-VI	**Advancements and Research**	**4 hours**
Open source Vs. Proprietary Cloud Computing Platforms, Introduction to Open Source Cloud Computing Platform. AWS Cloud Concepts Essentials, AWS Core Services Essentials, Compute in the Cloud, Global Infrastructure and Reliability Storage and Databases, AWS Security Essentials, AWS Architecting Essentials, AWS Pricing and Support Essentials, Identify future services and developments built on the cloud.		

LISTOFPRACTICALS
1. Write a Programme to conduct un informed and informed search.
2. Write a Programme to conduct game search.
3.Writeaprogram of depth first search
4. Write a Programme to construct a Bayesian network from given data.
5. Write a Programme to infer from the Bayesian network.
6. Write a program to solve travelling salesman problems.
7.Writeaprogram for8-queen problem
8. Write a Programme to do reinforcement learning in a grid world.

SEMESTER-IV

Name of TheCourse	Operating System	L	T	P	C
Course Code	BTCS2400	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

1. To understand the services provided by and the design of an operating system.
1. To understand the structure and organization of the file system.
2. To understand what a process is and how processes are synchronized and scheduled.
3. To understand different approaches to memory management.
4. Students should be able to use system calls for managing processes, memory and the file system.
5. Students should understand the data structures and algorithms used to implement an OS.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Remember the classification and diversification of Operating system
CO2	Understand the classical problems in Concurrent Processes and their solutions.
CO3	Implement different types of CPU Scheduling Algorithm along with the understanding of the concept of Deadlock in system and its methods of handling deadlocks.
CO4	Analyze the concept of memory management and paging concept in operating system.
CO5	Demonstrate the learnt knowledge with a optimized solution in the functions like memory management, I/O management and various scheduling algorithms and take care of deadlocks.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Silberschatz, Galvin and Gagne, “Operating Systems Concepts”, Wiley, Ninth Edition, 2013.
2. D M Dhamdhere, “Operating Systems: A Concept based Approach”, McGraw Hill Education, 3 edition, 2012

Reference Books

1. Sibsankar Halder and Alex A Aravind, “Operating Systems”, Pearson Education India, 2014.
2. Harvey M Dietel, “ An Introduction to Operating System”, Pearson Education, 1990.Cloud Computing Architected: Solution Design Handbook by Rhoton, John.

Course Content

Unit-1 OPERATING SYSTEMS OVERVIEW **6 hours**

Introduction to Operating System, System Calls, Types of system call, Structure of Operating Systems, Operations of Operating System, Types of OS.

Unit-II PROCESS MANAGEMENT **6 hours**

Process Concept, States of Process, Process Scheduling, Inter process Communication, Process Synchronization, Semaphore and Monitor.

Unit-III SCHEDULING AND DEADLOCK MANAGEMENT **6 hours**

Introduction of CPU Scheduling, CPU Scheduling Algorithms (FCFS, SJF, ROUND ROBIN, PRIORITY), Preconditions for Deadlock ,Banker's Algorithm , Deadlock Prevention, Deadlock Avoidance, Recovery from Deadlock.

Unit-IV STORAGE MANAGEMENT **6 hours**

Swapping, Contiguous Memory Allocation, Segmentation, Paging, Demand Paging, Page Replacement Techniques, Virtual memory, Compaction, Concept of working sets

Unit-V DEVICE MANAGEMENT **6 hours**

Disk Scheduling Strategies, Rotational Optimization, System Consideration, Caching and Buffering , Introduction of RAID, File Management Concept

Unit VI: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Name of TheCourse	Computer Graphics	L	T	P	C
Course Code	BTCS2401	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	To develop a facility with the relevant mathematics of computer graphics, e.g., 3D rotations are using vector algebra, geometrical transformations and projections using homogeneous co-ordinations.
CO2	Apply principles and techniques of computer graphics, e.g., the graphics pipeline, and Bresenham algorithm for speedy line and circle generation.
CO3	Apply computer graphics concepts in the development of computer games, information visualization, and business applications.
CO4	To develop a facility with the relevant mathematics of computer graphics, e.g., 3D rotations are using vector algebra, geometrical transformations and projections using homogeneous co-ordinations.
CO5	Apply principles and techniques of computer graphics, e.g., the graphics pipeline, and Bresenham algorithm for speedy line and circle generation.
CO6	Gain understanding of latest trends and research areas in the course

Course Content

Unit 1	**Introduction and Line Generation**	**8 Hours**
Types of computer graphics, Graphic Displays- Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines, Line drawing algorithms, Circle generating algorithms, Midpoint circle generating algorithm, and parallel version of these algorithms.		
Unit II	**Transformations**	**8 Hours**
Basic transformation, Matrix representations and homogenous coordinates, Composite transformations, Reflections and shearing.Windowing and Clipping: Viewing pipeline, Viewing transformations, 2-D Clipping algorithms-Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Barskyalgorithm, Line clipping against non rectangular clip windows; Polygon clipping – SutherlandHodgeman polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Textclipping**.**		
Unit III	**Three Dimensional**	**8 Hours**
3-D geometric primitives, 3-D Object representation, 3-D Transformation, 3-D viewing, projections, 3-D Clipping.		
Unit-IV	**Curves and Surfaces**	**8 Hours**
Quadric surfaces, Spheres, Ellipsoid, Blobby objects, Introductoryconcepts of Spline, Bspline and Bezier curves and surfaces.		
Unit-V	**Hidden Lines and Illumination models**	**8 Hours**
Hidden Lines and Surfaces: Back Face Detection algorithm, Depth buffer method, A-buffer method, Scan line method, basic illumination models – Ambient light, Diffuse reflection, Specular reflection and Phong model, Combined approach, Warn model, Intensity, Attenuation, Color consideration, Transparency and Shadows.		
Unit-VI	**Advancements and Research**	**6 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of TheCourse	Analysis and Design of Algorithms	L	T	P	C
Course Code	BTCS2402	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

The primary objective of this course is to introduce the topic of algorithms as a precise mathematical concept, and study how to design algorithms, establish their correctness, study their efficiency and memory needs. The course consists of a strong mathematical component in addition to the design of various algorithms.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Analyze the complexity of the algorithms and use technique divide and conquer to solve the problems
CO2	Identify feasible solutions for different problems through greedy method and minimize the solutions space and to solve the problems through dynamic programming.
CO3	Solve the problems through graph algorithms.
CO4	Justify that a certain problem is NP-Complete
CO5	Understand and apply linear programming concepts to real time applications.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Michael T. Goodrich and Roberto Tamassia: Algorithm Design: Foundations, Analysis and Internet examples (John Wiley &Sons, Inc., 2002).
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran. Fundamentals of Computer
3. Algorithms, MIT Press, Second Edition (Indian reprint: Prentice-Hall), 2008.

Reference Books

1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, “Introduction to Algorithms”, The MIT Press, 3rd edition, 2009.
2. RCT Lee, SS Tseng, RC Chang and YT Tsai, “Introduction to the Design and Analysis of Algorithms”, Mc Graw Hill, 2005.
3. Aho, Hopcraft, Ullman, “The Design and Analysis of Computer Algorithms” Pearson Education.

Course Content

Unit 1	**Module 1: Introduction**	**9 Hours**
Introduction: Algorithms, Analyzing algorithms, Complexity of algorithms, Growth of functions, Performance measurements, Sorting and order Statistics - Shell sort, Quick sort, Merge sort, Heap sort, Comparison of sorting algorithms, Sorting in linear time.		
Unit II	**Module 2: Tree**	**9 Hours**
Advanced Data Structures: Red-Black trees, B – trees, Binomial Heaps, Fibonacci Heaps.		
Unit III	**Module 3: Algorithm**	**9 Hours**
Divide and Conquer with examples such as Sorting, Matrix Multiplication, Convex hull and Searching. Greedy methods with examples Huffman Coding, Knapsack, Minimum Spanning trees – Prim's and Kruskal's algorithms, Single source shortest paths - Dijkstra's and Bellman Ford algorithms.		
Unit-IV	**Module 4: Dynamic Programming**	**9 Hours**
Dynamic programming with examples such as Knapsack, All pair shortest paths – Warshal's and Floyd's algorithms, Resource allocation problem. Backtracking, Branch and Bound with examples such as Travelling Salesman Problem, Graph Coloring, n-Queen Problem, Hamiltonian Cycles and Sum of subsets.		
Unit-V	**Module 5: Computations**	**9 Hours**
Selected Topics: Algebraic Computation, String Matching, Theory of NP-completeness, Approximation algorithms and Randomized algorithms.		
Unit-VI	**Module 6: Advancements and Research**	**6 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of TheCourse	Internet of Things	L	T	P	C
Course Code	BTCS9201	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Content

Unit 1	Introduction to Internet of Thing	5 hours
Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, Iot Communication APIs, IoT enabled Technologies– Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.		
Unit II	**IoT and M2M**	**5 hours**
Software defined networks, network function virtualization, difference between SDN and NFV for IoT. Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER.		
Unit III	**Introduction to Python**	**5 hours**
Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling. Python packages - JSON, XML, HTTP Lib, URL Lib, and SMTP.		
Unit-IV	**IoT Physical Devices and Endpoint**	**5 hours**
Introduction to Raspberry PI - Interfaces (serial, SPI, I2C). Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.		
Unit-V	**IoT Physical Servers and Cloud Offerings**	**5 hours**
Introduction to Cloud Storage models and communication APIs. Web server – Web server for IoT, Cloud for IoT, Python web application framework. Designing a RESTful web API.		
Unit-VI	**Advancements and Research**	**4 hours**
Open source Vs. Proprietary Cloud Computing Platforms, Introduction to Open Source Cloud Computing Platform. AWS Cloud Concepts Essentials,AWS Core Services Essentials,Compute in the Cloud, Global Infrastructure and ReliabilityStorage and Databases, AWS Security Essentials,AWS Architecting Essentials,AWS Pricing and Support Essentials, Identify future services and developments built on the cloud.		

Text Books

1. Michael T. Goodrich and Roberto Tamassia: Algorithm Design: Foundations, Analysis and Internet examples (John Wiley &Sons, Inc., 2002).
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran. Fundamentals of Computer
3. Algorithms, MIT Press, Second Edition (Indian reprint: Prentice-Hall), 2008.

Reference Books

1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, “Introduction to Algorithms”, The MIT Press, 3rd edition, 2009.
2. RCT Lee, SS Tseng, RC Chang and YT Tsai, “Introduction to the Design and Analysis of Algorithms”, Mc Graw Hill, 2005.
3. Aho, Hopcraft, Ullman, “The Design and Analysis of Computer Algorithms” Pearson Education.

Name of TheCourse	Data Sciences	L	T	P	C
Course Code	BTCS9202	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

The primary objective of this course is to develop both theoretical knowledge on data analysis skills, which can be applied to practical problems for explain how math and information sciences can contribute to building better algorithms and software. To develop applied experience with data science software, programming, applications and processes.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	To acquire good introducing knowledge of the essentials in Statistical Fundamentals used in Data science.
CO2	An ability to apply algorithmic principles and Programing knowledge using Python language on Data Science.
CO3	Understand the fundamentals of statistics and probability used in data science.
CO4	To establish basic knowledge about optimization techniques in Data Virtualization.
CO5	Apply and Implement ML processing principles using Probability and Statistics.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Data Science from Scratch: First Principles with Python 1st Edition, by Joel Grus , O'Reilly Publication,2020.
2. James, G., Witten, D., Hastie, T., Tibshirani, R. An introduction to statistical learning with applications in R. Springer, 2013.
3. Han, J., Kamber, M., Pei, J. Data mining concepts and techniques. Morgan Kaufmann, 2011.

Reference Books

1. "Data Science for business", F. Provost, T Fawcett, 2013
2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services , 2015.
3. Murphy, K. Machine Learning: A Probabilistic Perspective. - MIT Press, 2012.

Course Content

Unit 1	Introduction with Statistical Fundamentals	5 hours
Introduction : Intermediate Algebra& Linear Algebra: Functions, Exponentials and Logarithm's, Polynomial's, Alternate Coordinate systems, Binomial Distribution, Poisson distribution and Normal distribution its properties, Assumption of ANOVA, Measures of Central Tendency in Data.		
Unit II	**Python for Data Science**	**5 hours**
Introduction about NumPy, Different NumPy Operations, Broadcasting with NumPy, Introductionabout Pandas, Reading or Loading data into Data frame, Pandas Data Frame Manipulations, Data Loading /Reading in different formats(CSV,Excel,Json,HTML).		
Unit III	**Data Science with R**	**5 hours**
Intro to R Programming, Understanding data structures in R - lists, matrices, vectors, Basic Building Blocks in R, Basic Operations Operators and Types, Matrices and Data Frames in R, Logical Statements in R, Lapply, sapply, vapply and tapply Functions. Summarizing and Visualizingthe Important Characteristics of Data.		
Unit-IV	**Data Visualizations & Data Cleaning**	**5 hours**
Introduction to data Visualizations, Principles Behind Data Visualizations, Histograms-Visualize,Box plots-Visualize, the Distribution of Continuous Numerical Variables (Bar Plots Pie Chart Line Chart). Data Visualization using R- Line Plots and Regression.		
Unit-V	**Statistics and Probability concepts to understanding Machine learning**	**5 hours**
Unsupervised Learning in Python: K- Means Theory/ Implementation, Quantifying K-Means Clustering Performance, Hierarchical Clustering Theory, Principal Component Analysis (PCA) theory / Implementation. Selection criteria for number of clusters choosing.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applica the areas covered in the course. The latest research conducted in the areas covered in the Discussion of some latest papers published in IEEE transactions and ACM transactions, Science and SCOPUS indexed journals as well as high impact factor conferences as symposiums. Discussion on some of the latest products available in the market be the areas covered in the course and patents filed in the areas covered in the course.		

Name of TheCourse	Data Mining and Warehousing	L	T	P	C
Course Code	BTCS9203	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

To gain knowledge on various Data Mining tasks Data Warehousing and application-oriented Data Mining concepts.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Knowledge in the basic concepts of data warehousing and data mining.
CO2	Ability to create large multidimensional data storage and carry out OLAP operations.
CO3	Ability to apply the concepts, algorithm, techniques and tools for developing practical applications
CO4	. Gain understanding of latest trends and research areas in the course

Text Books

1. Han, J., Kamber, M., Pei, J. Data mining concepts and techniques. Morgan Kaufmann, 2011.
2. Margaret H. Dunham, S. Sridhar,"Data Mining: Introductory and Advanced Topics" Pearson Education 5. Arun K. Pujari, "Data Mining Techniques" Universities Press
3. Pieter Adriaans, Dolf Zantinge, "Data-Mining", Pearson Education.

Reference Books

1. Alex Berson, Stephen J. Smith "Data Warehousing, Data-Mining & OLAP", TMH
2. Mark Humphries, Michael W. Hawkins, Michelle C. Dy, " Data Warehousing: Architecture and Implementation", Pearson
3. Singh, Data Mining and Warehousing, Khanna Publishing House.

Course Content

Unit 1	**Overview**	**5 hours**
Definition, Data Warehousing Components, Building a Data Warehouse, Warehouse Database, Mapping the Data Warehouse to a Multiprocessor Architecture, Difference between Database System and Data Warehouse, Multi Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations.		
Unit II	**Data Warehouse Process and Technology**	**5 hours**
Warehousing Strategy, Warehouse/management and Support Processes, Warehouse Planning and Implementation, Hardware and Operating Systems for Data Warehousing, Client/Server Computing Model & Data Warehousing. Parallel Processors & Cluster Systems, Distributed DBMS implementations, Warehousing Software, Warehouse Schema Design, 08.		
Unit III	**Data Mining**	**5 hours**
Overview, Motivation, Definition & Functionalities, Data Processing, Form of Data Pre-processing, Data Cleaning: Missing Values, Noisy Data, (Binning, Clustering, Regression, Computer and Human inspection), Inconsistent Data, Data Integration and Transformation. Data Reduction:-Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Discretization and Concept hierarchy generation, Decision Tree.		
Unit-IV	**Classification**	**5 hours**
Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases, Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree-Based Algorithms. Clustering: Introduction, Similarity and Distance Measures, Hierarchical and Partitioned Algorithms. Hierarchical Clustering- CURE and Chameleon. Density Based Methods DBSCAN, OPTICS. Grid Based Methods- STING, CLIQUE. Model Based Method. Statistical Approach, Association rules: Introduction, Large Item sets, Basic Algorithms,Parallel and Distributed Algorithms, Neural Network approach.		
Unit-V	**Data Visualization and Overall Perspective**	**5 hours**
Aggregation, Historical information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse. Warehousing applications and Recent Trends: Types of Warehousing Applications, Web Mining, Spatial Mining and Temporal Mining.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applica the areas covered in the course. The latest research conducted in the areas covered in the Discussion of some latest papers published in IEEE transactions and ACM transactions, Science and SCOPUS indexed journals as well as high impact factor conferences as symposiums. Discussion on some of the latest products available in the market b the areas covered in the course and patents filed in the areas covered in the course.		

Name of TheCourse	Bio Informatics	L	T	P	C
Course Code	BTCS9204	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

Impart knowledge on basic techniques of Bioinformatics and on analysis of biological data using computational methods. Investigating problems in molecular and biology from a computational perspective.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Extract information from different types of bioinformatics data (gene, protein, disease, etc.), including their biological characteristics and relationships.
CO2	Employ different data representation models and formats used for bioinformaticsdata representation, including markup languages such as SBML and CellML, andontologies such as GO ontology.
CO3	Apply the different approaches used for data integration and data management, including data warehouse and wrapper approaches.
CO4	Analyze processed data with the support of analytical and visualization tool.
CO5	Interact with non-bioinformatics professionals, such as biologists and biomedical researchers, to better understand their bioinformatics needs for improved supportand service delivery.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. D E Krane & M L Raymer, " Fundamental concepts of Bioinformatics", Perason Education.
2. Rastogi, Mendiratta, Rastogi, "Bioinformatics Methods & applications, Genomics, Proteomics & Drug Discovery" PHI, New Delhi.

Reference Books

1. Shubha Gopal et.al. " Bioinformatics: with fundamentals of genomics and proteomics", McGraw Hill.
2. O'Reilly, " Developing Bio informatics computer skills", CBS
3. Forsdyke, "Evolutionary Bioinformatics", Springer

Course Content

Unit 1	**Bioinformatics**	**5 hours**
Bioinformatics objectives and overviews, Interdisciplinary nature of Bioinformatics, Data integration, Data analysis, Major Bioinformatics databases and tools. Metadata: Summary 40 & reference systems, finding new type of data online. Molecular Biology and Bioinformatics: Systems approach in biology, Central dogma of molecular biology, problems in molecular approach and the bioinformatics approach, overview of the bioinformatics applications.		
Unit II	**Quaternary structure**	**5 hours**
Basic chemistry of nucleic acids, Structure of DNA, Structure of RNA, DNA Replication, -Transcription, -Translation, Genes- the functional elements in DNA, Analyzing DNA, DNA sequencing. Proteins: Amino acids, Protein structure, Secondary, Tertiary and Quaternary structure, Protein folding and function, Nucleic acid-Protein interaction.		
Unit III	**Perl**	**5 hours**
Perl Basics, Perl applications for bioinformatics- Bioperl, Linux Operating System, mounting/unmounting files, tar, gzip / gunzip, telnet, ftp, developing applications on Linux OS, Understandingand Using Biological Databases, Overview of Java, CORBA, XML, Web deployment concepts.		
Unit-IV	**Genomic sequencing**	**5 hours**
Genome, Genomic sequencing, expressed sequence tags, gene expression, transcription factor binding sites and single nucleotide polymorphism. Computational representations of molecularbiological data storage techniques: databases (flat, relational and object oriented), and controlled vocabularies, general data retrieval techniques: indices, Boolean search, fuzzy search and neighboring, application to biological data warehouses.		
Unit-V	**Macromolecular**	**5 hours**
Macromolecular structures, chemical compounds, generic variability and its connection to clinical data. Representation of patterns and relationships: sequence alignment algorithms, regular expressions, hierarchies and graphical models, Phylogenetics BLAST.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applica the areas covered in the course. The latest research conducted in the areas covered in the Discussion of some latest papers published in IEEE transactions and ACM transactions, Science and SCOPUS indexed journals as well as high impact factor conferences as symposiums. Discussion on some of the latest products available in the market b the areas covered in the course and patents filed in the areas covered in the course.		

Name of TheCourse	Network Design and Management	L	T	P	C
Course Code	BTCS9205	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

To learn about computer network organization and implementation, obtaining a theoretical understanding of data communication and computer networks, and gaining practical experience in installation, monitoring, and troubleshooting of current LAN systems.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Describe Computer network topologies.
CO2	Describe the various layers of ISO-OSI model.
CO3	Describe different protocols and their features.
CO4	Distinguish different security techniques.
CO5	State the various digital signature schemes.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. "Data and Computer Communication" by William Stallings.
2. "Data Communication and Networking" by Behrouz A Forouzan

Reference Books

1. "Computer Networks" by Andrew S Tanenbaum
2. "Internetworking with TCP/IP, Volume 1" by Douglas Comer
3. "TCP/IP Illustrated" by W Richard Stevens

Course Content

Unit 1	**Overview of Cloud Computing**	**5 hours**
Brief history and evolution - History of Cloud Computing, Evolution of Cloud Computing, Traditional vs. Cloud Computing. Why Cloud Computing, Cloud service models (IaaS, PaaS&SaaS). Cloud deployment models (Public, Private, Hybrid and Community Cloud), Benefits and Challenges of Cloud Computing. Introduction to AWS Public Cloud Vendor ; Overview of Cloud Computing Architecture: Working Model; Role of N/Ws and Web Services in Cloud Computing Architecture.		
Unit II	**Introduction to Virtualization**	**5 hours**
Traditional IT Infrastructure, Benefits of Virtualization, Types of Virtualization, History of Virtualization.Types of Server Virtualization, Hypervisors, Anatomy of Server Virtualization, Benefits of Storage Virtualization, Types of Storage Virtualization, VPN, VLAN, Benefits of Application Virtualization ; Virtualization for Enterprises : VMware, Hyper-V.		
Unit III	**Cloud Deployment & Delivery Models**	**5 hours**
Decision Factors for Cloud Implementations, Public, Private and Hybrid Cloud, Private Cloud Definition, Characteristics of Private Cloud, Private Cloud deployment models, Private Cloud Vendors - CloudStack, Eucalyptus and Microsoft, Private Cloud – Benefits and Challenges. Private Cloud implementation in Amazon EC2 service. What is Public Cloud, Why Public Cloud, When to opt for Public Cloud, Public Cloud Service Models, and Public Cloud Vendors and offerings (IaaS, PaaS, SaaS). Demonstrating public cloud with AWS, Introduction to EC2 and Storage services of AWS.Private vs. Public Cloud – When to choose.		
Unit-IV	**Overview of Cloud Security**	**5 hours**
Explain the security concerns in Traditional IT, Introduce challenges in Cloud Computing in terms of Application Security, Server Security, and Network Security. Security reference model, Abuse and Nefarious Use of Cloud Computing, Insecure Interfaces and APIs, Malicious Insiders, Shared Technology Issues, Data Loss or Leakage, Account or Service Hijacking, Unknown Risk Profile, Shared security model between vendor and customer in IAAS/PAAS/SAAS, Implementing security in AWS.		
Unit-V	**Migration path to Cloud**	**5 hours**
When and not to migrate to Cloud, Migration paths for cloud, Selection criteria for cloud deployment, Issues/risks in cloud computing, Future technology trends in Cloud Computing. Cloud workload Overview, Workloads most suitable for Cloud, Workloads not suitable for Cloud.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applica the areas covered in the course. The latest research conducted in the areas covered in the Discussion of some latest papers published in IEEE transactions and ACM transactions, Science and SCOPUS indexed journals as well as high impact factor conferences as symposiums. Discussion on some of the latest products available in the market b the areas covered in the course and patents filed in the areas covered in the course.		

SEMESTER – V

Name of TheCourse	Theory of Computation	L	T	P	C
Course Code	BTCS3501	3	0	0	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

This course introduces some fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, formal language, pushdown automaton and Turing machine. This subject not only forms the basic models of computation, it also includes the foundation of many branches of computer science, e.g. compilers, software engineering, concurrent systems, etc. The properties of these models will be studied and various rigorous techniques for analysing and comparing them will be discussed, by using both formalism and examples.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Demonstrate an understanding of abstract models of computing, including deterministic (DFA), non-deterministic (NFA), and Turing (TM) machine models.
CO2	Demonstrate an understanding of regular expressions and grammars, including context-free and context-sensitive gram-mars.
CO3	Understand the relationships between language classes, including regular, context-fee languages
CO4	Understand context-sensitive, recursive, and recursively enumerable languages.
CO5	Able to design Turing Machine
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Theory of Computer Science : Automata, Languages and Computation - K.L.P. Mishra and N.Chandrasekaran,", PHI

2. Introduction to Languages and Theory of Computations - Martin J. C., TMH

Reference Books

1. Introduction to Automata Theory, Languages and Computation - Hopcroft, Ullman, Pearson Education
2. Elements of the Theory of Computation - Papadimitrou, C. and Lewis, C.L, PHI

Course Content

Unit 1	**Introduction**	**8 Hours**
Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transit ion, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem.		
Unit II	**Regular expression (RE)**	**8 Hours**
Regular expression (RE) Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to 39 Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages . Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.		
Unit III	**Context free grammar (CFG) & Context Free Languages CFL)**	**8 Hours**
Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammer, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure proper ties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.		
Unit-IV	**Push Down Automata (PDA)**	**8 Hours**
Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA.		
Unit-V	**Turing machines (TM)**	**8 Hours**
Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.		
Unit-VI	**Advancements and Research**	**6 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of TheCourse	Software Engineering & Testing Methodologies	L	T	P	C
Course Code	BTCS3502	2	0	4	4
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

The scope of the course is concerns with the stages of the software engineering process, including requirements gathering, specification, design, implementation, and testing. Students will teach the various the testing techniques.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Understand the key concerns that are common to all software development processes.
CO2	Able to select appropriate process models, approaches and techniques to manage a given software development process.
CO3	Able to elicit requirements for a software product and translate these into a documented design.
CO4	Recognize the importance of software reliability and how we can design dependable software, and what measures are used.
CO5	Understand the principles and techniques underlying the process of inspecting and testing software and making it free of errors and tolerable.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Software Engineering: A practitioner's Approach, Roger S Pressman, Sixth Edition. McGraw- Hill International Edition, 2005.

2. Software Engineering: Ian Summerville, Seventh Edition, Pearson Education, 2004.

Reference Books

1. Fundamentals of Software Engineering: Rajib Mall, PHI, 2005.

2. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010.

3. Software Engineering: A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008.

Course Content

Unit 1	**Introduction to Software Engineering**	**9 Hours**
Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.		
Unit II	**Software Requirement Specifications (SRS) and Design**	**9 Hours**
Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modelling, Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design Data Flow Diagrams, Entity Relationship Diagrams.		
Unit III	**Software Testing Methods and Selection**	**9 Hours**
Testing Objectives ,Faults, Errors, and Failures, Basics of software testing, Testing objectives, Principles of testing, Requirements, behavior and correctness, Testing and debugging, Test metrics and measurements, Verification, Validation and Testing, Types of testing, Software Quality and Reliability, Software defect tracking.		
Unit-IV	**Software Testing Methods and Selection**	**9 Hours**
Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Integration Testing, , Regression Testing, Testing for Functionality and Testing for Performance, Top-Down and Bottom- Up, Acceptance Testing ,Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Regression testing, Regression test process, Initial Smoke or Sanity test, Tools for regression testing, Ad hoc Testing: Pair testing, Exploratory testing, Iterative testing, Defect seeding.		
Unit-V	**Software Project and Test Management**	**9 Hours**
Software as an Evolutionary Entity, Need for Maintenance, Categories of maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re- Engineering, Reverse Engineering. Software Configuration Management Activities, Constructive Cost Models (COCOMO). Test Planning, Management, Execution and Reporting, Software Test Automation: Testing in Object Oriented Systems.		
Unit-VI	**Advancements and Research**	**5 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of TheCourse	Microprocessor & Interfacing	L	T	P	C
Course Code	BTCS9301	2	0	2	3
Version No	Date of Approval: 8/6/2021				
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

To Familiarize the students with the architecture of 8086. To introduce the concepts of Assembly language programming of 8086. To make the students familiar with ICs required for interfacing 8086 with I/O devices.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	To understand architecture of 8086 processor
CO2	To design Assembly language program for 8086
CO3	To use advanced features of 8086
CO4	To interface 8086 with various devices and memory
CO5	To understand the architecture and principles of USART 8245
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. D.V. Hall, Microprocessors & Interfacing, TMH, 3rd edition
2. Barry B Brey, The intel microprocessor: architecture, programming and interfacing, Prentice hall of India, New Delhi, 2003.ISBN-0138027455, 4th Edition

Reference Books

1. Alan Clements, "Principles of Computer Hardware", Oxford University Press, 3rd Edition, 2003, ISBN-9780198564539

Course Content

Unit 1	**Introduction**	**5 hours**
History of microprocessors, Introduction of 8086, Functional diagram of 8086, Register Organization, Memory Segmentation, Programming Model, Memory addresses. Physical memory organization, signal descriptions of 8086- common function signals. Minimum andMaximum mode signals, Timing diagrams.		
Unit II	**Assembly Language Programming(Part-I)**	**5 hours**
Instruction formats, addressing modes, instruction set, assembler directives, simple programs involving logical, branch and arithmetic expressions.		
Unit III	**Assembly Language Programming(Part- II)**	**5 hours**
Procedures: Near and Far procedures, Macros, String Manipulations, searching and sortingprograms, Advanced features of Assembly language programming		
Unit-IV	**I/O Interface**	**5 hours**
8255 PPI, various modes of operation and interfacing to 8086, Interfacing keyboard, display, stepper motor interfacing, D/A and A/D converter, 8251 USART architecture and interfacing, RS- 232.		
Unit-V	**Interfacing with memory & Interrupts**	**5 hours**
Memory interfacing to 8086, Interrupt structure of 8086, Vector interrupt table, Interrupt service routine. Introduction to DOS and BIOS interrupts, Interfacing 8259 Interrupt Controller, DMA Controller 8257.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applica the areas covered in the course. The latest research conducted in the areas covered in the Discussion of some latest papers published in IEEE transactions and ACM transactions, Science and SCOPUS indexed journals as well as high impact factor conferences as symposiums. Discussion on some of the latest products available in the market b the areas covered in the course and patents filed in the areas covered in the course.		

Name of TheCourse	Quantum Computing	L	T	P	C
Course Code	BTCS9302	2	0	2	3
Version No	Date of Approval: 8/6/2021				
Prerequisite	Linear Algebra, Discrete Mathematics and Computer Science.				
Co requisite					
Anti- requisite					

Course Objectives

The objective of this course is to provide the students an introduction to quantum computation. This course teaches the fundamentals of quantum information processing, including quantum computation, quantum cryptography, and quantum information theory. Quantum computation is an emerging field whose goal is to design effectively atomic sized computers which exploit the parallelism of the quantum mechanical laws of the universe.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Understand the basic principles of quantum computation and quantum mechanics.
CO2	Understand the model of quantum computation to design quantum circuits.
CO3	Analyze the behavior of basic quantum algorithms.
CO4	Be familiar with basic quantum protocols such as teleportation and superdense coding and quantum cryptography.
CO5	Simulate a simple quantum error-correcting code.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Micheal A. Nielsen. &Issac L. Chiang, "Quantum Computation and Quantum Information", Cambridge University Press, Fint South Asian edition, 2002.
2. P. Kaye, R. Laflamme, and M. Mosca, "An introduction to Quantum Computing", Oxford University Press, 1999.

Reference Books

1. Benenti G., Casati G. and Strini G., **Principles of Quantum Computation and Information**, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific. (2004)
2. Pittenger A. O., **An Introduction to Quantum Computing Algorithms (2000).**

Course Content

Unit 1	**Introduction**	**5 hours**
Introduction: Introduction to quantum computing. Quantum bits, Bloch sphere representation of a qubit, multiple qubits. Introduction to quantum states and measurements. Postulates of quantum mechanics. Classical computation versus quantum computation.		
Unit II	**Quantum Model of Computation**	**5 hours**
The model of quantum computation. Quantum circuits: single qubit gates, multiple qubit gates, design of quantum circuits.		
Unit III	**Quantum Algorithms**	**5 hours**
Deutsch's algorithm, Deutsch-Jozsa algorithm and the Bernstein-Vazirani Algorithm .Grover's search algorithm. Simon's algorithm and Shor's algorithm for factoring. Quantum Fourier transform.		
Unit-IV	**Quantum Information Theory and Quantum Cryptography**	**5 hours**
Comparison between classical and quantum information theory. Applications of quantum information. Bell states. super dense coding and Quantum teleportation. Quantum Cryptography, no cloning theorem.		
Unit-V	**Quantum Error Correction**	**5 hours**
Introduction, Shor code, Theory of Quantum Error –Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applica the areas covered in the course. The latest research conducted in the areas covered in the Discussion of some latest papers published in IEEE transactions and ACM transactions, Science and SCOPUS indexed journals as well as high impact factor conferences as symposiums. Discussion on some of the latest products available in the market b the areas covered in the course and patents filed in the areas covered in the course.		

Name of TheCourse	Soft Computing	L	T	P	C
Course Code	BTCS9303	2	0	2	3
Version No	Date of Approval: 8/6/2021				
Prerequisite	Linear Algebra, Discrete Mathematics and Computer Science.				
Co requisite					
Anti- requisite					

Course Objectives

In this course, the concepts of Neural Networks, Genetic Algorithm and Fuzzy systems are discussed.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Understand the principle of Neural Networks.
CO2	Discuss the concepts of Genetic Algorithm.
CO3	Have knowledge on Fuzzy systems.
CO4	Gain understanding of latest trends and research areas in the course

Course Content

Unit 1	Artificial Neural Networks	5 hours
Basic-concepts-single layer perception-Multi layer perception-Supervised and un supervised learning back propagation networks, Application.		
Unit II	**Fuzzy Systems**	**5 hours**
Fuzzy sets and Fuzzy reasoning-Fuzzzy matrices-Fuzzy functions-decomposition-Fuzzy automata and languages- Fuzzy control methods-Fuzzy decision making, Applications.		
Unit III	**Neuro-Fuzzy Modelling**	**5 hours**
Adaptive networks based Fuzzy interfaces-Classification and Rpresentation trees- Datadustemp algorithm –Rule base structure identification-Neuro-Fuzzy controls.		
Unit-IV	**Genetic Algorithm**	**5 hours**
Survival of the fittest-pictures computations-cross overmutation-reproduction-rank method- rank spacemethod, Application.		
Unit-V	**Artificial Intelligence**	**5 hours**
AI Search algorithm-Predicate calculus rules of interface - Semantic networks- frames-objects-Hybrid models, applications.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applica the areas covered in the course. The latest research conducted in the areas covered in the Discussion of some latest papers published in IEEE transactions and ACM transactions, Science and SCOPUS indexed journals as well as high impact factor conferences as symposiums. Discussion on some of the latest products available in the market b the areas covered in the course and patents filed in the areas covered in the course.		

Text Books

1. Jang J.S.R.,Sun C.T and Mizutami E - Neuro Fuzzy and Soft computing Prentice hall New Jersey,1998
2. Timothy J.Ross:Fuzzy Logic Engineering Applications.McGraw Hill,NewYork,1997.
3. Laurene Fauseett:Fundamentals of Neural Networks.prentice Hall India,New Delhi,1994.

Reference Books

1. George J.Klir and Bo Yuan,Fuzzy Sets and Fuzzy Logic,Prentice Hall Inc.,NewJersey,1995
2. Nih.J.Ndssen Artificial Intelligence,Harcourt Asia Ltd.,Singapore,1998.

Name of TheCourse	Machine Learning	L	T	P	C
Course Code	BTCS9304	2	0	2	3
Version No	Date of Approval: 8/6/2021				
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

The objective of this course is to introduce the students about the knowledge of basicconcepts of machine learning systems, types of learning etc.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Understand learning systems.
CO2	Apply learning and classification algorithms
CO3	Use regression techniques.
CO4	Apply unsupervised learning algorithms.
CO5	Understand reinforcement learning techniques.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Tom M Mitchell, Machine Learning, McGraw Hill Education, McGraw HillEducation; First edition, 2017.
2. Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.
3. Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. NewYork, NY: Wiley-Inderscience, 2000. ISBN: 9780471056690.

Reference Books

1. Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY:Oxford University Press, 1995. ISBN: 9780198538646.
2. Introduction to Machine Learning - EthemAlpaydin, MIT Press, Prentice hall ofIndia.
3. Patrick Henry Winston, Artificial Intelligence, 3rd Edition, AW, 1999.
4. Elaine Ric, Kevin Knight and Shiv Shankar B. Nair, Artificial Intelligence, 3rdedition, Tata McGraw Hill, 2009.

Course Content

Unit 1	**Introduction**	**5 hours**
Basic concepts: Definition of learning systems, Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation**.**		
Unit II	**Learning and Classification**	**5 hours**
Types of Learning: Supervised learning and unsupervised learning. Overview of classification: setup, training, test, validation dataset, over fitting. Classification Families: linear discriminative, non-linear discriminative, decision trees, probabilistic (conditional and generative), nearest neighbor.		
Unit III	**Regression**	**5 hours**
Logistic regression, Perceptron, Exponential family, Generative learning algorithms, Gaussian discriminant analysis, Naive Bayes, Support vector machines: Optimal hyper plane, Kernels. Model selection and feature selection. Combining classifiers: Bagging, boosting (The Ada boost algorithm), Evaluating and debugging learning algorithms, Classification errors.		
Unit-IV	**Unsupervised learning**	**5 hours**
Clustering, K-means, EM Algorithm, Mixture of Gaussians, Factor analysis, PCA (Principal components analysis), ICA (Independent components analysis), latent semantic indexing, Spectral clustering, Markov models Hidden Markov models (HMMs).		
Unit-V	**Reinforcement Learning**	**5 hours**
MDPs. Bellman equations, Value iteration and policy iteration, Linear quadratic regulation (LQR). LQG, Q-learning, Value function approximation, Policy search, Reinforce, POMDPs		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applica the areas covered in the course. The latest research conducted in the areas covered in the Discussion of some latest papers published in IEEE transactions and ACM transactions, Science and SCOPUS indexed journals as well as high impact factor conferences as symposiums. Discussion on some of the latest products available in the market b the areas covered in the course and patents filed in the areas covered in the course.		

Name of TheCourse	Modeling and Simulation	L	T	P	C
Course Code	BTCS9305	2	0	2	3
Version No	Date of Approval: 8/6/2021				
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

To learn the basics principles of simulation modeling and understand computer simulation needs. To understand the queuing model for simulation purpose. To study the simulation model for verification and validation model. To know the system output and simulation software for the user requirements. To apply simulation concepts to achieve in business, science, engineering, industry and services goals.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Related to systems development, ori BTCS3501ginating the basic source requirements and goals.
CO2	Understand the techniques of modeling in the context of hierarchy of knowledge about a system.
CO3	Analyze and fit the collected data to different distributions.
CO4	Develop skills to apply simulation software to construct and execute goal-driven system models.
CO5	Interpret the model and apply the results to resolve critical issues in a real world environment
CO6	Knowledge prove through design and implement the simulation model

Text Books

1. Jerry Banks, John S Carson II, Berry L Nelson, David M Nicol, Discrete Event system Simulation, Pearson Education, Asia, 4th Edition, 2007, ISBN: 81-203-2832-9.
2. Geoffrey Gordon, System Simulation, Prentice Hall publication, 2nd Edition, 1978, ISBN: 81-203-0140-4.

Reference Books

1. Averill M Law, W David Kelton, Simulation Modelling & Analysis, McGraw Hill International Editions – Industrial Engineering series, 4th Edition, ISBN: 0-07-100803-9.
2. Narsingh Deo, Systems Simulation with Digital Computer, PHI Publication (EEE), 3rd Edition, 2004, ISBN : 0-87692-028-8.
3. Banks C M , Sokolowski J A, Principles of Modeling and Simulation, Wiley
4. Kelton, W. David, Sadowski, Randall P., and Swets, Nancy B. (2010). Simulation with Arena, Fifth Edition McGraw-Hill Higher Education (ISBN: 978-0-07-337628-8)

Course Content

Unit 1	**Introduction to Discrete Event System Simulation**	**5 hours**
System Simulation, Advantages, Disadvantages, Areas of application, System environment, components of a system, Model of a system, types of models, steps in a simulation study. Simulation Examples: Simulation of Queuing systems, Simulation of Inventory System, Other simulation examples.		
Unit II	**General Principles and Queuing model**	**5 hours**
Concepts in discrete - event simulation, event scheduling/ Time advance algorithm, simulation using event scheduling. queuing Model theory, Simulation of single-server queue, Simulation of two-server queue		
Unit III	**Analysis of Simulation Data**	**5 hours**
Input Modeling - Data collection, Identification and distribution with data, parameter estimation, Goodness of fit tests, Selection of input models without data, Multivariate and time series analysis. Verification and Validation of Model – Model Building, Verification, Calibration and Validation of Models.		
Unit-IV	**Output Analysis for a single model**	**5 hours**
Types of Simulations with Respect to Output Analysis, Stochastic Nature of output data, Measures of Performance and their estimation, Output analysis of terminating simulation, Output analysis of steady state simulations. Simulation Software's: MAT Lab, NS2, Data Processing tools, Etc.,		
Unit-V	**Application Study**	**5 hours**
Simulation of Computer networks, Computer System, Medical science, etc.,		
Unit-VI	**Case study**	**4 hours**
Using sample data do the analysis using different domain and simulate the models for the purpose of optimum control by using software.		

Name of TheCourse	Cloud Application Development	L	T	P	C
Course Code	BTCS9401	2	0	2	3
Version No	Date of Approval: 8/6/2021				
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

The primary objective of this course is to introduce the topic of algorithms as a precise mathematical concept, and study how to design algorithms, establish their correctness, study their efficiency and memory needs. The course consists of a strong mathematical component in addition to the design of various algorithms.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Develop cloud based applications
CO2	To analyze and trouble shoot the problems while deploying application on cloud.
CO3	Use web application based technologies for developing application using cloud
CO4	Use public cloud like IBM Blue mix, Amazon AWS, Google cloud platform or Microsoft Azure for developing an application
CO5	Deploy the application on real cloud
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Chris Hay, Brian Prince, “Azure in Action” Manning Publications [ISBN: 978- 1935182481],2010.
2. Henry Li, “Introducing Windows Azure” Apress; 1 edition [ISBN: 978-1- 4302-2469-3],2009
3. Eugenio Pace, Dominic Betts, Scott Densmore, Ryan Dunn, Masashi Narumoto, MatiasWoloski, Developing Applications for the Cloud on the Microsoft Windows Azure Platform [ISBN: 9780735656062]

Reference Books

1. Eugene Ciurana, Developing with Google App Engine [ISBN: 978-1430218319]
2. Charles Severance, Using Google App Engine [ISBN: 978-0596800697]

Course Content

Unit 1	**Cloud Based Applications**	**5 hours**
Introduction, Contrast traditional software development and development for the cloud. Public v private cloud apps. Understanding Cloud ecosystems – what is SaaS/PaaS, popular APIs, mobile.		
Unit II	**Designing Code For The Cloud**	**5 hours**
Class and Method design to make best use of the Cloud infrastructure; Web Browsers and the Presentation Layer: Understanding Web browsers attributes and differences. Building blocks of the presentation layer: HTML, HTML5, CSS, Silverlight, and Flash.		
Unit III	**Web Development Techniques And Frameworks**	**5 hours**
Building Ajax controls, introduction to JavaScript using Query, working with JSON, XML, REST. Application development Frameworks e.g. Ruby on Rails , .Net, Java API's or JSF; Deployment Environments – Platform As A Service (PAAS) ,Amazon, vmForce, Google App Engine, Azure, Heroku, AppForce.		
Unit-IV	**USE CASE 1**	**5 hours**
Building an Application using the LAMP stack: Setting up a LAMP development environment. Building a simple Web app demonstrating an understanding of the presentation layer and connectivity with persistence.		
Unit-V	**USE CASE 2**	**5 hours**
Developing and Deploying an Application in the Cloud : Building on the experience of the first project students will study the design, development, testing and deployment of an application in the cloud using a development framework and deployment platform.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applications ofthe areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest productsavailable in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

1. List of Experiments
2. Install Oracle Virtual box and create two VMs on your laptop
3. Install Turbo C in guest OS and execute C program.
4. Test ping command to test the communication between the guest OSand Host OS
5. Install Hadoop single node setup.
6. Hopkinson‘s test on DC shunt machines.
7. Develop hadoop application to count no of characters, no of words andeach character frequency.
8. Develop hadoop application to process given data and produce resultssuch as finding the year of maximum usage, year of minimum usage.
9. Develop hadoop application to process given data and produce resultssuch as how many female and male students in both schools the resultsshould be in following format. GP-F #number GP-M #numbers MS-F #number MS-M #number.
10. Establish an AWS account. Use the AWS Management Console tolaunch an EC2 instance and connect to it.
11. Design a protocol and use Simple Queue Service(SQS)to implement the barrier synchronization after the first phase .
12. Use the Zookeeper to implement the coordination model in Problem ;
13. Develop a Hello World application using Google App Engine.
14. Develop a Guestbook Application using Google App Engine
15. Develop a Windows Azure Hello World application using.
16. Create a Mashup using Yahoo! Pipes.

Name of TheCourse	Adhoc & Sensor Networks	L	T	P	C
Course Code	BTCS9402	2	0	2	3
Version No	Date of Approval: 8/6/2021				
Prerequisite	Wireless Sensor Networks				
Co requisite	Interfacing Methods – Protocols				
Anti- requisite	Requisite Organization				

Course Objectives

The student should be made to learn Ad hoc network and Sensor Network fundamentals understand the different routing protocols have an in-depth knowledge on sensor network architecture and design issues understand the transport layer and security issues possible in Ad hoc and Sensor networks have an exposure to mote programming platforms and tools.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Know the basics of Ad hoc and Sensor Networks
CO2	Apply this knowledge to identify the suitable routing algorithm based on the network and userrequirement.
CO3	Apply the knowledge to identify appropriate physical and MAC layer protocols
CO4	Understand the transport layer and security issues possible in Ad hoc and sensor networks.
CO5	Be familiar with the OS used in Sensor Networks and build basic modules.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Ad Hoc and Sensor Networks — Theory and Applications, Car/os Corderlo Dharma R Aggarwal, World Scientific Publications /Cambridge University Press, March 2018
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp 2017.
3. C. Siva Ram Murthy, and B. S. Manoj, "Ad hoc Wireless Networks: Architectures and Protocols ", Prentice Hall Professional Technical Reference, 2016.

Reference Books

1. Adhoc Wireless Networks — Architectures and Protocols, C.Siva Ram Murthy, B.S.Murthy, Pearson Education, 2016.
2. Wireless Sensor Networks — Principles and Practice, Fei Hu, Xiaojun Cao, An Auerbachbook, CRC Press, Taylor & Francis Group, 2017.
3. Wireless Ad hoc Mobile Wireless Networks — Principles, Protocols and Applications, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2018.

Course Content

Unit 1	**Introduction**	**5 hours**
Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio.		
Unit II	**Mac protocols for ad hoc wireless networks**	**5 hours**
Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols- Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11		
Unit III	**Routing protocols and transport layer in ad hoc wireless networks**	**5 hours**
Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand), hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.		
Unit-IV	**Wireless sensor networks (wsns) and mac protocols**	**5 hours**
Single node architecture: hardware and software components of a sensor node - WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.		
Unit-V	**Wsn routing, localization & qos**	**5 hours**
Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applications ofthe areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of The Course	Statistical Analysis using R	L	T	P	C
Course Code	BCSE9403	2	0	2	3
Version No	Date of Approval: 8/6/2021				
Prerequisite					
Co requisite					
Anti-requisite					

Course Objectives

This is an introductory course on how to use the R programming language and software environment for data manipulations and munging, exploratory data analysis and data visualizations.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Understand the basic R programming.
CO2	Understand the basic frequency distribution.
CO3	Students will be familiar to the R ecosystem and learn how to use R for the most common data analysis tasks, including loading, cleaning, transforming, summarizing and visualizing data.
CO4	Interpretation of different error detection and correction.
CO5	Apply an advanced R programming ecosystem.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Ugarte, M.D., Militino, A.F., Arnholt, A.T. (2008). Probability and Statistics with R. CRC Press.
2. Peter Daalgard (2008). Introductory Statistics with R, Springer.
3. Thomas Rahlf (2017). Data Visualization with R: 100 Examples, Springer.

Reference Books

1. The R statistical software program. Available from: https://www.r-project.org/.
2. RStudio an Integrated Development Environment (IDE) for R. Available from: https://www.rstudio.com/

Course Content

Unit 1	**Introduction**	**5 hours**
The basics of R- first steps in writing code; variables; functions; vectors; simple calculations. Working directory, reading and writing, loading and saving data, data frames. Vectors; matrices; indexing, Built-in Commands and Missing Data Handling.		
Unit II	**Frequency Distribution**	**5 hours**
Objectives, Steps and Basic Definitions, Variables and Types of Data, Absolute Frequency, Relative Frequency and Frequency Distribution. Frequency Distribution and Cumulative Distribution Function.		
Unit III	**Visualization**	**5 hours**
Subdivided Bar Plots and Pie Diagrams, 3D Pie Diagram and Histogram-Kernel Density and Stem - Leaf Plots- Arithmetic Mean- Median- Quantiles-Mode, Geometric Mean and Harmonic Mean.		
Unit-IV	**Error detection and correction**	**5 hours**
Absolute Deviation and Absolute Mean Deviation- Range, Interquartile Range and Quartile Deviation-Mean Squared Error, Variance and Standard Deviation-Coefficient of Variation and Boxplots. Raw and Central Moments-Skewness and Kurtosis. Univariate and Bivariate Scatter Plots.		
Unit-V	**R ecosystem**	**5 hours**
Least Squares Method - R Commands and More than One Variables-Extending R with add-on packages and the R-ecosystem. Dynamic and web reporting: Knitr and Shiny. Running R as part of a business pipeline—the R terminal. Simulation I.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applications ofthe areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of The Course	Block Chain Technology	L	T	P	C
Course Code	BCSE9404	2	0	2	3
Version No	Date of Approval: 8/6/2021				
Prerequisite	Programming and Data structures, Advanced Data structures and Algorithm				
Co requisite					
Anti- requisite					

Course Objectives

The primary objective of this course is to cover the technical aspects of crypto currencies, block chain technologies, and distributed consensus. The potential applications for Bit coin-like crypto currencies are enormous. The course will enable an individual to learn, how these systems work and how to engineer secure software that interacts with the Bit coin network and other crypto currencies.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Familiarize the functional/operational aspects of crypto currency ECOSYSTEM.
CO2	Understand emerging abstract models for Blockchain Technology.
CO3	Analyze the concept of bit coin and mathematical background behind it.
CO4	Apply the tools for understanding the background of crypto currencies.
CO5	Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Melanie Swan, “Block Chain: Blueprint for a New Economy”, O’Reilly, 2015.
2. Josh Thompsons, “Block Chain: The Block Chain for Beginners- Guide to Block chain Technology and Leveraging Block Chain Programming”.
3. Daniel Drescher, “Block Chain Basics”, Apress; 1stedition, 2017
4. Anshul Kaushik, “Block Chain and Crypto Currencies”, Khanna Publishing House, Delhi.
5. Imran Bashir, “Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Packt Publishing
6. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Block Chain”, Packt Publishing
7. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O’Dowd, Venkatraman Ramakrishna, “Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer”, Import, 2018

Reference Books

1. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and crypto currency, IEEE Symposium on security and Privacy, 2015
2. J.A.Garay et al, The bitcoin backbone protocol - analysis and applications EUROCRYPT 2015 LNCS VOl 9057, (VOLII), pp 281-310.
3. R.Pass et al, Analysis of Block chain protocol in Asynchronous networks , EUROCRYPT 2017

Course Content

Unit 1	**Introduction**	**5 hours**
The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS).		
Unit II	**Cryptographic fundamentals**	**5 hours**
cryptographic basics for cryptocurrency - a short overview of Hashing, signature schemes, encryption schemes and elliptic curve cryptography.		
Unit III	**Bitcoin**	**5 hours**
Bitcoin - Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bit coin.		
Unit-IV	**Ethereum**	**5 hours**
Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts.		
Unit-V	**Block chain-Recent trend**	**5 hours**
Zero Knowledge proofs and protocols in Block chain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves - Zcash.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applications ofthe areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of The Course	Software Defined Network	L	T	P	C
Course Code	BTCS9405	2	0	2	3
Version No	Date of Approval: 8/6/2021				
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

This course introduces software defined networking, an emerging paradigm in computer networking that allows a logically centralized software program to control the behavior of an entire network.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Differentiate between traditional networks and software defined networks
CO2	Understand advanced and emerging networking technologies
CO3	Obtain skills to do advanced networking research and programming.
CO4	Learn how to use software programs to perform varying and complex networking tasks
CO5	Expand upon the knowledge learned and apply it to solve real world problems.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Software Defined Networks: A Comprehensive Approach by Paul Goransson and
2. Chuck Black, Morgan Kaufmann Publications, 2014.
3. SDN - Software Defined Networks by Thomas D. Nadeau & Ken Gray, O'Reilly,
4. 2013.
5. Software Defined Networking with OpenFlow By SiamakAzodolmolky, Packt Publishing, 2013.

Reference Books

1. Feamster, Nick, Jennifer Rexford, and Ellen Zegura. "The road to SDN: an intellectual history of programmable networks." ACM SIGCOMM Computer Communication Review 44.2 (2014): 87-98.
2. Kreutz, Diego, et al. "Software-defined networking: A comprehensive survey." Proceedings of the IEEE 103.1 (2015): 14-76.
3. Nunes, Bruno AA, et al. "A survey of software-defined networking: Past, present, and future of programmable networks." Communications Surveys & Tutorials, IEEE 16.3 (2014): 1617- 1634
4. Lantz, Bob, Brandon Heller, and Nick McKeown. "A network in a laptop: rapid prototyping for software-defined networks." Proceedings of the 9th ACM SIGCOMM Workshop on Hot Topics in Networks. ACM, 2010
5. Monsanto, Christopher, et al. "Composing software defined networks." Presented as part of the 10th USENIX Symposium on Networked Systems Design and Implementation (NSDI 13). 2013.

Course Content

Unit 1	**Introduction to SDN**	**5 hours**
SDN Origins and Evolution – Introduction – Why SDN? - Centralized and DistributedControl and Data Planes - The Genesis of SDN		
Unit II	**SDN Abstractions**	**5 hours**
How SDN Works - The Open flow Protocol - SDN Controllers: Introduction - General Concepts - VMware - Nicira - VMware/Nicira - OpenFlow-Related - Mininet - NOX/POX - Trema - Ryu - Big Switch Networks/Floodlight - Layer 3 Centric - Plexxi - Cisco OnePK.		
Unit III	**Programming SDN'S**	**5 hours**
Network Programmability - Network Function Virtualization - NetApp Development,Network Slicing		
Unit-IV	**SDN Applications and Use Cases**	**5 hours**
SDN in the Data Center - SDN in Other Environments - SDN Applications - SDN UseCases - The Open Network Operating System 3		
Unit-V	**SDN'S Future and Perspectives**	**5 hours**
SDN Open Source - SDN Futures - Final Thoughts and Conclusions.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applications ofthe areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

SEMESTER-VI

Name of The Course	Web Technology	L	T	P	C
Course Code	BTCS3601	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

1. Acquire knowledge and skills for creation of web site considering both client and server side.
2. Gain ability to develop responsive web applications.
3. Acquire the knowledge to develop dynamic web pages.
4. Obtain the ability to develop server side application.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Understand the web development strategies and identify the problem
CO2	Develop the SRS document of the project
CO3	Design a visual representation of web application
CO4	Implement and establish database connectivity with front end.
CO5	Validate the web page using testing methodology
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Xavier, C, " Web Technology and Design" , New Age International Publishers.
2. Uttam/Roy," WEB Technology", Oxford Publication.

Reference Books

1. IvanBayross -Web Enabled Commercial Application Development Using HTML, DHTML, Java Script, Perl, CGI-2000.
2. Raj Kamal, "Internet and Web Technologies", McGraw Hill Eduction.
3. Jackson, "Web Technologies" Pearson Education
4. Patel and Barik, "Introduction to Web Technology & Internet", Acme Learning.
5. Steve Suehring, Tim Converse, Joyce Park, "PHP 6 and MySQL 6" WILLEY.

Course Content

Unit 1	**Introduction to web and HTML**	**8 Hours**
Introduction to web, web development strategies, web team. HTML introduction: basic tag, elements, attributes, formatting, comments, marquee, list, table, images, frames, forms; Links : text, image and email. XHTML: Syntax and Semantics.		
Unit II	**CSS and XML**	**8 Hours**
CSS : color, background, fonts, images, link, table, margins, lists, border, paddings, scroll, class. CSS3 : border Image, round corner, text shadow, layers. XML: DTD, XML schemes, presenting and using XML.		
Unit III	**JAVA SCRIPT**	**8 Hours**
Java script: Introduction, documents, forms, statements, functions, objects; Event and event handling; Error handling; validation.		
Unit-IV	**JSP**	**8 Hours**
Java server pages (JSP), JSP application design, declaring variables and methods, debugging, sharing data between JSP pages, JSP objects, Session, development of java beans in Jsp, data base action with JSP.		
Unit-V	**PHP**	**8 Hours**
PHP (Hypertext Pre-processor): Introduction, syntax, variables, strings, operators, if- else, loop, switch, array, function, form ,mail, file upload, session, error, exception, filter, PHP-ODBC.		
Unit-VI	**Advancements and Research**	**6 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of TheCourse	Compiler Design	L	T	P	C
Course Code	BTCS3602	3	0	0	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

1. Provide an understanding of the fundamental principles in compiler design
2. Provide the skills needed for building compilers for various situations that one may encounter in a career in Computer Science.
3. Learn the process of translating a modern high-level language to executable code. Grasp of compiler construction.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Use language specifications behind the design of compiler.
CO2	Construct LL, SLR, CLR and LALR parsing table.
CO3	Evaluate different intermediate codes.
CO4	Implement different data structure and allocation schemes for symbol table.
CO5	Develope optimized codes.
CO6	Apply modern tools and technologies for designing new compiler.

Text Books

1. ALFRED V AHO, JEFFREY D ULLMAN “Principles of Compiler Design”.
2. V Raghvan, “ Principles of Compiler Design”, TMH
3. Kenneth Louden,” Compiler Construction”, Cengage Learning

Reference Books

1. Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools”, Pearson Education 2
2. Charles Fischer and Ricard LeBlanc,” Crafting a Compiler with C”, Pearson Education

Course Content

Unit 1	**Introduction**	**8 Hours**
Introduction to Compiler, Phases and passes, Bootstrapping, Finite state machines and regular expressions and their applications to lexical analysis, Optimization of DFA-Based Pattern Matchers, implementation of lexical analyzers, lexical-analyzer generator, LEX-compiler, Formal grammars and their application to syntax analysis, BNF notation, ambiguity, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG.		
Unit II	**Basic Parsing Techniques**	**8 Hours**
Parsers, Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR (0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, and implementation of LR parsing tables.		
Unit III	**Syntax Directed Translation**	**8 Hours**
Syntax-directed Translation schemes, Implementation of Syntax directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top down parser. More about translation: Array references in arithmetic expressions, procedures call, declaration sand case statements.		
Unit-IV	**Symbol Table**	**8 Hours**
Data structure for symbols tables, representing scope information. Run-Time Administration: Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.		
Unit-V	**Code Generation**	**8 Hours**
Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis.		
Unit-VI	**Advancements and Research**	**6 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of The Course	Digital Signal Processing	L	T	P	C
Course Code	BTCS9501	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

The primary objective of this course is to introduce the topic of Digital Signal Processing. Introduction to digital signal processing and application, discrete time signals and structure of discrete time system. Analysis of LTI systems, Filter designing techniques, DFT and FFT, Architecture of DSP Processors and Multi-rate Signal Processing and applications.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Formulate engineering problems in the field of digital signal processing
CO2	Analyze digital and analog signals and systems
CO3	Analyze discrete time signals in frequency domain and Design digital filters
CO4	Identify the need of adaptive filters in communication applications.
CO5	Apply Architectural features of Digital Signal Processor in various areas.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. "Discrete Time Signal Processing":Oppeheim, Schafer, Buck Pearson education publication, 2nd Edition, 2003.
2. Digital Signal Processing fundamentals and Applications, Li Tan , Jean Jiang, Academic Press,2nd edition,2013
3. "Digital Signal Processing: Principles, Algorithm & Application", 4th edition, Proakis, Manolakis, Pearson.

Reference Books

1. Digital Signal Processing – A computer based Approach, S.K.Mitra, Tata McGraw Hill,3rd edition,2006
2. Digital Signal Processors, Architecture, programming and applications by B. Venkatramani, M Bhaskar, Mc-Graw Hill
3. Digital Signal processing-A Practical Approach,second edition, Emmanuel I. feacher, and BarrieW..Jervis, Pearson Education

Course Content

Unit 1	Introduction	5 hours
Overview: 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.		
Unit II	**Discrete-Time Signals and Analysis of Linear Time Invariant System**	**5 hours**
Discrete-Time Signals and Systems (Frequency Domain analysis): Z-transform & Inverse z- transform, Linear convolution and its properties, Linear Constant Coefficient Difference equations, Frequency domain representation of Discrete-Time Signals & Systems, Properties of discrete time Fourier Transform, and correlation of signals, Fourier Transform Theorems. **Analysis of Linear Time Invariant System:** Analysis of LTI systems in time domain System functions for systems with linear constant-coefficient Difference equations.		
Unit III	**Structures for Discrete Time Systems and Filter Design Techniques**	**5 hours**
Block Diagram and signal flow diagram representations of Linear Constant-Coefficient Difference equations, Effects of Co-efficient quantization. Design of Discrete-Time IIR filters from Continuous-Time filters Approximation by derivatives, Impulse invariance and Bilinear Transformation methods; Design of FIR filters by windowing techniques.`		
Unit-IV	**Discrete-Fourier Transform & Fast Fourier Transform**	**5 hours**
Representation of Periodic sequences: The discrete Fourier Series and its Properties Fourier Transform of Periodic Signals, Sampling the Fourier Transform, The Discrete-Fourier Transform, Properties of DFT, Linear Convolution using DFT. FFT-Efficient Computation of DFT, Goertzel Algorithm, radix2 Decimation-in-Time and Decimationin-Frequency FFT Algorithms.		
Unit-V	**Advance DSP Techniques**	**5 hours**
MultiMate Signal Processing: Decimation, Interpolation, Sampling rate conversion by rational factor **Adaptive filters:** Introduction, Basic principles of Forward Linear Predictive filter and applications such as system identification, echo cancellation, equalization of channels, and beam forming using block diagram representation. Architecture of DSP Processors & applications.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applications ofthe areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACMtransactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest productsavailable in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of The Course	Object Oriented Analysis & Design	L	T	P	C
Course Code	BTCS9502	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

To understand the fundamentals of object modeling to understand and differentiate Unified Process from other approaches. To design with static UML diagrams. To design with the UML dynamic and implementation diagrams. To improve the software design with design patterns. To test the software against its requirements specification

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	To be able to use an object-oriented method for analysis and design
CO2	To be able to analyse information systems in real-world settings and to conduct methods such as interviews and observations
CO3	know techniques aimed to achieve the objective and expected results of a systems development process
CO4	know different types of prototyping
CO5	know how to use UML for notation
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Grady Booch, James Rumbaugh, Ivar Jacobson : The Unified Modeling Language User Guide, Pearson Education.
2. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit, WILEY-Dreamtech India Pvt. Ltd.
3. Mark Priestley: Practical Object-Oriented Design with UML,TATA McGrawHill.

Reference Books

1. Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.
2. Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dreamtech India Pvt. Ltd.
3. Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

Course Content

Unit 1	UML DIAGRAMS	5 hours
Introduction to OOAD – Unified Process - UML diagrams – Use Case – Class Diagrams– Interaction Diagrams – State Diagrams – Activity Diagrams – Package, component and Deployment Diagrams.		
Unit II	**DESIGN PATTERNS**	**5 hours**
GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller - Design Patterns – creational - factory method - structural – Bridge – Adapter - behavioral – Strategy – observer.		
Unit III	**CASE STUDY**	**5 hours**
Case study – the Next Gen POS system, Inception -Use case Modeling - Relating Use cases – include, extend and generalization - Elaboration - Domain Models - Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies - Aggregation and Composition.		
Unit-IV	**APPLYING DESIGN PATTERNS**	**5 hours**
System sequence diagrams - Relationship between sequence diagrams and use cases Logical architecture and UML package diagram – Logical architecture refinement - UML class diagrams - UML interaction diagrams - Applying GoF design patterns		
Unit-V	**CODING AND TESTING**	**5 hours**
Mapping design to code – Testing: Issues in OO Testing – Class Testing – OO Integration Testing –GUI Testing – OO System Testing.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applications ofthe areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest productsavailable in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of The Course	Software Project Management	L	T	P	C
Course Code	BTCS9503	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

Define and highlight importance of software project management. Describe the software project management activities. Train software project managers and other individuals involved in software project. Planning and tracking and oversight in the implementation of the software project management process

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project.
CO2	Compare and differentiate organisation structures and project structures.
CO3	Implement a project to manage project schedule, expenses and resources with the Application of suitable project management tools.
CO4	Gain understanding of latest trends and research areas in the course

Text Books

1. Clifford F. Gray, Erik W. Larson, "Project Management: The Managerial Process with MS", Mc Graw Hill.

Reference Books

1. M. Cotterell, Software Project Management, Tata McGraw-Hill Publication.
2. Royce, Software Project Management, Pearson Education.
3. Kieron Conway, Software Project Management, Dreamtech Press.
4. S. A. Kelkar, Software Project Management, PHI Publication.

Course Content

Unit 1	**UML DIAGRAMS**	**5 hours**
Introduction to OOAD – Unified Process - UML diagrams – Use Case – Class Diagrams– Interaction Diagrams – State Diagrams – Activity Diagrams – Package, component and Deployment Diagrams.		
Unit II	**DESIGN PATTERNS**	**5 hours**
GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller - Design Patterns – creational - factory method - structural – Bridge – Adapter - behavioral – Strategy – observer.		
Unit III	**CASE STUDY**	**5 hours**
Case study – the Next Gen POS system, Inception -Use case Modeling - Relating Use cases – include, extend and generalization - Elaboration - Domain Models - Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies - Aggregation and Composition.		
Unit-IV	**APPLYING DESIGN PATTERNS**	**5 hours**
System sequence diagrams - Relationship between sequence diagrams and use cases Logical architecture and UML package diagram – Logical architecture refinement - UML class diagrams - UML interaction diagrams - Applying GoF design patterns		
Unit-V	**CODING AND TESTING**	**5 hours**
Mapping design to code – Testing: Issues in OO Testing – Class Testing – OO Integration Testing –GUI Testing – OO System Testing.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applications ofthe areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest productsavailable in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of The Course	Network Operating System	L	T	P	C
Course Code	BTCS9504	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

To understand the advanced topics in the computer networks, with more emphasis on the Internet architecture. To analyse the performance of different network functionalities.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	To understand basic operating systems features, setup and management.
CO2	To design network configuration by installing tools and packages.
CO3	To design network configuration by installing tools and packages.
CO4	Analyze various file systems and understand file server concepts.
CO5	Apply file server concepts in configuring server and its services.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Cisco™ Networking Academy Program: HP IT Essentials II: Network Operating Systems, Second Edition, 2004.
2. Cisco™ Networking Academy Program: HP IT Essentials II: Network Operating Systems Journal and Workbook, Second Edition, 2004.
3. Bharat Bhusan , Understanding Linux , Khanna Publishing , Nai Sarak , New Delhi.

Reference Books

1. Wale Soyinka, Linux Administration: A Beginner's Guide, McGraw-Hill Osborne Media.
2. http://news.samba.org/users/nine_user/
3. http://www.linuxstreet.net/articles/Samba/

Course Content

Unit 1	**Introduction**	**5 hours**
Introduction to Operating Systems (Microsoft Windows, UNIX and Linux on the Desktop. Network Operating Systems Overview). Network Setup and Management including Hardware/Software configuration of Gateway, Routers, and Switches.		
Unit II	**Network Operating System**	**5 hours**
Red Hat Linux, Installing Red Hat Linux. Preparing for installation. Booting from CD. Graphical Installation Launch. Setting disk partition levels. Setting Boot Loader, First Boot. Creation of User Account.		
Unit III	**Connecting to Internet**	**5 hours**
Network Configuration Tool. Connecting to LAN. DNS. Installing Software: RPM. Meaning, RPM Management Tool. Adding & Removing Packages. Querying RPM Packages.		
Unit-IV	**File System**	**5 hours**
What is File System. Anatomy of File System. File Permissions and Directories permissions. File Search Utilities. User Accounts: Super User Vs. Normal User. RedHat User Manager. Creating Groups. Server Role: Linux as Web Server. Apache Web Server. Installing Apache. Starting Apache. Configuring Web server. Setting up First Web Page.		
Unit-V	**FTP Server**	**5 hours**
Meaning, FTP Protocol. Installing vsftpd FTP Server. Starting FTP server. Testing FTP server. Using FTP server. Using FTP Client to Test Anonymous Read Access. File Server: Overview of Samba Server. Installing SAMBA server. Starting and Stopping the SAMBA server. SAMBA configuration with SWAT. Starting SWAT Service. Adding SAMBA User. Creating and Configuring SAMBA Share.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web ofScience and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based onthe areas covered in the course and patents filed in the areas covered in the course.		

Name of The Course	Robotics Process automation	L	T	P	C
Course Code	BTCS9505	2	0	2	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

Familiarize the students with the basic of Robotics & Automation. Design how to automate the process using RPA.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Understand Basic Programming concepts and the underlying logic/structure.
CO2	Learn how to install UiPath community edition and Analyze the different types of variables.
CO3	Control Flow and various activities used for it.
CO4	Develop understanding and application of Data Manipulation & recording techniques.
CO5	Understand Selectors, Image, Text and Data Tables Automation and how they are used in UiPath Studio.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Cisco™ Networking Academy Program: HP IT Essentials II: Network Operating Systems, Second Edition, 2004.
2. Cisco™ Networking Academy Program: HP IT Essentials II: Network Operating Systems Journal and Workbook, Second Edition, 2004.
3. Bharat Bhusan , Understanding Linux , Khanna Publishing , Nai Sarak , New Delhi.

Reference Books

1. Wale Soyinka, Linux Administration: A Beginner's Guide, McGraw-Hill Osborne Media.
2. http://news.samba.org/users/nine_user/
3. http://www.linuxstreet.net/articles/Samba/

Course Content

Unit 1
Understanding the application, Basic Web Concepts, Data Structures,Control structures and functions, Variables & Arguments. RPA Basics: History of Automation, RPA, Robot VS Automation, Processes & Flowcharts, What process canbe automated, Types of Bots, Robotic control flow architecture.
Unit II
Installing UiPath Studio community edition, The user Interface, Keyboard Shortcuts, Automation Debugging, Variables: Managing Variables, Naming Best Practice, The Variables Panel, Data Types, Managing Arguments, The Arguments Panel, Using Arguments, About Imported Namespaces. Activities: Message Box, Input Diaog, Type into, Click, Send HotKey, Write line, Read text File, Write Text File. Types of Button.
Unit III
Introduction, If Else Statements, Loops, Advanced Control Flow, Sequences, Flowcharts,Control Flow Activities, The Assign Activity, The Delay Activity, The Do While Activity, The If Activity,The Switch Activity, The While Activity, The For Each Activity, The Break Activity.
Unit-IV
Data Manipulation Introduction, Scalar variables, collections and Tables, Text Manipulation, Data Manipulation, Gathering and Assembling DataRecording Introduction, Basic and Desktop Recording, Web Recording, Input/Output Methods, Screen Scraping, Data Scraping, Scraping advanced techniques.
Unit-V
Selectors, Image, Text & Advanced Citrix Automation, Excel Data Tables & PDF, Email Automation, Exceptional Handling, Introduction to Orchestrator.
Unit-VI
The advances and the latest trends in the course as well as the latest applications ofthe areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.

Name of The Course	Entrepreneurship	L	T	P	C
Course Code	BTCS8101	3	0	0	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

1. To provide an opportunity of using their knowledge and skills in recognizing situations which offer business opportunities.
2. To understand the support system, incentives, policies and programmes available for entrepreneurial development in India.
3. Enable students to obtain a critical and practical understanding of the various aspects of entrepreneurship.
4. To motivate them to look at entrepreneurship as a viable, lucrative and preferred career.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Discuss the role of entrepreneurship and the myth, successful traits associated with the different entrepreneurs. (K2)
CO2	Illustrate the different opportunity selection and idea generation techniques which helps to understand the market feasibility.(K3)
CO3	Explain the various business models and to help the students to develop business plan for the initiation of an entrepreneurship firm.(K2)
CO4	Differentiate between the types of ownership structures, sources of finance and the issues relating to launch of a new venture.(K3)
CO5	Explain the various schemes, initiative and agencies which are provided by the Government for the assistance of entrepreneurs of India .(K2)
CO6	Evaluate opportunities to design and develop a start up by looking into the problems and reasons of failure.(K5)

Text Books

1. Entrepreneurship: Successfully Launching New Ventures- Barringer (2008), Pearson Education Publishing.
2. Entrepreneurship: Hisrich & Peters (2010), TMH Publication.

Reference Books

1. Entrepreneurship in the New Millennium- Kuratko, Donald F. & Hodgetts (2009), Cengage Learning.
2. Fundamentals of Entrepreneurship and Small Business Management- Desai Vasant, (2009), Himalaya Publishing House.

Course Content

Unit 1	The Entrepreneurial Perspective	10 Hours
Meaning-importance and relevance of entrepreneurship- role of entrepreneurship in economic development- impact of entrepreneurial firm's on society-Nature and characteristics of entrepreneurship and entrepreneur- why become an entrepreneur? Characteristics of successful entrepreneurs- myths about entrepreneurs/ entrepreneurship-Understanding details of entrepreneurship process- approaches to entrepreneurship-Macro vs. micro view of entrepreneurial school of thoughts-Developing entrepreneurial mindset and motivation- models of entrepreneurial motivation-Scope of entrepreneurship and entrepreneurial career. Case Study: Partnering for success: Working together: how Biotech firms and large drug companies bring pharmaceutical products to market. Case Study: Chem Connect: creating a new kind of marketplace through digital technologies. Stories of successful entrepreneurs.		
Unit II	**Understanding Opportunity and Market feasibility.**	**10 Hours**
Idea versus opportunity- sources of ideas and the idea generation process-Understanding environmental trends suggesting business or product opportunity gaps- Problem-Idea generation techniques-Encouraging and protecting new ideas- Idea Generation Exercise -Opportunity recognition process and selection of opportunities-Sources of opportunities-Details of feasibility analysis: product feasibility-market feasibility-Organizational and financial feasibility analysis- role of feasibility analysis in developing successful business ideas-Understanding industry analysis and its relevance in a new firm-using five forces model to pose questions to determine potential success of a new venture.		
Unit III	**Understanding Business Plan & Business Model**	**6 Hours**
Growing with opportunities: concept of business model and its importance- components of an effective business model Case Study: Netflix: Great idea- but will the business model work? The business plan and its components- writing an effective business plan.		
Unit-IV	**Starting and Managing Growth of an Entrepreneurial Firm**	**12 Hours**
The new venture team- qualities of founder/ founders- recruiting and selecting employees-Different types of business ownership structures- choosing a right form of business organization- Why most new ventures need funding- sources of personal financing-Preparation for debt or equity financing-sources of equity and debt financing-Key marketing issues for new ventures: marketing mix for a new venture-segmentation- targeting and positioning for a new venture firm Case Study: Nokia: how one company built its brand Dealing with the legal issues of a new venture creation- IPR and related issues-Preparing for the challenges for growth- the entrepreneurial culture vs. administrative culture to manage growth-Basic model of firm growth- attributes of a successful growing firm- a venture's typical life cycle-Understanding Internal vs. External growth strategies-Internal growth strategies: new product development- international expansion Case Study: Panera Bread: Occupying a favorable position in a highly competitive industry-External growth strategies: mergers and acquisitions, licensing-Strategic alliances & Joint Ventures and Franchising.		
Unit-V	**Entrepreneurial Support System and Regulatory Framework/Mechanisms for Entrepreneurs**	**7 Hours**
Government Policies & Programmes for entrepreneurs-Incentives, Schemes and other support system available to entrepreneurs in India-Role of various national, state, and district level agencies/organizations assisting entrepreneurs in India.		
Unit-VI	**Advancements and Research**	**6 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of The Course	Project Management	L	T	P	C
Course Code	BTCS8102	3	0	0	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

The objective of this course is to

1. Define and highlight importance of project management
2. Describe the project management activities
3. Train software project managers and other individuals involved in project
4. Planning and tracking and oversight in the implementation of the project management process.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	On completion of this course, the students will be able to
CO2	Describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
CO3	Compare and differentiate organization structures and project structures
CO4	Implement a project to manage project schedule, expenses.
CO5	Implement resources with the application of suitable project management tools.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. "Project Management: The Managerial Process with MS" - Clifford F. Gray and Erik W. Larson, Mc Graw Hill

Reference Books

1. Software Project Management - M. Cotterell, Tata McGraw-Hill Publication.
2. Software Project Management - Royce, Pearson Education
3. Software Project Management - Kieron Conway, Dreamtech Press
4. Software Project Management - S. A. Kelkar, PHI Publication

Course Content

Unit 1	**Introduction and Software Project Planning**	**8 Hours**
Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope document, Project Management Cycle, SPM Objectives, Management Spectrum, SPM Framework, Software Project Planning, Planning Objectives, Project Plan, Types of project plan, Structure of a Software Project Management Plan, Software project estimation, Estimation methods, Estimation models, Decision process.		
Unit II	**Project Organization and Scheduling**	**8 Hours**
Project Elements, Work Breakdown Structure (WBS), Types of WBS, Functions, Activities and Tasks, Project Life Cycle and Product Life Cycle, Ways to Organize Personnel, Project schedule, Scheduling Objectives, Building the project schedule, Scheduling terminology and techniques, Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts.		
Unit III	**Project Monitoring and Control**	**8 Hours**
Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned Value Indicators: 23 Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews, Types of Review: Inspections, Deskchecks, Walk through, Code Reviews, Pair Programming.		
Unit-IV	**Software Quality Assurance and Testing**	**8 Hours**
Testing Objectives, Testing Principles, Test Plans, Test Cases, Types of Testing, Levels of Testing, Test Strategies, Program Correctness, Program Verification & validation, Testing Automation & Testing Tools, Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, The SEI Capability Maturity Model CMM), SQA Activities, Formal SQA Approaches: Proof of correctness, Statistical quality assurance, Clean room process		
Unit-V	**Project Management and Project Management Tools**	**8 Hours**
Software Configuration Management: Software Configuration Items and tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control, Risk Management: Risks and risk types, Risk Breakdown Structure (RBS), Risk Management Process: Risk identification, Risk analysis, Risk planning, Risk monitoring, Cost Benefit Analysis, Software Project Management Tools: CASE Tools, Planning and Scheduling Tools, MS-Project.		
Unit-VI	**Advancements and Research**	**6 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of The Course	Managerial Economics	L	T	P	C
Course Code	BTCS8103	3	0	0	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

The course describes the basics of demand and demand forecasting. It explains cost functions, cost control, cost reduction and pricing techniques.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Apply the concept of demand.
CO2	Estimate production and cost function.
CO3	Formulate appropriate pricing strategies.
CO4	Describe the Migration path to Cloud
CO5	Gain understanding of latest trends and research areas in the course

Text Books

1. P.L. Mehta – Managerial Economics Analysis, Problems and cases, Sultan Chand & Co. Ltd., 2001

Reference Books

1. Peterson and Lewis: Managerial Economics, 4th Ed., Prentice Hall , 2004
2. Dholakia and Oza: Microeconomics for Management Students, 2nd Edition, Oxford University Press
3. Gregory Mankiw: Principles of Microeconomics, Havcourt Asia Publishers, 2001
4. Mote and paul – Managerial Economics, Tata McGraw Hill, 2001.

Course Content

Unit 1	**Introduction**	**8 Hours**
Introduction: The Scope and Method of Managerial economics – Fundamental Economics concepts – Managerial Economics with other subjects - Objectives of the Firm		
Unit II	**Demand and Supply Analysis**	**8 Hours**
Meaning, Types and Determinants – Demand estimation- Demand elasticities for decision making – Business and Economic forecasting: Qualitative and Quantitative methods – Supply analysis: Meaning, elasticities and determinants – Market equilibrium and price determination		
Unit III	**Production Economics**	**8 Hours**
Production and Production function – Types – Estimation – Returns to Scale – Economies and Diseconomies of Scale and Economies of Scope. Factor Inputs - Input-Output Analysis		
Unit-IV	**Market Structure**	**8 Hours**
Perfect Competition – Imperfect Competition: Monopoly – Monopolistic – Oligopolistic Strategy, Cartels, Cournot, Kinked Demand and Price Leadership. Oligopolistic Rivalry & Theory of Games – Measurement of economic concentration – Policy against monopoly and restrictive trade practices - Competition Law – Pricing Practices: Objectives – Determinants – Pricing Methods – Government Policies and Pricing.		
Unit-V	**Introduction to Macroeconomics**	**8 Hours**
Circular Flow of Income and Expenditures – Components of National Income and its significance - Measuring Gross Domestic Product (GDP) – Inflation and Business Cycles – Government Fiscal and Monetary Policy - Balance of payments – Foreign exchange markets		
Unit-VI	**Advancements and Research**	**6 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of The Course	Equity & Portfolio Management	L	T	P	C
Course Code	BTCS8104	3	0	0	3
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

To find employment in this industry, it is necessary to possess the skills that are required, skills above and beyond those taught in typical Investments and Corporate Finance courses. The goal of this course is to provide an introduction to the tools needed to enter the field of professional money management.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Explain the concepts of Cloud Computing , benefits and challenges of Cloud Computing
CO2	Explain about Virtualization and its types.
CO3	Explain the various deployment and service models of Cloud Computing
CO4	Describe the Security concerns of Cloud Computing
CO5	Describe the Migration path to Cloud
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Donald E.Fischer & Ronald J.Jordan, Security Analysis & Portfolio Management, PHI Learning., New Delhi, 8th edition, 2011.
2. Prasannachandra, Investment analysis and Portfolio Management, Tata McGraw Hill, 2011.

Reference Books

1. Reilly & Brown, Investment Analysis and Portfolio Management, Cengage Learning, 9th edition, 2011.
2. S. Kevin , Securities Analysis and Portfolio Management , PHI Learning , 2012.
3. Bodi, Kane, Markus, Mohanty, Investments, 8th edition, Tata McGraw Hill, 2011.
4. V.A.Avadhan, Securities Analysis and Portfolio Management, Himalaya Publishing House, 2011.
5. V.K.Bhalla, Investment Management, S.Chand & Company Ltd., 2012.

Course Content

Unit 1	**INVESTMENT SETTING**	**8 Hours**
Financial and economic meaning of Investment Types of Investment, Investment alternatives concepts.		
Unit II	**SECURITIES MARKETS**	**8 Hours**
Characteristics and objectives of Investment Choice and Evaluation Risk and return Financial Market - Segments Types - - Participants in financial Market Regulatory Environment, Primary Market Methods of floating new issues, Book building Role of primary market Regulation of primary market, Stock exchanges in India BSE, OTCEI , NSE, ISE, and Regulations of stock exchanges Trading system in stock exchanges SEBI.		
Unit III	**FUNDAMENTAL ANALYSIS**	**8 Hours**
Economic Analysis Economic forecasting and stock Investment Decisions Forecasting techniques. Industry Analysis : Industry classification, Industry life cycle Company Analysis Graham and Dodds Measuring Earnings Forecasting Earnings investor ratios.		
Unit-IV	**TECHNICAL ANALYSIS**	**8 Hours**
Fundamental Analysis Vs Technical Analysis Trend reversals Patterns - Moving Average Indicators Efficient Market theory.		
Unit-V	**PORTFOLIO MANAGEMENT**	**8 Hours**
Portfolio analysis Portfolio Selection Capital Asset Pricing model Portfolio Evaluation Mutual Funds.		
Unit-VI	**Advancements and Research**	**6 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

SEMESTER-VII

Name of TheCourse	Enterprise Resource Planning	L	T	P	C
Course Code	BTCS9603	2	0	2	3
Version No	Date of Approval: 8/6/2021				
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

Describe the concept of ERP and the ERP model; define key terms; explain the transition from MRP to ERP; identify the levels of ERP maturity. Explain how ERP is used to integrate business processes; define and analyze a process; create a process map and improve and/or simplify the process; apply the result to an ERP implementation. Describe the elements of a value chain, and explain how core processes relate; identify how the organizational infrastructure supports core business processes; explain the effect of a new product launch on the three core business processes.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Develop model for ERP for large project
CO2	Develop model for E-commerce architecture for any application
CO3	Describe the advantages, strategic value, and organizational impact of utilizing an ERP system for the management of information across the functional areas of a business: sales and marketing, accounting and finance, human resource management, and supply chain.
CO4	Demonstrate a working knowledge of how data and transactions are integrated in an ERP system to manage the sales order process, production process, and procurement process.
CO5	Evaluate organizational opportunities and challenges in the design system within a business scenario.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Vinod Kumar Garg and Venkitakrishnan N K, “Enterprise Resource Planning Concepts and Practice”, PHI.
2. Joseph A Brady, Ellen F Monk, Bret Wagner, “Concepts in Enterprise Resource Planning”, Thompson Course Technology.

Reference Books

1. Alexis Leon, “ERP Demystified”, Tata McGraw Hill
2. Rahul V. Altekar “Enterprise Resource Planning”, Tata McGraw Hill.
3. Vinod Kumar Garg and Venkitakrishnan N K, “Enterprise Resource Planning – A Concepts and Practice”, PHI.

Course Content

Unit 1	**ERP Introduction**	**5 hours**
ERP Introduction, Benefits, Origin, Evolution and Structure: Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP.		
Unit II	**Business Process Reengineering**	**5 hours**
Business Process Reengineering, Data Mining, Online Analytic Processing (OLAP), Product Life Cycle Management (PLM), LAP, Supply chain Management.		
Unit III	**ERP Marketplace and Marketplace Dynamics**	**5 hours**
Market Overview, Marketplace Dynamics, the Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications.		
Unit-IV	**ERP Implementation Basics**	**5 hours**
ERP Implementation Basics, ERP Implementation Life Cycle, Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees.		
Unit-V	**ERP & E-Commerce**	**5 hours**
ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into organizational culture. Using ERP tool: either SAP or ORACLE format to case study.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of TheCourse	Deep Learning	L	T	P	C
Course Code	BTCS9604	2	0	2	3
Version No	Date of Approval: 8/6/2021				
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

To implement Deep Learning neural networks.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	To Implement Neural Network
CO2	To analyse Performance of neural network
CO3	To implement CNN for image classification
CO4	To implement Alex Net and Google Net.
CO5	To implement and Analyse RNN and LSTM.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

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

Reference Books

1. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
2. R2. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
3. R3. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

Course Content

Unit 1	**Basics**	**5 hours**
Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm.		
Unit II	**Feedforward Networks & Deep Neural Networks**	**5 hours**
Difficulty of training deep neural networks, Greedy layer wise training. Multilayer Perceptron, Gradient Descent, Back propagation, Empirical Risk Minimization, regularization, auto encoders.		
Unit III	**Better Training of Neural Networks**	**5 hours**
Newer optimization methods for neural networks (Adagrad, ad delta, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization).		
Unit-IV	**Recurrent Neural Networks**	**5 hours**
Back propagation through time, Long Short-Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs, Convolutional Neural Networks: LeNet, AlexNet		
Unit-V	**Generative models**	**5 hours**
Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines. Recent trends: Variational Auto encoders, Generative Adversarial Networks, Multi-task Deep Learning, Multi-view Deep Learning.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of TheCourse	UI&UX	L	T	P	C
Course Code	BTCS9605	2	0	2	3
Version No	Date of Approval: 8/6/2021				
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

The proposed course exposes the BtechCS/IT students will be able to Define the term UI UX and identify how it fits into the software development lifecycle. Conduct generative user experience design activities to creatively fill user needs when designing a new user interaction. Participate effectively in design critiques, and be able to use this experience to be a more effective design team member. Design and produce an interactive prototype of a complete design concept to present to a client for a new user interaction.

Course Outcomes

Upon successful completion of this course, students will be able to

CO1	Understand the definition and principles of UI/UX Design in order to design with intention.
CO2	Achieve a deep understanding of the entire life-cycle of design—the process, purpose, and tools.
CO3	Learn the basics of HCI (human-computer interaction) and the psychology behind user decision-making.
CO4	Discover the industry-standard tools and specific project deliverables in UI/UX.
CO5	Explain why you made design decisions, through presentations of assignments and your personal portfolio.
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. A Project Guide to UX Design, Second Edition. Russ Unger and Carolyn Chandler. New Riders. 1249 Eighth Street. Berkeley, CA 94710. (510) 524-2178.
2. UI design from the expert web UI design best practices, Advice from UI & UX experts such as Luke Wroblewski, Jakob Nielsen, Jared Spool, and many others, Nov 20, 2014.
3. User Interface and User Experience (UI/UX) Design. Article (PDF Available), Nov 17, 2017.

Reference Books

1. Interaction Design: Beyond Human-Computer Interaction, by Rogers, Sharp, and Preece, ISBN-10 # 0470665769
2. The Design of Everyday Things, by Norman, ISBN-10 # 0465050654.
3. Sketching User Experiences: Getting the Design Right and the Right Design, by Buxton, ISBN- 10 # 0123740371.

Course Content

Unit 1	Introduction	**5 hours**
UI/UX Overview: Intro to UI/UX, The User Interface versus the User Experience, Scholarly Influences on UI/UX Design in Cartography and Visualization, Good/Bad UX, Designing the User Experience, Designing the User Interface, Interface Styles, Notion & Figma Setup, Design Thinking.		
Unit II	User Research & User Journeys	**5 hours**
How to identify stakeholders, Defining Stakeholders Figma Basics, How to identify user needs, User Research, Interaction Design, Mapping the user journey, User Journey Maps + HMW, Figma Gray scales, Finding solutions & constraint cards.		
Unit III	Gray scales & User Testing	**5 hours**
UX Principles, Blocking Gray scales + User Flow, Figma Prototype, Understanding user testing, Gray scales + Usability Testing, Design of Everyday Things.		
Unit-IV	UI Principles	**5 hours**
UI Principles, UI Analysis, Figma UI Part 1, Color and Font, UI Design in 3 Sprints, Refactoring UI.		
Unit-V	Style Guide	**5 hours**
Non-Traditional UI, Find UI in other Technologies, Figma UI Part 2, UI Special Topics, Create UI for other Technologies, Creating UI Design, UI Components, Style Guide Analysis, Figma Advanced, Responsive Design. Style Guide for Responsive UI, Visual Display of Information.		
Unit-VI	**Advancements and Research**	**4 hours**
The advances and the latest trends in the course as well as the latest applica the areas covered in the course. The latest research conducted in the areas covered in the Discussion of some latest papers published in IEEE transactions and ACM transactions, Science and SCOPUS indexed journals as well as high impact factor conferences as symposiums. Discussion on some of the latest products available in the market b the areas covered in the course and patents filed in the areas covered in the course.		

Name of TheCourse	Banking System	L	T	P	C
Course Code	BTCS8201	3	0	0	3
Version No	Date of Approval: 8/6/2021				
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

The course will help students to understand:

1) To acquire knowledge of working of Indian Banking system
2) The impact of government policy and regulations on the banking industry
3) Financial statements and performance of banks
4) Banking lending policies and procedures.

Text Books

1. Banking Theory & Practices: Dr. P. K. Srivatsava, Himalaya Publishers
2. Banking Theory & Practices: K.E. Shekar, Vikas Publications
3. Banking theory & Practices: Santhi Vedula, HPH.

Reference Books

1. Banking Theory & Practices: Dr. J. Jayanthi, PBP.
2. Banking Theory, Law & Practices: R. R Paul, Kalyani Publishers
3. Money Banking and Financial Markets: Averbach, Rabort. D, MacMillan. Landon

Course Content

Unit 1	INTRODUCTION	8 Hours
Origin and Growth of Banking in India - Unit Vs Branch Banking - Functions of Commercial Banks - Nationalization of Commercial Banks in India - Emerging Trends in Commercial Banking in India: E-Banking – Mobile Banking - Core Banking – Bank Assurance – OMBUDSMAN.		
Unit II	**RESERVE BANK OF INDIA**	**8 Hours**
RBI Constitution - Organizational Structure – Management - Objectives – Functions – Monetary Policy.		
Unit III	**TYPES OF BANKS**	**8 Hours**
District Co-Operative Central Banks – Contemporary Banks - Regional Rural Banks - National Bank for Agriculture and Rural Development (NABARD) – SIDBI – Development Banks.		
Unit-IV	**BANKER AND CUSTOMER RELATIONSHIP**	**8 Hours**
Definition of Banker and Customer - Relationship Between Banker and Customer - KYC norms - General and Special Features of Relationship - Opening of Accounts - Special Types of Customers Like Minor, Married Women, Partnership Firms, Companies, Clubs and other NonTrading Institutions.		
Unit-V	**NEGOTIABLE INSTRUMENTS**	**8 Hours**
Descriptions and their Special Features - Duties and Responsibilities of Paying and Collecting Banker - Circumstances under which a Banker can refuse Payment of Cheques - Consequences of Wrongful Dishonors - Precautions to be taken while Advancing Loans Against Securities – Goods - Documents of Title to Goods - Loans against Real Estate - Insurance Policies - Against Collateral Securities – Banking Receipts. Rule in Clayton's Case - Garnishee Order – Loans against Equitable Mortgage - Legal Mortgage - Distinction between them - Latest Trends in Deposit Mobilization.		
Unit-VI	**Advancements and Research**	**6 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of TheCourse	Export and Import Policy	L	T	P	C
Course Code	BTCS8203	3	0	0	3
Version No	Date of Approval: 8/6/2021				
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

The course will help students to understand:

1. To familiarize students with the process of international customs clearance operations.
2. To form a base of policy framework in International Business with special emphasis on Indian Customs.
3. To apprise them of the documentation procedures and its sanctity in Intl' Business.

Text Books

1. Handbook of Import-Export Procedures – Ministry of Commerce, -, Government of India, New Delhi
2. Export: What, Where and How, Paras Ram, Anupam Publishers, Delhi
3. Exports – Do it Yourself, Mahajan M.I., Snow White Publications, New Delhi

Reference Books

1. Import – Do it Yourself, M. I. Mahajan, Snow White Publications, New Delhi
2. Export Marketing, TAS Balagopal , Himalaya Publishing House
3. Export Documentation and Procedures, , Nabhi Publications, New Delhi
4. International Marketing Management, R.L. Varshney, Sultan Chand

Course Content

Unit 1	Preliminaries for Exports and Imports	8 Hours
Meaning and Definition of Export – Classification – Strategy and Preparation for Export Marketing – Export Marketing Organizations – Registration Formalities – IEC – RCMC – Export Licensing – Selection of Export Product – Identification of Markets – Methods of Exporting – Pricing Quotations – Payment Terms – Letter of Credit. Liberalization of Imports – Negative List for Imports – Categories of Importers – Special Schemes for Importers		
Unit II	**Export Import Documentation**	**8 Hours**
Aligned Documentation System – Commercial Invoice – Shipping Bill – Certificate of Origin – Consular Invoice – Mate's Receipt – Bill of Lading – GR Form – ISO 9000 – Procedure for obtaining ISO 9000 – BIS 14000 Certification – Types of Marine Insurance Policies. Import Documents – Transport Documents – Bill to Entry – Certificate of Inspection – Certificate of Measurements – Freight Declaration.		
Unit III	**Export Procedure**	**8 Hours**
Steps in Export Procedure – Export Contract – Forward Cover – Export Finance – Institutional framework for Export Finance – Excise Clearance – Pre-shipment Inspection – Methods of Pre-shipment Inspection – Marine Insurance – Role of Clearing and Forwarding Agents – Shipping and Customs Formalities – Customs EDI System – Negotiation of Documents – Realisation of Exports Proceeds.		
Unit-IV	**Import Procedure**	**8 Hours**
Pre-Import Procedure – Steps in Import Procedure – Legal Dimensions of Import Procedure – Customs Formalities for Imports – Warehousing of Imported goods – Exchange Control Provisions for Imports – Retirement of Export Documents.		
Unit-V	**Policy and Institutional Framework for Exports and Imports**	**8 Hours**
Foreign Trade Policy – Highlights – Special Focus Initiatives – Duty Drawback – Deemed Exports – ASIDE – MAI & MDA – Star Export Houses – Town of Export Excellence – EPCG Scheme – Incentives for Exporters. Export Promotion Councils-Commodity Boards – FIEO – IIFT – EOUs – SEZs – ITPO – ECGC – EXIM Bank.		
Unit-VI	**Advancements and Research**	**6 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

SEMESTER – VIII

Name of TheCourse	Capstone Design – Part-II	L	T	P	C
Course Code	BTCS9999	0	0	16	9
Version No					
Prerequisite					
Co requisite					
Anti- requisite					

RUBRICS DEVELOPED FOR PROJECT EVALUATION

Review	Agenda	Description	Assessment	Marks
First review	Project scopes and Proposal **(Rubric# P1R1)**	Identification of Problem Domain and detailed Analysis	P1R1	10
		Problem Statement and feasibility of project proposed		10
Second review	Literature Review **(Rubric# P1R2)**	Identify and acquire information needed for the design	P1R2	15
		Review based comparison of existing system		15
Final review	Methodology and expected outcome of the proposed work **(Rubric# P1R3)**	Originality of the project Idea	P1R3	10
		Methodology and design process - Proposed		20
	Project Report Evaluation **(Rubric# P1R4)**	Quality of Project Report	P1R4	10
		Description of concepts and Knowledge of contemporary issues		10
			Total Marks	100

Name of The Course	PREDICTIVE ANALYTICS	L	T	P	C
Course Code	CSAI2030	2	0	2	3
Version No	Statistics and applied mathematics, DBMS				
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

1. Student learn the various algorithms of Data Mining, Classification and Data Visualization
2. Student understand the concepts of Supervised and Unsupervised algorithms
3. Student learn various prediction measures and techniques of classification problems
4. Student understand the various model assessment techniques and selections
5. Student learn the different types of prediction methods and applications
6. Student learn the R programming to implement the various algorithms

Course Outcomes

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

CO1	Understand the basics of Data Mining, Classification techniques and Data Visualization.
CO2	Design and apply the various algorithms of Supervised and Unsupervised Learning.
CO3	Design and apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data.
CO4	Design and apply various prediction methods to determine the future prediction of results.
CO5	Understand the common idioms of neural networks and classification methods.
CO6	Implementing various machine learning algorithms using R programming.

Text Books

1.T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2008

2.Christopher Bishop. Pattern Recognition and Machine Learning. 2e

3. Trevor Hastie, Robert Tibshirani, Jerome Friedman , The Elements of Statistical Learning-Data Mining, Inference, and Prediction ,Second Edition , Springer Verlag, 2009.

4. G.James,D.Witten,T.Hastie,R.Tibshirani-An introduction to statistical learning with applications in R,Springer,

5. E.Alpaydin, Introduction to Machine Learning, Prentice Hall Of India,2010

Reference Books

1) Jiawei Han, Micheline Kamber, "Data Mining Concepts & Techniques" Elsevier

2) Mallach,"Data Warehousing System",McGraw –Hill.

Course Content

Unit 1:Overview of the Data Mining Process	**[8 lecture hrs]**
Overview of the Data Mining Process : Core Ideas in Data Mining -Classification - Prediction - Association Rules - Data Reduction - Data Exploration and Data Refinement: Data Summaries – Data Visualization – treatment of Missing Observation – Detection of Outliers – the Box Plot – Correlation analysis	
Unit 2 : Supervised/Unsupervised Learning	**[8 lecture hrs]**
Supervised Learning: Learning with Rules, Learning with Trees, Ensemble Learning, Nearest Neighbor, Unsupervised learning: clustering, dimensionality reduction, recommender systems, deep learning	
Unit 3 : Evaluation Methods for Prediction and Classification Problems	**[10 lecture hrs]**
Evaluation Methods for Prediction and Classification Problems : Prediction Measures: MAE, MSE, RMSE, MAPE, MSPE, and RMSPE - Classification Measures: Classification Matrix, ROC Curves, Lift Charts, and Lift Charts that Incorporate Costs and Benefits - The Role of Over-sampling in Classification Problems	
Unit 4 : Prediction Methods Model Assessment and Selection:	**[8 lecture hrs]**
Bias,Variance,and model complexity,Bias-variance trade off, Optimisim of the training error rate ,Esimate of In-sample prediction error,Effective number of parameters, Bayesian approach and BIC, Cross- validation ,Boot strap methods, conditional or expected test error.	
Unit 5 : Neural networks and Classification Methods	**[6 lecture hrs]**
Prediction Methods : Linear Regression: Best Subset Selection - Forward Selection - Backward Selection - Step-wise Regression (Efroymson's method) - All Subsets Regression - Information Criteria (AIC, SBC, etc.) - Penalized Regression Methods (Ridge, LASSO, Adaptive LASSO	
Unit VI: Advances and the Latest Trends	**[8 lecture hrs]**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Name of The Course	Computer Vision	L	T	P	C
Course Code	CSAI2040	2	0	2	3
Version No	Programming and Mathematic course				
Prerequisite					
Co requisite					
Anti- requisite					

Course Objectives

In this course students will learn basic principles of image formation, image processing algorithms and different algorithms for 3D reconstruction and recognition from single or multiple images (video). This course emphasizes the core vision tasks of scene understanding and recognition. Apllications to 3D modelling, video analysis, video surveillance, object recognition and vision based control will be discussed**.**

Course Outcomes

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

CO1	To implement fundamental image processing techniques required for computer vision
CO2	Understand Image formation process
CO3	To perform shape analysis
CO4	Extract features form Images and do analysis of Images
CO5	Generate 3D model from images applications
CO6	Ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems in Internet of Things. (Create)

Text Books

1. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.

2. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.

Reference Books

1. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992.

2. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.

3. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer, 2010

4. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.

5. E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012

6. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012

Course Content

Unit I:	**9 Lecture hours**
Introduction : Image Processing, Computer Vision and Computer Graphics , What is Computer Vision - Low-level, Mid-level, High-level , Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality	
Unit II:	**9 Lecture hours**
Image Formation Models : Monocular imaging system , Radiosity: The 'Physics' of Image Formation, Radiance, Irradiance, BRDF, color etc, Orthographic & Perspective Projection,• Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry, Structure determination, shape from shading , Photometric Stereo, Depth from Defocus , Construction of 3D model from images.	
Unit III:	**9 Lecture hours**
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.	
Unit IV:	**9 Lecture hours**
Object recognition : Hough transforms and other simple object recognition methods, Shape correspondence and shape matching Principal component analysis , Shape priors for recognition. **Image Understanding** : Pattern recognition methods, HMM, GMM and EM	
Unit V:	**9 Lecture hours**
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: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians	
Unit VI: Advances and the Latest Trends	**9 Lecture hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.	

Name of The Course	ANN AND DEEP LEARNING	L	T	P	C
Course Code	CSAI3050	2	0	2	3
Version No					
Prerequisite	Linear Algebra and Optimization,				
Co requisite					
Anti- requisite					

Course Objectives

• To understand and master the tools of Artificial Intelligence
• To explore in depth deep neural architectures for learning and inference
• To evaluate the performance of neural architectures in comparison to other machine learning methods

Course Outcomes

CO1	Understand basic Neural Network architectures
CO2	Apply fundamental principles, theory and approaches for learning with deep neural networks
CO3	Understand key concepts, issues and practices, core algorithms and optimization when training and modeling with deep architectures
CO4	Analyze main variants of deep learning (convolutional, recurrent, reinforcement and generative architectures), and their typical applications
CO5	Analyze how deep learning fits within the context of other Machine Learning approaches and what learning tasks it is considered to be suited and not well suited to perform
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville. Deep Learning, Second edition, MIT Press, 2016
2. Duda R.O., Hart P.E., Stork D.G., Pattern Classification, Second edition, Wiley-Interscience, 2001
3. Theodoridis, S., Koutroumbas, K. Pattern Recognition, Fourth edition, Academic Press, 2008
4. Russell S., Norvig N., Artificial Intelligence: A Modern Approach, Prentice Hall Series in Artificial Intelligence, 2003
5. Bishop C. M. Neural Networks for Pattern Recognition, Oxford University Press, 1995
6. Hastie T., Tibshirani R. and Friedman J., The Elements of Statistical Learning, Springer, 2001
7. Koller D. and Friedman N. Probabilistic Graphical Models, MIT Press, 2009

Course Content

Unit 1		**8 Hours**
Neural networks- Perceptrons, sigmoid units; Learning in neural networks - output vs hidden layers; linear vs nonlinear networks; linear models (regression) - LMS algorithm Perceptrons classification - limitations of linear nets and perceptrons - multi-Layer Perceptrons (MLP)- activation functions - linear, softmax, tanh, ReLU; error functions - feed-forward networks.		
Unit II		**8 Hours**
Backpropagation - recursive chain rule (backpropagation) - Learning weights of a logistic output neuron - loss functions - learning via gradient descent - optimization momentum method; Adaptive learning rates RmsProp - mini-batch gradient descent - bias-variance trade off.		
Unit III		**8 Hours**
Regularization - overfitting - inductive bias regularization - drop out - generalization. Deep neural networks - convolutional nets case studies using Keras/Tensorflow.		
Unit-IV		**8 Hours**
Introduction to deep reinforcement learning - neural nets for sequences - Recurrent Nets Long-ShortTerm-memory - Introduction to Deep unsupervised learning autoencoders - PCA to autoencoders - Deep Generative Models - Generative Models and Variational Inference.		
Unit-V		**8 Hours**
Autoregressive Models and Invertible Transformations - Adversarial Learning -Adversarial Variational Bayes: Unifying VariationalAutoencoders and Generative Adversarial Networks - AdverserialAutoencoders - Evaluation of Generative Models - A Lagrangian Perspective on Latent Variable Generative Modeling - Geometry of Deep Generative Models - Application - Model based Reinforcement Learning.		
Unit-VI	**Advancements and Research**	**6 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of The Course	Data Science Applications of NLP Vision	L	T	P	C
Course Code	CSAI3060	2	0	2	3
Version No					
Prerequisite	Machine Learning				
Co requisite					
Anti- requisite					

Course Objectives

• To understand text processing for extracting information
• To understand language specific tasks and learning models
• To explore artificial intelligence in understanding the semantics of text data

Course Outcomes

CO1	Understand the mechanics of language - the sound system, word structure, sentence structure, and meaning
CO2	Understand how to formulate NLP tasks as learning and inference tasks, and address the computational challenges involved
CO3	Apply text processing at syntactic, semantic, and pragmatic levels
CO4	Analyze text mining and manipulation techniques
CO5	Analyze entity recognition and relationship between entities to retrieve information from text
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Emily Bender, Linguistics Fundamentals for NLP, Morgan Claypool Publishers, 2013
2. Jacob Eisenstein, Natural Language Processing, MIT Press, 2019.
3. Dan Jurafsky, James H. Martin, Speech and Language Processing, Third edition, Prentice Hall, 2018.
4. Chris Manning, Hinrich Schuetze, Foundations of Statistical Natural Language Processing, MIT Press, 1999

Course Content

Unit 1		**8 Hours**
Introduction to Computational Linguistics - Word meaning - Distributional Semantics - Word Sense Disambiguation - Sequence Models - N-gram Language Models - Feedforward Neural Language Models - Word Embeddings - Recurrent Neural Language Models - POS tagging and Sequence Labeling - Structured Perceptron, Viterbi - Loss-augmented Structured Prediction - Neural text models and tasks.		
Unit II		**8 Hours**
Information Extraction from Text - Sequential Labeling - Named Entity Recognition - Semantic Lexicon Induction - Relation Extraction - Paraphrases Inference Rules - Event Extraction - Opinion Extraction.		
Unit III		**8 Hours**
Temporal Information Extraction - Open Information Extraction - Knowledge Base Population - Narrative Event Chains and Script Learning - Knowledge graph augmented neural networks for Natural Language.		
Unit-IV		**8 Hours**
Machine Translation - Encoder-decoder models, beam search - Attention Models - Multilingual Models - Syntax, Trees, Parsing - Transition-based Dependency Parsing.		
Unit-V		**8 Hours**
Graph-based Dependency Parsing - Deep Generative Models for Natural Language Data - Text Analytics - Information Extraction with AQL - Conversational AI.		
Unit-VI	**Advancements and Research**	**6 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of The Course	Game theory for AI and Data Science	L	T	P	C
Course Code	CSAI4070	2	0	2	3
Version No					
Prerequisite	Machine Learning				
Co requisite					
Anti- requisite					

Course Objectives

• Course aims to introduce how human behavior can be modeled using game theory principles for artificial intelligence

• To learn various ways game theory helps in different learning mechanisms

• To introduce how game theory can be used to produce novel and accurate data for data science problems

Course Outcomes

CO1	Understand behavioral game theory for artificial intelligence domain
CO2	Learn the concepts of game theory for learning techniques in artificial intelligence
CO3	Apply game theoretic principles for dealing data for data science
CO4	Model modern problems in AI and DS using game theory
CO5	Implement game-theoretic solutions for AI and DS
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Colin F. Camerer, Behavioral Game Theory: Experiments in Strategic Interaction, Princeton University Press, 2003
2. Boi Faltings, GoranRadanovic, Game Theory for Data Science: Eliciting Truthful Information, Morgan and claypool publishers, 2017.
3. Yoav Shoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, Cambridge University Press, 2009.
4. H. M. Schwartz, Multi-Agent Machine Learning: A Reinforcement Approach, Wiley publications, 2014
5. Peter Vrancx, Decentralized Reinforcement Learning in Markov Games, VUB Press, 2010Emily Bender, Linguistics Fundamentals for NLP, Morgan Claypool Publishers, 2013

Course Content

Unit 1		**8 Hours**
Behavioral game theory: Dictator, Ultimatum and trust games, Mixed strategy equilibrium, Bargaining, Dominant solvable games, Coordination games, Signaling and reputation		
Unit II		**8 Hours**
Types of learning Reinforcement, Belief, Imitation, stochastic game theory, evolutionary games and markov games for multi-agent reinforcement learning, Economic Reasoning and Artificial Intelligence		
Unit III		**8 Hours**
Game Theory for data science: Mechanisms for verifiable and unverifiable information, non-parametric mechanisms, prediction markets, decentralized machine learning		
Unit-IV		**8 Hours**
Machine Translation - Encoder-decoder models, beam search - Attention Models - Multilingual Models - Syntax, Trees, Parsing - Transition-based Dependency Parsing.		
Unit-V		**8 Hours**
Graph-based Dependency Parsing - Deep Generative Models for Natural Language Data - Text Analytics - Information Extraction with AQL - Conversational AI.		
Unit-VI	**Advancements and Research**	**6 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		

Name of The Course	Artificial Intelligence for Robotics	L	T	P	C
Course Code	CSAI4071	2	0	2	3
Version No					
Prerequisite	Machine Learning				
Co requisite					
Anti- requisite					

Course Objectives

To understand the principles of reinforcement learning which is one of the key learning techniques for robots • To understand uncertainty handling in robotics through probabilistic approaches • To learn how measurements work for robots

Course Outcomes

CO1	Learn the foundations of reinforcement learning for robotics
CO2	Understand basic probabilistic principles behind Robotics intelligence
CO3	Learn different measurement techniques for robotics
CO4	Understand POMDP and its significance for robotics
CO5	Implement principles of robotics intelligence for solving real world problems
CO6	Gain understanding of latest trends and research areas in the course

Text Books

1. Sebastian Thrun, Wolfram Burgard, Dieter Fox, Probabilistic Robotics, MIT Press 2005
2. Richard S. Sutton, Andrew G. Barto, Reinforcement Learning: An Introduction, Second edition, MIT Press, 2018
3. Jens Kober, Jan Peters, Learning Motor Skills: From Algorithms to Robot Experiments, Springer, 2014
4. Francis X. Govers, Artificial Intelligence for Robotics, Packt, 2018

Course Content

Unit 1		**8 Hours**
Overview: Robotics introduction, historical perspective on AI and Robotics, Uncertainty in Robotics Reinforcement Learning: Basic overview, examples, elements, Tabular Solution Methods -		
Unit II		**8 Hours**
Multiarmed bandits, Finite Markov decision process, Dynamic programming (Policy Evaluation, Policy Iteration, Value Iteration), Monte Carlo Methods, Temporal-Difference Learning (Q-learning, SARSA)		
Unit III		**8 Hours**
Approximate Solution Methods - On-policy Prediction with Approximation, Value function approximation, Non-linear function approximation, Reinforcement Learning in robotics, Recursive state estimation: Robot Environment Interaction.		
Unit-IV		**8 Hours**
Bayes filters, Gaussian filters The Kalman filter, The Extended Kalman Filter, The information filter, The particle filter Robot motion: Velocity Motion Model, Odometry Motion Model, Motion and maps.		
Unit-V		**8 Hours**
Measurement: Beam Models of Range Finders, Likelihood Fields for Range Finders, Correlation Based Sensor Models, Feature-Based Sensor Models, Overview of POMDP		
Unit-VI	**Advancements and Research**	**6 Hours**
The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course.		