GALGOTIAS UNIVERSITY

Syllabus of

Course Book B.Tech. (CSE) 2019-20

Name of School: School of Computing Science and Engineering

Department: Computer Science and Engineering

Year: 2019-20

Name of The Course	Fundamental of Computer Programming			
Course Code	**BCS101**			
Prerequisite	NA			
Corequisite	NA			
Antirequisite	NA			
	L	**T**	**P**	**C**
	3	0	0	3

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

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

Text Book (s)

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

Reference Book (s)

- **Brian W. Kernighan and Dennis M. Ritchie, The C programming Language,Prentice-Hall in 1988**
- **Byron Gottfried, Programming with C, Schaum's Outline**

Unit-1 Introduction to Computers and Algorithms **9 lecture hours**
Parts of a computer – Overview of operating systems, assembler, compilers, interpretersand 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 an integer, flowchart.
Unit-2 Constructs of C **8 lecture hours**
Lexical elements – Operators - data types – I/O statements – format specifications – controlstatements – 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 Arrays **8 lecture hours**
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 Functions **8 lecture hours**
Prototype – declaration - arguments (formal and actual) – return types – types of functionsdifference between built-in and user-defined functions.
Unit-5 Structures **7 lecture hours**
Declarations - nested structures- array of structures - structure to functions - unions-difference between structure and union.

Continuous Assessment Pattern

Internal Assessment(IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Fundamental of Computer Programming Lab**				
Course Code	BCS151				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	3	1	0	3	

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

CO1	The student would learn the basic concepts of Computer and acquire various problem solving techniques such as algorithms and flowchart.
CO2	To understand the basic terminology used in programming and able to write, compile and 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 call by value and call by reference methods.
CO5	Implement and develop small projects using the concept Structures in C programming language.
CO6	Algorithms and Advanced Programming development in different field.

Text Book (s)

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.
   1.

Reference Book (s)

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

List of Experiments

Course content	
Module	Topic
1	Writing first C Programme
2	Using different types of data in C Programme
3	Writing a programme to use decision control statements, cases
4	Writing a programme using loop structure, nested loop
5	Use of Arrays
6	Programme using pointers
7	Design a Database and create required tables, apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.
8	Write a sql statement for implementing ALTER, UPDATE and DELETE, Write the queries to implement the joins
9	Write the query for implementing the following functions: • String Function • Numeric/Math Functions • Aggregate Functions • Date/Time Functions
10	Create Functions, procedures, packages, triggers, Different types of queries using Cases

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Introduction to Computer Science & Engineering**				
Course Code	**BCSE1001**				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	0	0	2	1	

Course Objectives:
• **Provide an overview of computers and different development areas.**
• **Learn and Identify different domains emerging.**
• **Develop for student seek and idea about Internet and application.**
• **Learn about the Data Analysis, Business Process and other fields.**

Course Outcomes

CO 1	Understand the Fundamental of Computer and Programming Languages.
CO 2	Understand when and how to take decisions, to compare and iterate, to how chosetheir career and line of action for future studies.
CO 3	Recognize the Domain of Computers like grid, distributed, cloud and foggcomputing.
CO 4	To know about the Information system gateway and terminology.
CO 5	Introduction about Data and Data Analysis with business process.

CO 6	Develop idea about Internet of things and its applications.	

Text Book (s)
• **Computer Fundamental – By P. K. Sinha**
• **Cloud Computing: Concepts, Technology & Architecture – By ERL**
• **"The Internet of Things: Enabling Technologies, Platforms, and Use Cases", byPethuru Raj and Anupama C. Raman (CRC Press)**
• **Introduction to Information Security and Cyber Law – By Surya PrakashTripathi, Ritendra Goel, Praveen Kumar Shukla**

Reference Book (s)
1. E. Balagurusamy 7 Edition, Programming ANSI C, McGraw-Hill
2. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga andVijay Madisetti (Universities Press)
3. Cloud Computing: Business Trends and Technologies, Igor Faynberg,Kui-Lan Lu, and Dor Skuler, Wiley, 2015

Unit-1 Introduction Computer Fundamental	**6 hours**
Block Diagram of Computer System, Component of system, Instruction, Instruction flow. Introduction of Software, Classification of software, Languages and its Generations, Flow Diagram, Algorithm, Pseudo codes. Evolution of Computer hardware and their effect in the fields with relevance of size, speed and output.	
Unit-2 Domains of Computing	**6 hours**
Computers Application, Different era and field of computation with time, Advancement in computer field, Introduction to computing-grid, distributed, cloud, fog, Virtualization Green Computing , Operating system, difference between windows and Unix family, BasicLinux command-ls, cd, mv, man, mkdir, rmdir, touch, cat. Introduction to open source software.	
Unit-3Information System	**4 Lectures**
Introduction to Standards, Types of Standards; Open Standard, Closed Standard, Information Technology, Introduction to data communication and networking, standardsand protocols. SMTP, POP3, DNS, HTPS, IPV4, IPV6, cyber Security, Viruses	
Unit-4Data Analysis	**5 Lectures**

Data, Different types of Data and data Analysis, Business Analysis, Big-Data, Businessand healthcare, Banking IT Infrastructure. Demonstration of Web Page analysis using goggle Page speed like pingdoom.com.
Unit-5 Internet of Things **5 Lectures**
Internet, Introduction to IOT, Internet technologies, Advancement and applications in IOT,Professional society and association in computing, ethics

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Functional English**			
Course Code	FENG1005			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	1	0	3

Course Objectives:
• Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
• Foster their ability to write convincing job applications and effective reports.
• Develop their speaking skills to make technical presentations , participate in group discussions.
• Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

Course Outcomes

CO1	Read technical texts and write area- specific texts effortlessly.
CO2	Listen and comprehend lectures and talks in their area of specialisation successfully.
CO3	Speak appropriately and effectively in varied formal and informal contexts.
CO4	Write reports and winning job applications.

Text Book (s)

1. Board of editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016.
2. Sudharshana.N.P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.

Reference Book (s)

1. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.

2. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007

3. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015

4. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007

5. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice.Oxford University Press: New Delhi,2014.

Unit-1 Introduction Module-I Hours: 6

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- Speaking –Asking for and giving directions- Reading – reading short technical texts from journals- newsapapers- Writing- purpose statements – extended definitions – issue- writing instructions – checklists-recommendations- Vocabulary Development- technical vocabulary Language Development –subject verb agreement – compound words.

Unit-2Module-II Hours: 8

Listening- Listening to longer technical talks and completing exercises based on them- Speaking – describing a process-Reading – reading longer technical texts- identifying the various transitions in a text- paragraphing- Writing- interpreting carts, graphs- vocabulary Development- vocabulary used in formal letters/emails and reports Language Development personal passive voice, numerical adjectives.

Unit-3 Module-III Hours: 9

Listening- Listening to classroom lectures talk is on engineering /technology -Speaking – introduction to technical presentations- Reading – longer texts both general and technical, practice in speed reading; Writing-Describing a process, use of sequence words- Vocabulary Development- sequence words- Misspelled words. Language Development- embedded sentences.

Unit-4 Module-IV Hours: 9

Listening- Listening to documentaries and making notes. Speaking – mechanics of presentations- Reading – reading for detailed comprehension- Writing- email etiquette- job application – cover letter –Resume preparation(via email and hard copy)- analytical essays and issue based essays–Vocabulary Development- finding suitable synonyms- paraphrasing-. Language Development- clauses- if conditionals.
Unit-5 Module-V Hours: 10
Listening- TED/Ink talks; Speaking –participating in a group discussion -Reading– reading and understanding technical articles Writing– Writing reports- minutes of a meeting- accident and survey-Vocabulary Development- verbal analogies Language Development- reported speech.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Engineering Chemistry				
Course Code	BCH101				
Prerequisite					
Corequisite					
Antirequisite					
		L	**T**	**P**	**C**

Course Objectives:
1) To bring adaptability to new developments in Engineering Chemistry and to acquirethe skills required to become a perfect engineer.
2) To include the importance of water in industrial usage, significance of corrosioncontrol to protect the structures, polymers and their controlled usage.
3) To acquire knowledge of engineering materials and about fuels and batteries.
4) To acquire required knowledge about engineering materials like cement, refractoriesand composites.

Course Outcomes

CO1	Explain bonding theories in molecules and applications of nanomaterials.
CO2	Illustrate the various spectroscopic techniques and their applications
CO3	Describe Nernst equation , corrosion and Phase rule.
CO4	Compare the various techniques of water softening and determine the calorific value of fuel .
CO5	Generalize the preparation methods applications of polymers and organic compounds.

Text Book (s)
1. Text book of Engineering Chemistry by Jain & Jain, 14th Ed., pp 1-21
2. Text book of Engineering Chemistry by Shashi Chawla p.p 2-46

Reference Book (s)
1. University Chemistry By B.H. Mahan
2. University Chemistry By C.N.R. Rao
3. Organic Chemistry By I.L. Finar
4. Physical Chemistry By S. Glasstone
5. Engineering Chemistry By S.S. Dara
6. Polymer Chemistry ByFre W., Billmeyer
7. Engineering ChemistryBy Satya Prakash

Unit-1 Introduction **[08]**	**Lecture**
Atomic and Molecular Structure: Molecular orbital‟s of diatomic molecules. Band theory of solids. Liquid crystal andits applications. Point defects in solids. Structure and applications of Graphite and Fullerenes. Concepts of Nano materials and its application.	
Unit-2	**Lecture [08]**
Spectroscopic techniques and Applications: Elementary idea and simple applications of Rotational, Vibrational, Ultraviolet& Visibleand Raman spectroscopy.	
Unit-3	**Lecture [08]**
Electrochemistry Nernst Equation and application, relation of EMF with thermodynamic functions (ΔH, ΔF and Δ S). Lead storage battery. Corrosion; causes, effects and its prevention. Phase Rule and its application to water system.	
Unit-4	**Lecture [08]**
Water Analysis; Hardness of water, Techniques for water softening (Lime-soda, Zeolite, Ion exchange resin and Reverse osmosis method). Fuels: classification of fuels, Analysisof coal, Determination of calorific value (Bomb calorimeterand Dulong‟smethos).	
Unit-5	**Lecture [08]**
Polymer; Basic concepts of polymer-Blend and composites, Conducting and biodegradablepolymers. Preparation and application of some industrially important polymers (Buna-S, Buna-N, Neoprene, Nylon-6, nylon-6,6 and Terylene). General methods of synthesis of organ metallic compounds (Grignard reagent) and their applications.	

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	**Engineering Chemistry Lab**			
Course Code	**BCH152**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	2	1

Course Outcomes

CO 1	**Employ the volumetric titrations techniques used in chemistry laboratory foranalysis.**
CO 2	Analyse to differentiate between hard and soft water using complexometrictitration.
CO 3	Calculate the percentage of dissolved oxygen in water sample.
CO 4	Identify the viscosity of liquid using Ostwald viscometer.
CO 5	Analyse the Carbohydrate and protein in given organic compound.

List of Exper

i m e n t s
• **To determine the strength of ferrous ions in the given sample of Mohr'ssalt by using** **KMnO4 as a self-indicator.**
• **To estimate the total permanent Hardness of the given hard water sample. An** **approximately 0.01M solution of EDTA are provided.**
• **Estimate the amount of Nickel ion in the given sample solution by complex-metric** **titration.**
• **To Determine the Alkalinity of a given Water Sample.**
• **To estimate the amount of Zinc in the given solution by using a standard solution of** **Potassium Ferro cyanide**
• **Estimate the amount of ferrous iron in the whole of the given ferrous Solution using** **external indicator**
• **To estimate the amount of Copper present in the given solution using a standard** **solution by provided hypo solution.**
• **To find out the viscosity of a given liquid using Ostwald's viscometer.**
• **To find out the amount of dissolved oxygen in the given sample of water.**
• **(a)Identify element N, S and Halogen**
(b) Qualitative analysis of carbohydrates, lipids and proteins.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	50	100	100

Name of The Course	Engineering Physics			
Course Code	**BPH101**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives:
• **To impart knowledge in basic concepts of physics relevant to engineering applications**
• **To introduce advances in technology for engineering applications**

Course Outcomes

CO 1	**Discuss Classical and quantum physics and solve Schrodinger wave equations**
CO 2	Illustrate the phenomenon of Interference and Diffraction of light
CO 3	Discuss the principle, components and working of Laser
CO 4	Describe Maxwell's equations and their significance in electromagnetic
CO 5	Understand different magnetic materials and their properties

Text Book (s)
• **Arthur Beiser, S RaiChoudhury, ShobhitMahajan, (2009), Concepts of Modern Physics, 6th Edition, Tata-McGraw Hill. ISBN- 9780070151550.**
• **Dr. N. Subrahmanyam, BrijLal and Dr. M. N. Avadhanulu (2010) A Text book ofOptics, 24 Edition, S. Chand Higher Academy. ISBN 8121926114**

- **B.K Pandey and S. Chaturvedi (2012) Engineering Physics, Cengage Learning, ISBN 9788131517611**

Reference Book (s)
• **Robert Kolenkow, David Kleppner (2007), An Introduction to Mechanics, 1st Edition, Tata-McGraw Hill.**
• **B.B. Laud, Lasers and Non-Linear Optics (2011), 3rd Edition, New Ages International.**
• **William Silfvast (2002), Laser Fundamentals, Cambridge University Press.**
• **David. J. Griffiths (2009), Introduction to Electrodynamics, 3 Edition, PHI Learning.**

Unit-1 Introduction Quantum Mechanics **8 lecture hours**
Wave-Particle duality, de-Broglie waves, Davisson &Germer Experiment (Experimental verification of de-Broglie waves), Heisenberg Uncertainty Principle and its Applications, Schrodinger's wave equations, Particle in a Box.
Unit-2 Optics **8 lecture hours**
Interference- Interference of Light, Bi-prism experiment, interference in thin films, Newton's rings; Diffraction-Single slit, Diffraction grating, Grating spectra, Rayleigh's criterion and resolving power of grating.
Unit-3LASER **8 lecture hours**
Einstein's coefficients, Population Inversion, Three level and four level laser, Laser characteristics, He-Ne laser and applications.
Unit-4 Electromagnetics **8 lecture hours**
Displacement current, Maxwell's Equations (Integral and Differential form), Equation of continuity, EM-Wave equations and its propagation characteristics in free space, Poynting theorem and Poynting vectors.
Unit-5 Magnetism **8 lecture hours**
Origin of magnetization, Orbital and spin magnetic moment, Classification and properties of magnetic materials, Hysteresis curve, soft and hard magnetic materials.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**ENGINEERING PHYSICS LAB**				
Course Code	**BPH151**				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	

Course Outcomes

CO 1	Analyze the physical principle involve in the various instruments and relate them to new applications.
CO 2	Operate CRO and various optical instruments such as- spectrometer, travelling microscope and speedometer.
CO 3	Calculate the physical constants by various methods such as- Planck's constant, wavelength of monochromatic light, angle of prism and realize the accuracy in measurements.
CO 4	Develop the individual and team work for the performance of scientific works.
CO 5	Develop the skill for making scientific graphs, error analysis and measurement technology used in engineering.

Engineering Physics Lab (PHYS BPH 151)

LIST OF EX

PERIMENTS
• **To draw the hysteresis curve (B-H curve) of a given sample of ferromagnetic material and to determine retentivity, coercivity and hysteresis loss.**
• **To determine the frequency of alternating current (AC) mains using Sonometer.**
• **To determine Planck's constant using Light Emitting Diode (LED).**
• **To find the wavelength of monochromatic light with the help of a plane transmissiondiffraction grating and spectrometer.**
• **To Verify the Stefan's law by electrical method.**
• **To determine the wavelength of sodium light by Newton's rings.**
• **To determine the wavelength of He-Ne laser source using diffraction grating.**
• **To determine the resolving power of telescope and to verify the Rayleigh's criterion of resolution.**
• **To determine the low resistance by Carrey Foster's bridge.**
• **To study the characteristics of solar cell.**
• **To calibrate the ammeter and galvanometer with the help of Galvanometer.**
• **To study the polarization of light by reflection and to verify the Brewster's law.**
• **To find the wavelength of monochromatic light with the help of Fresnel's Biprism.**

Name of The Course	**Basic English**			
Course Code	SLBT 1001			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	0	0	2

Course Objectives:
1. To enhance knowledge of English grammar.
2. To help improve English communication skills.
3. To use quantitative methods for problem solving.

Course Outcomes

CO 1	**Construct grammatically correct sentences for effective communication.**
CO 2	Construct grammatically correct sentences for effective communication.
CO 3	Enhance self-awareness for the purpose of self-improvement.
CO 4	Attaining initial knowledge of Quantitative Aptitude for problem solving.

Text Book (s)

SLLL's own text book

Reference Book (s)
1. Practical English Usage - ISBN: 019431197X
2. Learning Spoken English - ©2012 by Lynn Lundquist - ASIN: B0094XNOPW
3. Essential English Grammar: A Self-Study Reference and Practice Book for Elementary
4. 4. Murphy's English Grammar with CD, Murphy, Cambridge University Press.
5. Quicker Maths , M Tyra

6. Quantitative Aptitude, Abhijeet Guha
Unit I: Introduction and Greetings **2 lectures** • Orientation and Ice- breaking Activities • SWOT Analysis
Unit II: English Grammar **4 lectures** • Parts of Speech – Orientation • Parts of Speech (LSRW) • Speaking Skills
Unit III: Quantitative Aptitude **6 lectures**

• Vedic Mathematics • Shortcuts to Calculations • Number Systems

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Exploration with CAS-I
Course Code	BMA 151

Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	2	1

Course Outcomes

CO 1	Describe **the SCILAB code for solving mathematical problem and** utilize **different function loops (if else, while , for) in SCILAB code.**
CO 2	**Write** a SCILAB code of matrix with different operations and **find** a inverse &transpose of a matrix.
CO 3	**Write** a SCILAB code for plotting a graph of 2 dimensional & 3 dimensional figures.
CO 4	**Write** a SCILAB code of expansion of function in Taylor's series & Fourier Serieswith different wave forms.
CO 5	**Write** a SCILAB code for computing double and triple integrals in Cartesian coordinates and **identifying** the critical points of 2-D and 3-D. surface.

List of Experiments

Introduction to Scilab and Basic syntax, Mathematical Operators, Predefined constants, Built in functions at SCILAB platform.
SCILAB -CODE for find addition, subtraction, multiplication and division of two matrices , transpose of a matrix and inverse of a non singular matrix.
SCILAB -CODE for programming -Functions - Loops - Conditional statements - Handling .sci files.
SCILAB -CODE for 2-D : circle, parabola, ellipse and hyperbola and 3-D surfaces: Planes, Sphere, Cylinder, Paraboloid, Ellipsoid, Hyperboloid, cone.
SCILAB -CODE to find expansion of functions in Taylor series.
SCILAB -CODE for Fourier series expansion of different wave forms and comparison with the original function.
SCILAB -CODE for identifying the critical points of 2-D and 3-D. surface.

SCILAB -CODE for computing double integrals in Cartesian coordinates.
SCILAB -CODE for computing triple integrals in Cartesian coordinates.
SCILAB –CODE for computing and plotting grad of scalar point function .
SCILAB –CODE for computing and plotting divergence of vector point functions.
SCILAB –CODE for computing and plotting curl of Vector point functions.

• **To determine the strength of ferrous ions in the given sample of Mohr'ssalt by using KMnO4 as a self-indicator.**
• **To estimate the total permanent Hardness of the given hard water sample. An approximately 0.01M solution of EDTA are provided.**
• **Estimate the amount of Nickel ion in the given sample solution by complex-metrictitration.**
• **To Determine the Alkalinity of a given Water Sample.**
• **To estimate the amount of Zinc in the given solution by using a standard solution of Potassium Ferro cyanide**
• **Estimate the amount of ferrous iron in the whole of the given errous Solution using external indicator**
• **To estimate the amount of Copper present in the given solution using a standard solution by provided hypo solution.**
• **To find out the viscosity of a given liquid using Ostwald's viscometer.**
• **To find out the amount of dissolved oxygen in the given sample of water.**
• **(a)Identify element N, S and Halogen**
(b) Qualitative analysis of carbohydrates, lipids and proteins.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	50	100	100

Name of The Course	Product Design using Graphics			
Course Code	**BTME1002**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	4	2

Course Outcomes

CO 1	**Understand the concept and principles of engineering graphics in product design.**
CO 2	Make isometric and orthographic projection of solids along with free hand sketching
CO 3	Develop a solid model using AutoCAD

CO 4	Make a solid model for a given assembly using AutoCAD.
CO 5	Apply the concepts and techniques learnt in the course to make hands-on project.

COURSE CONTENT

Unit I: Introduction – Understanding the Concept of Product Design 10 lab hours

Fundamentals of Design : Design by Evolution and Design by Innovation, Principles that govern any design, Morphology and Process of Design, Application of Graphics in Design, Engineering Graphics: An Overview, Introduction to Computer Aided Drafting, Lettering, Numerals and Dimensioning.

Unit II: Projection of Solids 13 lab hours

Concept of Projection, Object in four quadrant, 2-D description of quadrants, Orthographic Projection of Solids, Isometric Projection of Solids, Free-hand sketching

Unit III: Solid Modeling 12 lab hours

Division of Engineering Solids- Polyhedra, Regular and Irregular polyhedral, solids of revolution, Geometric Modeling – Wireframe, B-Rep and Solid Modeling, Solid Modelling using AutoCAD

Unit IV: Introduction to Assembly 11 lab hours

Types of assembly drawings, Accepted Norms for Assembly Drawings, Sequences of Preparing the Assembly Drawing, Solid Modeling of assembly

Unit V: Application of Design Concepts for Product Design 10 lab hours

Hands-on Project in Groups: Choose a specific objective for Product Design, Design the Product and Model it using AutoCAD, presentation.

Name of The Course	German-I				
Course Code	GERN-1001				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	

	0	0	2	1

Course Objectives:
• This course focuses on basic linguistic and communicative structures of the German language.
• Students will be introduced to various aspects of German culture and learn to communicate in simple everyday situations and personal interaction.
• The module will adopt an integrated approach to language learning and will emphasize equally all four skills of reading, writing, listening and speaking as well as the acquisition of grammar structures and vocabulary.

- Audio and video materials will also be used to supplement the textbook and to provide students with a better insight into Germany, her culture and the life of her people.

Course Outcomes

CO 1	Interpret simple sentences, and read short sentences and, paragraphs.
CO 2	Apply simple sentences to discuss about their family members, friends etc
CO 3	Develop an understanding of German society and culture.
CO 4	Assess all the four skills viz. reading, writing ,listening and speaking.

Text Book (s)
1. Dengler, Stefanie, Netzwerk A1: 2015
2. Hieber, Wolfgang. Lernziel Deutsch. München: 2005
Reference Book (s)
1. Gick, Cornelia, Momentmal, Grundstufenlehrwerk Deutsch als Fremdsprache.M: 2003
2. Maria Dallapiazza, Eduard von Jan, Til Schonherr.Tangram, Deutsch als Fremdsprache.Berlin: 2005

3. Griesbach, Schulz. Deutsche Sprachlehre für Ausländer. München: 2005.

Unit-1 Introduction	**4 hours**
Begrüssung / Greeting, Nummern/numbers Monate, Wochentage/ Name of months, days	
Unit-2	**2 hours**
Sich vorstellen – Introduction Interviewspiel mit Fragen und Antworten	
Unit-3	**2 hours**
Information zu Ländern, Nationalitäten und ihre Sprachen/Name of countries, nationalitiesand languages.	
Unit-4	**6 hours**
W-fragen/ Questions Nominativ Kasus/ Nominative case Pronomen / pronounsNominative)	
Unit-5	**6 hours**
Regelmäβige Verben / Regular Verbs Verbkonjugation/ Verb conjugation (sein und haben)Landeskunde /History Film –Spielzeugland	

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	COMMUNICATIVE FRENCH-I				
Course Code	**FREN1001**				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	0	0	2	1	

Course Outcomes

CO1	**Interpret simple sentences, and read short sentences and,paragraphs.**
CO2	Apply simple sentences to discuss about their family members, friends etc.
CO3	Develop an understanding of French society and culture.
CO4	Assess all the four skills viz. reading, writing, listening and speaking.

Text Book (s)

1. « Tech French » :Ingrid Le Gargasson, Shariva Naik, Claire Chaize. Goyal Publishers and Distributors Private Ltd, Delhi, 2012. Units 1 & 2.

Reference Book (s)

1. CONNEXIONS 1, Méthode de français, Régine Mérieux, Yves Loiseau, Les ÉditionsDidier, 2004
2. CONNEXIONS 1, Le cahier d'exercices, Régine Mérieux, Yves Loiseau LesÉditions Didier, 2004
3. ALTER EGO 1, Méthode de français, Annie Berthet, Catherine Hugo, Véronique M.Kizirian, Béatrix Sampsonis, Monique Waendendries Hachette livre 2006
4. ALTER EGO 1, Le cahier d'activités, Annie Berthet, Catherine Hugo, BéatrixSampsonis, Monique Waendendries Hachette livre

2006

Unit-1 Introduction Saluer	**08 Lectures**
Saluer - se présenter – demander et dire le prénom et le nom – identifier une personne – demander des nouvelles d'une personne – demander l'age, l'adresse, le numéro de téléphone – Formes de politesse – parler de ses gouts (Audio tape)	
Unit-2Nommer des objets	**08 Lectures**
Nommer des objets – montrer et situer des objets – exprimer la possession – indiquer les couleurs – caractériser un objet – demander et indiquer le prix – montrer et situer des personnes	

Unit-3 Situer un lieu sur un plan	**08 Lectures**
Situer un lieu sur un plan – s'informer sur un lieu – demander son chemin – indiquer ladirection – indiquer le moyen de transport – situer un lieu sur une carte – donner un conseil – week-end à la mer. (Audio tape)	
Unit-4 Demander et donner l'heure	**08 Lectures**
Demander et donner l'heure – indiquer une date – faire une demande polie – demander la profession de quelqu'un – demander des informations. (Audio tape).	

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	COMMUNICATIVE JAPANESE-I				
Course Code	**JAPA1001**				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	0	0	2	1	

Course Objectives:
• **This course is designed for students who have little or no knowledge of Japanese.**
• **It is aimed at developing basic oral and written communicative skills through the study of vocabulary, grammar, and culture.**
• **Japanese is spoken in class as much as possible.**

Course Outcomes

CO1	**Interpret simple sentences, and read short sentences and, paragraphs.**
CO2	Apply simples sentences to discuss about their family members, friends etc.
CO3	Develop an understanding of Japanese society and culture.
CO4	Assess all the four skills viz. reading,writing,listening and speaking.

Text Book (s)

• **Shokyuu Nihongo, Japanese Language Center for International Students, TokyoUniversity of foreign Studies, Japan.**
• **Nihongo Kana nyuu mon, Japan foundation, Japan.**
• **Shin Nihongo no KISO-1, AOTS, 3A Corporation, Japan.**
Reference Book (s)
• **Random House Japanese-English Dictionary**
• **Japanese for Busy people, Video CD , AJALT, Japan.**
•

Unit-1 Introduction KANA NYUUMON	**08 Lectures**
Introduction to Japanese syllabary. Vowels and Consonants, Hiragana, Katakana,& Romaji. Japanese Numerals, Demonstrative pronoun, Greetings, Set phrases – Onegaishimasu – Sumimasen, wakarimasen, Parts of body (look and learn)	
Unit-2IIKATA NO NYUUMON Lectures	**08**
1. Hajimemashite. 2. Honno Kimochi.	
Unit-3 OREI TO SHITSUMON Lectures	08
3. kore wo kudasai. 4. Sochira wa nanjikara nanji made desu ka.	
Unit-4 BUNPOO NO KATA Lectures	**08**
5. Koos	

hienei kimasuka .6. Isshounii kimasenka.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Multivariable Calculus**				
Course Code	BMA101				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	3	1	0	3	

Course Objectives:
• **To present the fundamental concepts of multivariable calculus and to developstudent understanding and skills in the topic necessary for its applications to science and engineering.**
• **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 itsvelocity and acceleration vectors.**
• **A comprehensive understanding of the gradient, including its relationship to level curves (or surfaces), directional derivatives, and linear approximation.**
• **The ability to compute derivatives using the chain rule or total differentials.**
• **The ability to set up and solve optimization problems involving several variables, with or without constraints.**

Course Outcomes

CO1	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 ofthe improper integral and **apply** curvature to find evolutes & involutes.
CO	**use** methods to find limit, continuity, derivatives of multivariable scalar functionsand **relate** derivatives to solve the problems of optimization.

3	
CO 4	**apply** methods to find integrals of multivariable scalar functions and **relate** it tosolve the problems finding areas and volumes.
CO 5	**explain** the three elements of vector differential calculus, **apply** these elements forevaluation of integrals of vector valued functions and **relate** the three important theorems to **evaluate** the problems of integrations.

Text Book (s)
• ***Robert T. Smith and Roland B. Minton,*** **Calculus, 4th Edition, McGraw Hill Education.**
• ***George B. Thomas and Ross L. Finney,*** **Calculus, 9 Edition, Pearson Education**
Reference Book (s)
• ***R. K. Jain and S. R. K. Iyengar,*** **Advanced Engineering Mathematics, 4 Edition,Narosa publishers.**
• ***Michael D. Greenberg,*** **Advanced Engineering Mathematics, 2 Edition, PearsonEducation**

Unit-1 Introduction Module-I **Hours: 6**
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-2Module-II **Hours: 8**
Evolutes and involutes, Rolle's Theorem, Mean value theorems, Taylor's and Maclaurintheorem with remainders; indeterminate forms and, Evaluation of definite and improper integrals; Beta and Gamma functions and their properties.
Unit-3 Module-III **Hours: 9**

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-4 Module-IV **Hours: 9**
Double integrals in Cartesian and Polar coordinates, Change of order of integration, changeof variables (Cartesian to polar), Applications of double integrals to find area and volume, Triple integrals in Cartesian, Aapplications of triple integral to find volume.
Unit-5 Module-V **Hours: 10**
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 (withoutproof& simple problems).

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Universal Human Values and Ethics

Course Code	**UHVE1001**				
Prerequisite	NA				
Corequisite	NA				
Antirequisite	NA				
	L	**T**	**P**	**C**	
	0	0	4	2	

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

Course Outcomes

CO1	Understand the significance of value inputs in a classroom and start applying themin their life and profession
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
CO3	Understand the value of harmonious relationship based on trust and respect in theirlife and profession
CO4	Understand the role of a human being in ensuring harmony in society and nature.
CO5	Distinguish between ethical and unethical practices, and start working out thestrategy to actualize a harmonious environment wherever they work.

Text Book (s)

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

Reference Book (s)

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E. F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W.

Unit-1

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A criticalappraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

Unit-2 Understanding Harmony in the Human Being - Harmony in Myself

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmonyin 'I'
11. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Swasthya

Unit-3 Understanding Harmony in the Family and Society- Harmony inHuman- Human Relationship

Understanding harmony in the Family- the basic unit of human interaction

14. Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*; Trust (*Vishwas*) and Respect (*Samman*) as the foundational values ofrelationship
15. Understanding the meaning of *Vishwas*; Difference betweenintention and competence
16. Understanding the meaning of *Samman*, Difference between respectand differentiation; the other salient values in relationship

17. Understanding the harmony in the society (society being an extension of family): *Samadhan*, *Samridhi*, *Abhay*, *Sah-astitva* as comprehensive Human Goals
18. Visualizing a universal harmonious order in society- Undivided Society (*AkhandSamaj*), Universal Order (*SarvabhaumVyawastha*)- from family to world family!

Unit-4 Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

19. Understanding the harmony in the Nature
20. Interconnectedness and mutual fulfillment among the four orders ofnature- recyclability and self-regulation in nature
21. Understanding Existence as Co-existence (*Sah-astitva*) of mutuallyinteracting units in all-pervasive space
22. Holistic perception of harmony at all levels of existence

Unit-5 Implications of the above Holistic Understanding of Harmony on Professional Ethics

23. Natural acceptance of human values
24. Definitiveness of Ethical Human Conduct
25. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
26. Competence in Professional Ethics:
a) Ability to utilize the professional competence for augmenting universal human order,
b) Ability to identify the scope and characteristics of people-friendly andeco-friendly production systems, technologies and management models
27. Case studies of typical holistic technologies, management modelsand production systems
28. Strategy for transition from the present state to Universal HumanOrder:
a) At the level of individual: as socially and ecologically responsibleengineers, technologists and managers
b) At the level of society: as mutually enriching institutions and organizations

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

I. **Sem**

Name of The Course	**Basic Electrical and Electronics Engineering**			
Course Code	BEC101			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives:
1. To develop solid foundation for further study of electrical and electronics courses
2. To develop the analytical skills for solving the electrical and electronics circuits
3. To learn the utility of basic electronics devices and circuits
4. To understand the basic principles of electrical machines

Course Outcomes

CO1	**Learn and solve different electrical and electronic circuits applying different lawsand theorems.**
CO2	Develop concepts of the logic circuits, minimize and realize the digital circuits
CO3	Implement electronic circuits involving semiconductor diodes and transistors
CO4	Acquire the knowledge about working of transformers, DC, induction andsynchronous machines
CO5	Explain the electrical and electronic circuit theories and verify them throughexperiments

Text Book (s)

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical and Electronics Engineering”, McGrawHill, 20016.

2. V. Mittle and Arvind Mittle, “Basic Electrical Engineering”, McGraw Hill, 2005.

3. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, 9thEdition, Pearson Education, 2007.

4. A. P. Malvino and Donald Leach, “Digital Principles and Applications”, 6th Edition, TataMcGraw Hill, 2006.

Reference Book (s)

1. D. C. Kulshreshtha,”Basic Electrical Engineering”, Tata McGraw Hill, 2009.

2. J. Edminister and M. Nahvi , “Electric Circuits”, 3rd Edition, Tata McGraw-Hill, NewDelhi, 2002.

3. Jacob Millman, Christos C. Halkias, Satyabrata Jit, “Electronics Devices and Circuits”,

4. 3rd Edition, Tata McGraw Hill, 2008

Unit I: Elementary Circuit Analysis **8 lecture hours**

Ohm’s law, KCL, KVL, node voltage analysis, mesh current, circuits with independent sources,Thevenin’s & Norton’s equivalent, maximum power transfer and superposition theorem.

Unit II: Analysis of DC and AC Circuits **7 lecture hours**

RL and RC transients in circuits with DC source, RMS values, the use of phasors for constant frequency sinusoidal sources, steady state AC analysis of a series circuit, parallel circuits, AC power calculations.

Unit-3 Digital Systems **8 lecture hours**

Basic logic circuit concepts, Basic Gates and Universal Gates, representation of numerical data in binary form – Binary to decimal, Octal, Hexadecimal, Boolean algebra, combinational logic circuits- Half adder, full adder, synthesis of logic circuits, minimization of logic circuits.

Unit-4 Semiconductor Devices **7 lecture hours**

Basic diode concepts, ideal diode model, rectifier and wave-shaping circuits, zener diode voltage regulator concepts, bipolar junction transistors, current and voltage relationship, common emittercharacteristics.

Unit-5 Electro-mechanics **10 lecture hours**

Transformers-Ideal and real transformers, Construction, Principle of operation of transformer, E.M.F Equation, Phasor diagram of transformer, Losses, efficiency.

D.C Machines-Construction, principles of rotating DC machines, Types of Excitations-separately excited and self excited (shunt, series and compound) DC machines.

Three phase induction motors-Construction, Principle of operation, synchronous speed, slip, and frequency of rotor emf. Synchronous Machines-construction, principle of operation of synchronous motor and applications.

Continuous Assessment Pattern

Internal Assessment(IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Disruptive Technology				
Course Code					
Prerequisite	Basic programming Languages				
Corequisite					
Antirequisite	No Antirequisite for Disruptive technology				
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:	
i)	Able to outline the strength of various systems and their role in an Industry 4.0world
ii)	Learners will gain deep insights into the fundamental concepts of disruptivetechnologies, their promises as well as their current limitations
iii)	To provide an overview with the fundamental techniques and principles in theexciting growing field of big data analytics.
iv)	To understand the state of the art of Arduino architecture and Sensors
v)	To study about different tools like Python, Tableau and Arduino

Course Outcomes

CO 1	**Understand the drivers and enablers of Industry 4.0 and how organizations and individuals should handle challenges to reap the benefits.**
CO 2	Build the deep insight into the main methods used in machine learning (ML) andartificial intelligence (AI) Utilize the potential impact of Artificial Intelligence and machine learning

CO 3	Acquire fundamental enabling techniques and scalable algorithms to Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
CO 4	Analyse basic IOT protocols and its characteristics to determine the performance
CO 5	Implement the basic IoT applications on embedded platform

Unit-1	**Introduction to Industry 4.0**	**9 hours**
Introduction - Business and IT Trends - Enterprise Software Trends- Key Emerging, Invention & Innovation, Industry 4.0, Industry Evolution, Key Technologies - AR/VR- Digital currencies and Block chain Technology- Intelligent Computing AI and Autonomous Robots– Data Science and Deaplearning- Computer Vision – Industrial IoT.		
Unit-2	**Introduction AI & ML using Python**	**8 Lectures**
Introduction, Scope of AI & ML, Applications, Challenges, Types of learning: Supervised, Unsupervised, Reinforcement. Preparation of Data-Training and Testing. Introduction to Python, Data types, Variables, Conditions, Loops, List, Dictionary, Functions, Class and Objects, NumPy array and operations, Pandas Dataframe and operations, Matplotlib Visualization, Scikit-Learn usage, installation of Anaconda distribution, End-to-end AI & ML Project.		
Unit-3	**Introduction Data Analytics using Tableau**	**9 lecture hours**
Introduction - Big data, challenges, applications, Big data analytics algorithms , Big data system, Big Data Life Cycle, data representation, cleansing, validation, Data analysis and visualization. Tableau Introduction- Installation, connecting to data, Aggregate functions, sorting, Calculation, grouping, Set, Action, Dashboard creation.		
Unit IV: Introduction to Embedded system & arduino 9 lecture hours		

Overview of Embedded Systems, Components of Embedded Systems, about arduino IDE ,Arduino architecture and pin details, Digital & Analog I/O's, Types of Arduino boards, Installing and Setting up the Arduino development environment and simulation software, Software simulation on LED and switches, Software simulation on motor with driver, Software simulation on analog and digital sensors .
Unit V: Introduction to IoT & Programming Concepts 9 lecture hours
Introduction to IoT , IoT Protocols, IoT open source platform and sensors, Basic programming Structure, Variables, constants and data types, Operators, Control Structure, Library Functions, Creating account in open source IoT platform, Configuring and programming Wi-Fi module with MCUs, Interfacing switches and LEDs with MCUs , Interfacing motor and driver with MCUs , Interfacing analog and digital sensors with
controller. Line follower robot.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Psychology and Sociology**				
Course Code	BLE201				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	3	0	0	2	

Course Outcomes

CO1	**Understanding of the basic facts of psychology and their application**
CO2	develop an ability to work in the work groups and communicate effectively
CO3	Develop sociological understanding of Social process, Social Institutions, Socialinequality, stratification, mobility, Social change and Movement.
CO4	Demonstrate scientific understanding of major social themes & social phenomenaof industrial society, that impact engineer's various realms of life.
CO5	Develop leadership quality, potential to analyze and address social issues and totransform young engineers as a very good human being and successful technocrat.

Text Book (s)
1. Bottomore, T B .,Sociology: A Guide to Problems and Literature, London: GeorgeAllen & Unwin1962
2. .Robbins Stephens, Organizational Behaviour. P. Printice Hall International ,Inc.Eaglewood cliffs, 2005,ISBN: 0-13-191435,11th Edition
3. Giddens, A. ., Sociology, Cambridge; Polity ,2000.
4. Horton P B & Hunt C L Sociology, New York: McGraw-Hill Co., 1964.

5. *The Sociology of Social Problems*. Authors, Paul B. Horton, Gerald R. Leslie, RichardF. Larson. Edition, 10, illustrated. Publisher, Prentice Hall, 1991

Reference Book (s)

1. Clifford T. *Morgan*, Richard A *King*, John R Weisz and John Schopler; Introductionto Psychology Published: 19/02/2001; Edition: 7; ISBN: 9780074622506

2. Haralambos, M and Holborn., M. Sociology, London: HaperCollins,2000.

Unit-1 Industrial Psychology 8 hours

Psychology: Meaning, Definition, nature and Scope. Relevance for engineers.

Personality: Definition and types, theories.

Memory: Types, and models, strategies to improve memory

Motivation: Motivational theories and job satisfaction,

Learning: Types, classical conditioning, operand conditioning & observational learning

Unit-2 **8 hours**

Group dynamics and leadership: skills and various types,

Stress ,Stress management Definition, types, causes, strategies to cope with stress
WorkEnvironment: Fatigue and boredom, , accidents and safety

Unit-3 **8 hours**

Introduction To Industrial Sociology: Sociology , Industrial Sociology: Meaningdefinition, Nature , scope, Importance of Sociology for Engineers,

Basic concepts: Interaction, Group, community, Society,

Social Processes: Associative & Dissociative, social process and organizational goals.

Social Institutions: Family ,Marriage, Religion: Functions and dysfunctions & Impact ofIndustrialization

Unit-4 **8 hours**

Social and Industrial Concerns :

Social Inequality, Stratification & Mobility, Impact of Industrialization on Sanskritization Urbanization, Westernization, & Modernization , **Social Change and Social Movements:** Meaning Definition, Genesis, Types, Functions, role in Social transformation.

Industrialization in India and Industrial policy resolution 1956.,

Industrial Disputes: Strikes and lockouts,

Unit-5 8hours

Industrial relations machinery Bi-partite & Tripartite agreement, Labour courts,Industrial tribunals, code of Discipline, Standing orders.,

Social Problems: - Social Disorganization, Unemployment, Deviance, Delinquentbehaviour amongst youth, Crime, , Gender injustice, Child Abuse, Terrorism.

Continuous Assessment Pattern

Internal Assessment(IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Exploration with CAS-II**			
Course Code	BMA252			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	2	**1**

Course Outcomes

CO1	**Demonstrate knowledge of SciLabfor solvingsimple problems.**
CO2	Apply commands of SciLab for solvingasystem of equations including eigen valueproblems.
CO3	Write a program in SciLab to solve ainitial value problems.
CO4	Solve domain related problems using SciLab

	List of Experiments
1	Review of working with Scilab

	Using Scilab for basic operations on matrices including inverse, rank, trace anddeterminant of a matrix.
	Using Scilab to determine LI of vectors and determining solution of system of linearequations.
	Use of Scilab to find the Kernel, range and verification of rank and nullity theorem.
	Matrix representation of any linear transformation, using Scilab to find inverse of alinear transformation.
	Using Scilab to compute the Eigen Values and Vectors and check whether a givenmatrix is symmetric, skew-symmetric, orthogonal.
	Develop a code in Scilab for Gram-Schmidt orthogonalization process.
	Solving an initial value problem of II order and plotting the solution.
	Solving an initial value problem of first and second order (domain specific) andplotting the solution of problem
10	Using Scilab to Solve one dimensional wave equation under specified conditionsand graphing the solution.
11	Using Scilab to solve one dimensional heat equation under specified conditions andgraphing the solution.
12	Using Scilab to Solve a Laplace equation to find the steady state temperature in thesquare plate satisfying specific boundary conditions and graphing isotherms

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	50	100	100

Name of The Course	Application Oriented Programming using Python
Course Code	BCS252
Prerequisite	
Corequisite	

Antirequisite				
	L	**T**	**P**	**C**

Course Outcomes

CO1	**Gain knowledge of Basic Programming with Python**
CO2	Learn to create and use functions and modules.
CO3	Familiarize with python string handling techniques and user defined functions
CO4	Understand and use data structures like Lists, tuples and dictionaries.
CO5	Understand text and csv File handling

List of Experiments	
1	Implement Python script to read person's age from keyboard and display whether heis eligible for voting or not.
2	Implement Python script to find biggest number between two numbers.
3	Implement Python Script to generate prime numbers series up to n
4	Implement Python Script to check given number is palindrome or not.
5	Implement Python script to print factorial of a number.
6	Implement Python Script to perform various operations on string using string libraries
7	Implement Python Script to check given string is palindrome or not.
8	Define a function max_of_three() that takes three numbers as arguments and returnsthe largest of them.
9	Write a program which makes use of function to display all such numbers which aredivisible by 7 but are not a multiple of 5, between 1000 and 2000.
10	Define a function which generates Fibonacci series up to n numbers

11	a) Write a program which accepts a sequence of comma-separated numbers fromconsole and generate a list and a tuple which contains every number.
12	Suppose the following input is supplied to the program:34,67,55,33,12,98. Then, theoutput should be: ['34', '67', '55', '33', '12', '98'] ('34', '67', '55', '33', '12', '98').
13	a) Write Python script to display file contents. b) Write Python script to copy file contents from one file to another.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	50	100	100

Name of The Course	**Basic Electrical and Electronics Engineering Lab**				
Course Code	BEC151				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	0	**0**	**2**	**1**	

Course Outcomes

CO 2	Realize and apply basic theorems in electrical network and circuits.
CO 3	Verify the truth tables of logic Gates.
CO 4	Analyze characteristics of basic diodes and transistors.
CO 5	Realize and verify the working of transformer.

List of Experiments	
1	To verify (i) Kirchoff's current law (ii) Kirchoff's voltage law
2	Verification of Thevenin's Theorem
3	Verification of Norton's Theorem
4	Verification of Maximum power transfer Theorem
5	Verification of Truth table for logic Gates- AND , OR, NOT, NAND, NOR and XORand Half adder Circuit.
6	Study of P-N Junction Diode characteristics.
7	Study of ZENER Diode characteristics.
8	Study of CE characteristics of a Bipolar Junction Transistor.
9	Study of characteristics of FET.
10	Study of open circuit and short circuit tests on a single phase transformer and obtaining its equivalent circuit parameters.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	50	100	100

Name of The Course	**Basic Workshop**
Course Code	
Prerequisite	
Corequisite	

Antirequisite				
	L	**T**	**P**	**C**

Course Outcomes

CO1	**Develop a product using Welding Process.**
CO2	Develop a product out of a given sheet.
CO3	Assemble a product of wood in carpentry shop.
CO4	Create a product using casting and then machining.
CO5	Assemble different components to get final product with the help of welding.

	Course Content

1	**Unit-1 : Welding Shop** a. InstructionofBIstandardsandreadingofweldingdrawings. b. T- Joint c.LapJo int d. TIGWelding e.MIGWelding
2	**Unit-2 : Sheet Metal Shop** 1. MakingofCylinder 2. MakingofCylinderusingdevelopmentofsurface. 3. MakingofSquareboxusingdevelopmentofsurface
3	**Unit-3 : Soldering Shop** Any one of the following a. SolderinganddesolderingofResistorinPCB. b. SolderinganddesolderingofICinPCB. c. SolderinganddesolderingofCapacitorinPCB
4	**Unit-4 : BOSCH TOOLS** Demonstration ofallBOSCHTOOLS

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	50	100	100

Semester-III

Name of The Course	Discrete Mathematics			
Course Code	MATH2005			
Prerequisite				
Co requisite				
Antirequisite				
L	**T**	**P**	**C**	
3	0	0	3	

Course Objectives:
1. This course is aimed at helping students build up an understanding.
2. Cultivate clear thinking and creative problem solving.
3. Thoroughly train in the construction and understanding of mathematical proofs.

4. Exercise common mathematical arguments and proof strategies.
5. Cultivate a sense of familiarity and ease in working with mathematical notation and common concepts in discrete mathematics.
6. Teach the basic results in set theory, logic, combinatorics, and graph theory.
7. Thoroughly prepare for the mathematical aspects of other computer science course.

Course Outcomes

CO1	Explain at high levels concepts and implement basic operations in discrete mathematics.
CO2	Perform combinatorial analysis to solve counting problems.
CO3	Develop mathematical models from computation theory to programming languages throughcombinatorics, graphs.
CO4	Use mathematical reasoning to comprehend and construct mathematical arguments.
CO5	Develop techniques for counting, permutations and combinations.

Text Book (s)
1. Seymour lipschutz, Marc Lars Lipson, Theory and Problems of Discrete MathematicsThird Edition, Schaum's Outline Series McGRAW-HILL.
2. B. Kolman, R.C. Busby, and S.C. Ross, Discrete Mathematical Structures, PHI
3. Kenneth H. Rosen, Discrete Mathematics and Its Applications, McGraw-Hill

Reference Book (s):
1. Swapan Kumar Sarkar, A Textbook of Discrete Mathematics, S.Chand Publication
2. Jean Paul Trembley, R Manohar, Discrete Mathematical Structures with Applicationto Computer Science, McGraw-Hill
3. J.L. Mott, A. Kandelad T.P. Baker, Discrete Mathematics for Computer Scientists andMathematicians, PHI, 2nd Edition, 1999.
4. Liu and Mohapatra, "Elements of Distcrete Mathematics", McGraw Hill

Unit I: MATHEMATICAL LOGIC:	**10 lecture hours**

Introduction, Propositions, Connectives, Truth tables, Tautologies and Contradictions, Equivalences implications, Normal forms, Methods of proof rules of inference for quantifiedpropositions, Mathematical induction.
Unit II: COMBINATORICS: **6 lecture hours**
Basics of counting, Combinations of permutations, Enumeration of combination and permutation,Pigeonhole principle, Inclusion, Exclusion principle, Ordered and unordered portions.
Unit III: RECURRENCE RELATIONS: **8 lecture hours**
Generating function of sequences, Calculating coefficients of generating functions, Recurrence relations, solving recurrence relations by substitutions and generating functions, Method of characteristic roots, Solution of homogenous recurrence relations
Unit IV: GRAPH THEORY: **8 lecture hours**
Basic concepts of graph theory, Diagraph, Paths, Reachability connectedness, Matrix representationof graphs, Subgraphs, Isomorphism trees, Properties, Directed tress, Binary trees.

Unit V: BOOLEAN ALGEBRA: **8 lecture hours**
Post, Hasse diagrams, Lattices, Types of Lattices, Boolean Algebra, Basic theorems, Applications.
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.

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	Data Structures and Algorithms				
Course Code	BCSE2003				
Prerequisite					
Co requisite					
Antirequisite					
	L	**T**	**P**	**C**	
	3	0	0	3	

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

CO 1	Understand the comparison and use of Recursion and Loops
CO 2	Understand the application of linear data structure(s) to solve various problems
CO 3	Understand the application of non linear data structure(s) to solve various problems
CO 4	Understand the shortest path algorithms involving complicated data structures likeGraphs.
CO 5	Become expert in calculating and comparing complexities of various searching andsorting algorithms.

Text Books
1. Horowitz and Sahani, “Fundamentals of Data Structures”, Galgotia Publication
Reference Books

1 Aaron M. Tenenbaum, 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 withapplications”, 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

Unit I:Introduction: Basic Terminology **9 lecture 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 theirrepresentations. 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: Stacks and Queues: Abstract Data Type **8 lecture 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: Trees: Basic terminology **8 lecture 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 Postorder, Threaded Binary trees, Traversing Threaded Binary trees, Huffman algorithm.

Unit IV: Graphs **7 lecture 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: Sorting and Searching **8 lecture hours**

Sequential search, Binary Search, Comparison and Analysis Internal Sorting: Insertion Sort,
Selection, Bubble Sort, Shell sort.

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 onthe areas covered in the course and patents filed in the areas covered in the course.

Continuous Assessment Pattern:

Theory			Practical	
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**
20	15	30	15	20

Name of The Course	Data Structures and Algorithms Lab				
Course Code	**BCSE2007**				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	0	**0**	**2**	**1**	

Course Objectives:

Understand the data structure shortest path algorithms involving complicated data structures like Graphs.

Course Outcomes

CO 1	**Understand the comparison and use of Recursion and Loops.**
CO 2	Understand the application of linear data structure(s) to solve various problems.
CO 3	Understand the application of non-linear data structure(s) to solve various problems.
CO 4	Understand the shortest path algorithms involving complicated data structures like Graphs.
CO 5	Become expert in calculating and comparing complexities of various searching and sorting algorithms.

Text Book
1. Cormen T.H., Leiserson, C.E., Rivest, R.L., and C. Stein. Introduction to Algorithms,MIT Press, Second Edition (Indian reprint: Prentice-Hall), 2013.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson, 4thEdition, 2014.

3.

References

1. "Aaron M. Tenenbaum, YedidyahLangsam and Moshe J. Augenstein “Data StructuresUsing C and C++” , PHI, 1996."

2. Jean Paul Trembley and Paul G. Sorenson, “An Introduction to Data Structures withapplications”, McGraw Hill, 2007.

3. R. Kruse, “Data Structures and Program Design in C++”, Pearson Education, 2000.

List of Experiments

1. a) Write a Program to implement linear search algorithm.

b) Write a Program to implement binary search algorithm.

2. Write a Program to Implement Singly Linked List and its operations.

3. a) Write a Program to Implement Stack Operations by using Array.

b) Write a Program to Implement Stack Operations by using Linked List.

4. a) Write a program that uses stack operations to convert a given infix expression into its postfix.

b) Write a program that uses stack operations to evaluate given postfix expression.

5. a) Write a Program to implement the operations of Queue using array. b) Write a Program to implement the operations of Queue using linked list.

6. Write a Program to Implement Circular Queue Operations by using Array.
7. Write a Program to Sort the set of element s by using Quick Sort. iii) Merge Sort.
8. Write a Program to Implement All functions of a Dictionary by using Hashing.
9. Write a Program to Implement the Binary Search Tree Operations.
10. Write a Program to Perform the Tree Traversal Techniques by using Iterative Method
11. Write a Program to Perform the Tree Traversal Techniques by using recursion.
12. Write a program to Implement Insertion and Deletion Operations on AVL Trees
13. Write a program for implementing the following graph traversal algorithms: Depth First Search b) Breadth First Search.

Continuous Assessment Pattern:

Theory			**Practical**	
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**

20	15	30	15	20

Name of The Course	Database Management Systems
Course Code	BCSE2011
Prerequisite	Structures and Algorithms", "Discrete Mathematics"
Corequisite	"C-Programming"
Antirequisite	

	L	**T**	**P**	**C**
	3	0	0	3

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

CO 1	Learn knowledge of ER Modeling.
CO 2	Apply programming concepts using DDL and DML commands in SQL.
CO 3	Understand the storage system in Relational Database and imposing security.
CO 4	Able to remove various anomalies from databases.
CO 5	Understanding of transaction process.

Text Book (s)	
1	"Database system concepts" Henry F Korth, Abraham Silberschatz, S. Sudurshan, McGraw- Hill

Reference Book (s):	
1	T2. Date C J, " An Introduction to Database Systems", Addision Wesley
2	T3. Elmasri, Navathe, " Fundamentals of Database Systems", Addision Wesley
3	T4: O'Neil, Databases, Elsevier Pub.
4	T5: Leon & Leon,"Database Management Systems", Vikas Publishing House
5	T6: Bipin C. Desai, " An Introduction to Database Systems", Gagotia Publications
6	T7: Majumdar & Bhattacharya, "Database Management System", TMH (14)
7	T8: Ramkrishnan, Gehrke, " Database Management System", McGraw Hill

Unit I: Introduction	**9 lecture 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.	
Module II: Relational data Model and Language	**9 lecture 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	
Module III: Data Base Design & Normalization	**10 lecture 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.

Module IV: Transaction Processing Concept **6 lecture 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.

Module V: Concurrency Control Techniques **6 lecture hours**

Concurrency control, Locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation based protocol, multiple granularity, Multi version schemes, Recovery with concurrent transaction, case study of Oracle.

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	Database Management Systems Lab

Course Code	BCSE2014			
Prerequisite				
Co requisite				
Antirequisite				
L	**T**	**P**	**C**	
3	0	0	3	

Course Objectives:

- To understand design of ER Diagrams and represent using Relational model

• To understand the concept of normal forms in the design of databases.
• To comprehend the structure of SQL Queries to retrieve data from the databases

Course Outcomes

CO 1	Apply ER concepts to design databases.
CO 2	Apply programming concepts using DDL and DML commands in SQL.
CO 3	Design simple database using a tool and implement it using SQL.
CO 4	Apply all constrains to develop a business application using cursors, triggers and stored procedures.
CO 5	Design the storage structures and indexed structures

Text Book (s)
"Data base System Concepts", Silberschatz, Korth, McGraw Hill, V edition.
The UNIX Programming Environment, B.W. Kernighan & R. Pike, Prentice Hall of India, Sixth Edition, 2013.

List of Experiments

Write the

queries for Data Definition and Data Manipulation Language.

Write SQL queries using Comparison operators (=,<,>,etc).
Write SQL queries using Logical operators.
Write SQL query using SQL Operators.
Write SQL queries for relational algebra.
Write SQL queries for extracting data from more than one table.
Write SQL queries for sub queries, nested queries.
Write programme by the use of PL/SQL.
Concepts for ROLL BACK, COMMIT & CHECK POINTS.
Create VIEWS, CURSORS and TRGGERS & write ASSERTIONS.
Create FORMS and REPORTS

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Data Communication and Networking**

Course Code	**BCSE2012**			
Prerequisite	Basic Knowledge of Networking and communication			
Co requisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	0	0	2

Course Objectives:

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

Course Outcomes:

CO1	Understand the different networking sub-systems and their functions in atelecommunication 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

Text Book (s)
1. Forouzan, Data Communications and Networking, McGraw Hill, 4th ed.
2. Tannenbaum, Computer Networks, Pearsoned Education.

Unit I:Introduction Concepts **8 lecture 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 lecture 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 lecture 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 lecture 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 lecture hours**

Electronic mail, WWW, HTTP, SMTP, POP3, IMAP, FTP, SSH.

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	Data Communication & Networking Lab				
Course Code	**BCSE2012**				
Prerequisite					
Co requisite					
Antirequisite					
	L	**T**	**P**	**C**	
	0	0	2	1	

Course Objectives:

This course is designed to help organizations understand Data communication in computer network and learn working of different networking protocols. Student can also have understanding about various routing protocols and how they used in different types of computer
network. This course also describe basic idea about security concern in computer network

CO1	**Understand the basics of various transmission media and networks.**
CO2	Compare and analyze various types of signals and conversion.
CO3	Analyze the various Data Link layer protocols and IEEE standards.
CO4	Analyze the network-layer, transport layer protocols, compression and security mechanism.
CO5	Use various application layer protocols

Text Book (s)

- **Behrouz A. Frozen, Data Communications and Networking, McGraw Hill, 4th edition, 2007.**
- Andrew S. Tanenbaum, Computer Networks, Pearson, Fifth Edition, 2011.

Reference Book (s):

1	**William Stallings, Data and Computer Communications, Pearson,8th Edition, 2007.**
2	Simon Haykin, Michael Moher, Introduction to Analog and Digital Communications, Wiley Publications, Second Edition, 2007.

	List of Experiments
1	Introduction to basic Linux networking commands. (Commands like ipconfig, getmac, tracert, pathping, arp, ping, netstat, finger etc.)
2	Implement bit stuffing and de-stuffing
3	Write a program for hamming code generation for error detection and correction.
4	Implement cyclic redundancy check (CRC).
5	Write a program for congestion control using the leaky bucket algorithm.
6	Implement Dijkstra's algorithm to compute a shortest path through graph.
7	Take a 64-bit plain text and encrypt the same using DES algorithm.
8	Using RSA algorithm encrypts a text data and decrypts the same.
9	Implementation of the link state routing protocols.
10	Implementation of LZW compression and decompression algorithms.

Continuous Assessment Pattern

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course:Java Programming				
Course Code	**BCSE2015**			
Prerequisite				
Co requisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	2	1

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

UNIT – I Introduction to Java, Classes and Objects: History and Evolution of Java – Overview – Data Types - Variables - Arrays – Operators - Control Statements – Classes – Fundamentals – Declaring Objects - Assigning Object Reference Variables - Methods – Constructors - this keyword - Garbage collection - finalize method - Stack Class.

UNIT – II Reusability, Packages, Interfaces and Exception Handling: Overloading Methods - Objects as Parameters - Argument Passing - Returning Objects – Recursion -Access Control – Static – Nested and Inner Classes - Command Line Arguments – Variable Length Arguments. Inheritance – Basics – Super keyword - Multilevel Hierarchy - Method Overriding - Dynamic Method Dispatch - Abstract Classes - final with Inheritance. Packages - Access Protection - Importing Packages – Interfaces. Exception Handling – Multiple catch Clauses- Nested try Statements - Java‘s Built-in Exceptions – User defined Exception – Chained exceptions.

UNIT – III 9 Multithreading, I/O, Applet and String Handling: Java Thread Model - Creating a Thread - Priorities – Synchronization – Inter thread Communication – Suspending - Resuming, and Stopping Threads – Multithreading. Enumerations - Wrappers – Auto boxing – Annotations. I/O Basics - Reading and Writing Console I/O - Print Writer Class - Reading and Writing Files - Applet – Architecture – Skeleton – Display methods - Repainting – Applet tag – Passing parameters - transient and volatile modifiers. String Handling – String Class – methods – String Buffer Class – Methods – String Builder.

UNIT – IV 9 Generics, Collections and Event Handling: Generics – Example – Parameters - General Form- Bounded Types - Wildcard Arguments - Generic Method and Interfaces – Raw Types and Legacy Code - Generic Class Hierarchies. Collection Classes – Array List – Linked List – Hash Set and Maps. Event Handling – Mechanisms -Delegation Event Model - Event Classes - Sources of Events - Event Listener Interfaces – Mouse and Keyboard events - Adapter Classes - Inner Classes.

UNIT – V 9 AWT: AWT Classes - Window Fundamentals - Frame Windows - Frame Window in an Applet – Graphics –Color – Fonts - Font Metrics. AWT Controls - Layout Managers - Menu Bars and Menus -Dialog Boxes - File Dialog - Handling Events by Extending AWT Components.

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.

TEXT BOOKS: 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/

ELCTIVE

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, HashSet 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

Name of The Course	**Cryptographic Fundamentals**			
Course Code	**BCSE2331**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	0	3

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

CO1	Understand the fundamentals of networks security, security architecture, threats andvulnerabilities
CO2	Apply the different cryptographic operations of symmetric cryptographicalgorithms
CO3	Apply the different cryptographic operations of public key cryptography
CO4	Apply the various Authentication schemes to simulate different applications
CO5	Understand various Security practices and System security standards

Text Book (s)

	William Stallings, Cryptography and Network Security: Principles and Practice, PHI3rd Edition, 2006.

Reference Book (s)

1	C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and NetworkSecurity, Wiley India Pvt.Ltd
2	BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
3	Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATECommunication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2

Course Contents:

Unit-1: INTRODUCTION	**9 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: substitutiontechniques, transposition techniques, Steganography.	

Unit II: SYMMETRIC KEY CRYPTOGRAPHY	**9 hours**
Algebraic structures - Modular arithmetic-Euclid's algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipherPrinciples of DES – Strength of DES – Differential and linear cryptanalysis - Block ciphermode of operation – Advanced Encryption Standard - RC4 – Key distribution.	
Unit III : PUBLIC KEY CRYPTOGRAPHY	**9 Hours**
Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRICKEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.	
Unit IV : MESSAGE AUTHENTICATION	**9 Hours**
Authentication requirement – Authentication function – MAC – Hash function – Securityof 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	**9 Hours**
Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEMSECURITY: Intruders – Malicious software – viruses – Firewalls.	
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.

List of Experiments (Introduction to Cryptographic Fundamentals Lab)	
	Demonstration of Symmetric conventional cryptographic techniques
	Demonstration of Symmetric classic cryptographic techniques
	Demonstration of Asymmetric cryptographic techniques
	Demonstration of Hashing and Message digest techniques
	Design and implementation of new cryptographic algorithms
	Demonstration and implementation of secure communication using standard crypto libraries
	Implementation of smart card based server/client applications
	Demonstration of authentication techniques
	Developing cryptographic algorithms for innovative applications

Continuous Assessment Pattern:

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	Software Project Management				
Course Code	PE11				
Prerequisite					
Co requisite					
Antirequisite					
	L	T	P	C	
	3	0			

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

Course Outcomes

CO1	Describe and determine the purpose and importance of project management fromthe 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.

Text Book (s)
Clifford F. Gray, Erik W. Larson, "Project Management: The Managerial Process withMS", Mc Graw Hill

Reference Book (s):

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 Contents:

Unit I: Introduction and Software Project Planning	**8 lecture 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, Estimationmethods, Estimation models, Decision process.	
Module II: Project Organization and Scheduling	**8 lecture hours**
Project Elements, Work Breakdown Structure (WBS), Types of WBS, Functions, Activities andTasks, 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.	
Module III: Project Monitoring and Control	**8lecture 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.
Module IV: Software Quality Assurance and Testing **8 lecture 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.
Module V: Project Management and Project Management Tools **8 lecture 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: 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 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.

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

Continuous Assessment Pattern

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**

20	15	30	15	20	100

Name of The Course	CYBER SECURITY			
Course Code	BSCS2332			
Prerequisite	Network security, System security			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	0	3

Course Objectives:
1. Define the area of cybercrime and forensics.
2. Explain the motive and causes for cybercrime , detection and handling.
3. Investigate Areas affected by cybercrime.
4. Illustrate tools used in cyber forensic
5. Infer legal Perspectives in cyber security

Course Outcomes

CO 1	Define cyber security, cyber law and their roles
CO 2	Identify cyber security cybercrime and forensics.
CO 3	Apply tools and methods used in cyber crime.
CO 4	Integrate the tools and methods used in Cyber Forensics.
CO 5	Comprehend the Security Policies and Cyber Laws.

Text Book (s)

	Sunit Belapure 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

	Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, KLSI. "Introduction to information security and cyber laws". Dreamtech Press. ISBN: 9789351194736, 2015

Reference Book (s)

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

Course Contents:

Unit-1: INTRODUCTION TO CYBERCRIME	**9 hours**

I 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. Cyberoffenses: How Criminals Plan Them: How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

Unit II: CYBERCRIME **9 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
9 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 **9 Hours**

Introduction, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics 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, Antiforensics.

Unit V : SECURITY POLICIES AND CYBER LAWS **9 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: 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.

LIST OF PRACTICALS:
1. Implementation to gather information from any PC's connected to the LAN using whois,port scanners, network scanning, Angry IP scanners etc.
2. Implementation of Symmetric and Asymmetric cryptography.
3. Implementation of Steganography.
4. Implementation of MITM- attack using wireshark/ network sniffers
5. Implementation of Windows security using firewall and other tools
6. Implementation to identify web vulnerabilities, using OWASP project
7. Implementation of IT Audit, malware analysis and Vulnerability assessment and generatethe report.
8. Implementation of OS hardening and RAM dump analysis to collect the Artifacts andother information's.
9. Implementation of Mobile Audit and generate the report of the existing Artiacts.
10. Implementation of Cyber Forensics tools for Disk Imaging, Data acquisition, Data extraction and Data Analysis and recovery

Continuous Assessment Pattern

Theory	**Practical**	

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	(Continuous Assessment) IA	ETE	Total Marks
20	15	30	15	20	100

Name of The Course	Optimization Techniques			
Course Code	BCSE2333			
Prerequisite				
Co requisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

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, 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 unconstrained problems.

Course Outcomes

CO 1	Study and analyze different techniques of optimization and its applications
CO 2	Formulate the design problem in mathematical form which can be solved by suitable optimization algorithm
CO 3	Optimize the constrained and unconstrained design problem
CO 4	Compare the efficiency of different optimization techniques
CO 5	Formulate and solve constrained optimization problems of linear and non-linear programming

Text Book (s)

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

Reference Book (s)

	Bhavikatti S.S. (2010), Fundamental of Optimum Design IN Engineering, New Age International Publishers, ISBN-978-81-224-2591-8

	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 Contents:

Unit I: Introduction to Optimization Methods 4 lecture hours
Introduction, Optimization methods in Engineering, Characteristics of Optimization Models, Application in Engineering Areas, General Method of Optimization, Limitation of Optimization Models
Unit II: Unconstrained Single-variable Optimization 8 lecture hours
Unconstrained Optimization: Optimizing Single-Variable Functions using Analytical Method, Maxima-Minima Method of Optimization, Local and Global Maxima and Minima, Inflection Point, Single –variable Optimization using Bisection (Newton-Raphson) Numerical method
Unit III: UnConstrained Multi-variable Optimization 8 lecture hours
Unconstrained Optimization: Optimizing Multi-Variable Functions using Analytical Method, Multi- variable Optimization using Numerical Method: Univariate Method, Hooke-Jeeves Pattern Search Method
Unit IV: Constrained Optimization for Linear Programming 10 lecture hours
Constrained Optimization, Optimizing Multivariable Functions with Equality Constraint: Direct Substitution Method, Constraint Variations Method, Optimizing Multivariable Functions with Inequality Constraint, Branch and Bound Method
Unit V: Constrained Optimization for Nonlinear Programming 10 lecture hours

Kuhn-Tucker Method with Necessary Conditions and Sufficient Conditions, Constrained Optimization techniques for Nonlinear Programming Problems, Factors Affecting a Constrained Problem, Normalization of Constraints, Exterior Penalty Function Method, Interior Penalty Function Method, Introduction to AI in optimization
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.

Text book, title, author, and year

1. *Taha, H.A., Operations Research: An Introduction, Prentice Hall of India 8th ed.*
2. *Kasana, H.S., Introductory Operation Research: Theory and Applications, Springer Verlag .*
3. *Rardin, Ronald L., Optimization in Operations research, Pearson Education (2005). Ravindran A, Phllips D.T. and Solberg J.J. Operation Research: Principles and Practice, John Wiley .*

Course Contents:

Unit I:Unit -I: Origin & Development of Operations Techniques 4 lecture hours
Nature & Characteristic feature of operation research, Modeling in operation research, Methodology of operation research, Application, use & limitations of operation research.
Unit I Unit-II: Linear Programming Problems 8 lecture hours

Definition of LPP, Canonical and Standard forms of linear programming problems, Mathematical formulation of LPP, Graphical solutions of Linear Programming Problems, Graphical solution of LPP, Simplex method and Artificial method, Two phase method, Big-M Method, Duality theory, Dual Simple method
Unit III: Transportation Problem & Assignment Problem 8 lecture hours
Introduction to Transportation Model, Application of TP Models, Basic feasible solution of a TP, Degeneracy in TP, Different Methods for obtaining initial Basic Feasible solutions, Matrix Minima Method, Row Minima Method, Column Minima Method, Vogel's Approximation Method, Techniques for obtaining Optimal basic feasible solution, Assignment Problems, Assignment Model Formulation, Mathematical Formulation of Assignment Problems, Hungarian Method, Unbalanced Assignment Problems, Multiple Optimum Solution, Traveling-salesman problem
Unit IV: Network Analysis 04 lecture hours
CPM & PERT-Network minimization, shorter route problem, maximal – flow problem, Project scheduling, critical path calculation, PERT Calculation
Unit V: Non-Linear Programming 06 lecture hours

Kuhn-Tucker Method with Necessary Conditions and Sufficient Conditions, Constrained Optimization techniques for Nonlinear Programming Problems, Factors Affecting a Constrained Problem, Normalization of Constraints, Exterior Penalty Function Method, Interior Penalty Function Method, Introduction to AI in optimization
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.

Course Outcome

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

- Understand operation research modeling,
- Formulate and solve linear programming problems.
- Solve the problems on networks models such as Transportation, Assignment,
- Solve the problems of Project Management using CPM and PERT
- Solve Non-linear Programming problems of some kinds.

Continuous Assessment Pattern:

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	Artificial Intelligence			
Course Code	BCSE3042			
Prerequisite				
Co requisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives: The objective of this course is to:

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

Course Outcomes: **At the end of the course student will be able to:**
1. Analyze the dimensions along which agents and environments.
2. Implement agents using search algorithms
3. Develop strategies for agents in games of perfect and imperfect information
4. Ability to handle knowledge representation.
5. Understand Bayesian network to make quantitative (probabilistic) and qualitative inferences
6. Understanding of Pattern Recognition and network.

Text Books:
1. Elaine Rich and Kevin Knight, “Artificial Intelligence”, McGraw-Hill

Reference Books
References:

1. Stuart Russell, Peter Norvig, “Artificial Intelligence – A Modern Approach”, Pearson Education

2. E Charniak and D McDermott, “Introduction to Artificial Intelligence”, Pearson

Education

3. Dan W. Patterson, “Artificial Intelligence and Expert Systems”, Prentice Hall of India,

Unit – I: **Scope of AI:** 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:** 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**: 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**: 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**: 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

LIST OF PRACTICALS
1. Write a programme to conduct uninformed and informed search.
2. Write a programme to conduct game search.
3.Write a program 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 traveling salesman problems.
7.Write a program for 8-queen problem

8. Write a programme to do reinforcement learning in a grid world.

Continuous Assessment Pattern:

		Theory		Practical	
Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	(Continuous Assessment) IA	ETE	Total Marks
20	15	30	15	20	100

Name of The Course	**English Proficiency and Aptitude Building 3**				
Course Code	LLL213				
Prerequisite					
Co requisite					
Antirequisite					
	L	**T**	**P**	**C**	
	2	0	0	2	

Course Objectives:
1. To understand soft-skills pertaining to the industry
2. Enhance formal writing skills
3. To enhance mathematical reasoning skills and apply them for problem solving
.

CO1	**Demonstrate corporate skills required in a real life scenario using simulated environment.**
CO2	Enabling the students to germinate ideas, nurture them and take them to logical conclusion with the help of various resources and real life situations.
CO3	Demonstrate skills required to participate in a simulated environment that helps learners build know and deliver collaboratively.
CO4	Demonstrate effective writing skills for a variety of professional and corporate settings.
CO5	Develop logic framing techniques and various possible solutions
CO6	Stimulating creative and mathematical thinking.

Text Book (s)
SLLL's own text book

Reference Book (s)
1. Communication Skills for Engineers, Mishra, Sunita & C. Muralikrishna, , Pearson
2. Corporate Soft skills, Sarvesh Gulati, 2006.
3. Effective Communication, John Adair , Macmillan Ltd.1997.
4. Developing Communication Skills, Krishna Mohan and Meera Bannerji, MacmillanIndia Ltd. 1990

5. Quicker Maths , M Tyra
6. Quantitative Aptitude, Abhijeet Guha

Unit I: Thematic Activity 15 lectures • Industry Expectations from graduates for employability • Presentation Skills • Team Skills • Dressing Etiquettes • Creativity And Leadership skills • Interactive Communicative Skills • Assessment
Unit II: Quantitative Aptitude 9 lectures • Data Interpretation • Coding, decoding and Direction • Blood Relation • Binary Logic • Cube and Dice • Seating Arrangement

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50		50	100

BCSE2089	Technical Training-I	0	0	4	4	2	-	-	-	70	30	100	Training

BCSE2089	Technical Training-	0	0	4	4	2	-	-	-	70	30	100

	I											

BCSE2090	Industrial/Summer Training - I	0	0	0	0	2	-	-	-	70	30	100	

SEMESTER -IV

Name of The Course	**English Proficiency and Aptitude Building 4**

Course Code	LLL222			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	0	0	2

Course Objectives:
1. Enable students to develop effective Presentation Skills
2. Enable students to develop creative writing skills
3. Enable students to use their aptitude knowledge in decision making

.

Course Outcomes

CO 1	**Enhance skills to effectively deliver formal and informal presentations to a variety of audience in multiple context.**
CO 2	Construct grammatically correct and complex sentences and articulate thoughtsand interpretations effectively.
CO 3	Become accomplished and active readers who appreciate ambiguity and complexity of thoughts and ideas on variety of topics.
CO 4	Developing the skill of skimming irrelevant information from a large data set.
CO 5	Drawing out useful inferences from different types of problem.

Text Book (s)
SLLL's own text book
Reference Book (s)
1. Communication Skills for Engineers, Mishra, Sunita & C. Muralikrishna, , Pearson
2. Corporate Soft skills, Sarvesh Gulati, 2006.
3. Effective Communication, John Adair , Macmillan Ltd.1997.

4. Developing Communication Skills, Krishna Mohan and Meera Bannerji, MacmillanIndia Ltd. 1990

5. Quicker Maths , M Tyra

6. Quantitative Aptitude, Abhijeet Guha.

Unit I: Presentation Skills **6 lectures**

- Presentation Skills – Concepts
- Presentation Skills – Team work
- Presentation Skills – Practice Session

Unit II: Grammar Lectures **7**

- Phrasal Ve

rbs
- SubjectVerbAgreement
- ParallelismandModifiers
- Idioms

and Phrases
- Tenses
- Common errors in English

Unit III: Reading Skills and Creative Writing **5 lectures**

- Reading Comprehension
- Story Writing
- Creative Writing

Unit IV: Quantitative Aptitude **6 lectures**

- Time, Speed, Work
- Seating Arrangement
- Logical Reasoning
- Mensuration

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50		50	100

Name of The Course	**Operating Systems**			
Course Code	BCSE2010			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	
	2	0	2	3

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

Course Outcomes

CO 1	**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 understandingof 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 takecare of deadlocks.

Text Book (s)

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 Book (s)

1. Sibsankar Halder and Alex A Aravind, "Operating Systems", Pearson EducationIndia, 2014.

2. Harvey M Dietel, " An Introduction to Operating System", Pearson Education, 1990.

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.

Unit-2 PROCESS MANAGEMENT 6 hours.

Process Concept, Process Scheduling, Inter process Communication, Process Synchronization.

Unit-3 SCHEDULING AND DEADLOCK MANAGEMENT

6 hours

CPU Scheduling Algorithms, Deadlock Prevention, Deadlock Avoidance, Recovery fromDeadlock.

Unit-4 STORAGE MANAGEMENT 6 hours

Swapping, Contiguous Memory Allocation, Segmentation, Paging, Demand Paging, Page Replacement.

Unit-5 STORAGE STRUCTURE 6 hours

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.

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	Design & Analysis of Algorithms			
Course Code	BCSE3001			
Prerequisite	Data Struture & Algorthms			
	L	T	P	C
	3	0	0	3

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

CO 1	Analyze the complexity of the algorithms and use technique divide and conquer to solve the problems
CO 2	Identify feasible solutions for different problems through greedy method and minimize the solutions space and to solve the problems through dynamic programming.
CO 3	Solve the problems through graph algorithms.
CO 4	Justify that a certain problem is NP-Complete
CO 5	Understand and apply linear programming concepts to real time applications.

Text Book (s)

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

Reference Book (s)

	Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, “Introduction to Algorithms”, The MIT Press, 3rd edition, 2009.

	RCT Lee, SS Tseng, RC Chang and YT Tsai, "Introduction to the Design and Analysis of Algorithms", Mc Graw Hill, 2005.
	Aho, Hopcraft, Ullman, "The Design and Analysis of Computer Algorithms" Pearson Education.

Course Contents:

Unit-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: Tree	**9 hours**
Advanced Data Structures: Red-Black trees, B – trees, Binomial Heaps, Fibonacci Heaps.	
Unit III : 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 : 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 : Computations	**9 Hours**
Selected Topics: Algebraic Computation, String Matching, Theory of NP-completeness, Approximation algorithms and Randomized algorithms.	
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	**Design & Analysis of Algorithms Lab**
Course Code	**BCSE3006**
Prerequisite	
Co requisite	

Antirequisite				
	L	T	P	C
	0	0	2	1

Course Objectives:

To identify and apply the concept of computational intractability.

Course Outcomes

CO 1	To analyze the running time of asymptotic algorithm.
CO 2	To develop algorithms for sorting, searching, insertion and matching.
CO 3	To identify and apply the concept of computational intractability.
CO 4	Apply the algorithms and design techniques to solve problems
CO 5	Analyze the complexities of various problems in different domains.

Text Book (s)

Reference Book (s)
1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, “Introduction to
Algorithms”, Printice Hall of India.
2. RCT Lee, SS Tseng, RC Chang and YT Tsai, “Introduction to the Design and Analysis
of Algorithms”, Mc Graw Hill, 2005.
3. E. Horowitz & S Sahni, "Fundamentals of Computer Algorithms",
4. Berman, Paul,” Algorithms”, Cengage Learning.
5. Aho, Hopcraft, Ullman, “The Design and Analysis of Computer Algorithms” Pearson

Education, 2008.

List of Experiments:

1. Write a program to sort given set of numbers in ascending/descending order using Bubblesort and also search a number using binary search.
2. Write a program to sort given set of numbers in ascending/descending order usingInsertion sort and also search a number using linear search.
3. Write a program to sort given set of numbers in ascending/descending order using Quicksort and any other sorting algorithm. Also record the time taken by these two programs and compare them.
4. Write a program to sort given set of numbers using Heap sort.
5. Write a program to sort given set of numbers Merge Sort.
6. Write a program to sort given set of numbers Counting Sort.
7. Write a program to implement Strassen's Matrix Multiplication by Divide and Conquer
8. Write a program to implement Knapsack using Greedy technique.
9. Write a program to implement Knapsack using Dynamic programming.
10. Write a program to implement Dijkstra's Algorithm.
11. Write a program to implement n-Queen Problem using backtracking.
12. Write a program to implement String Matching using Rabin-Karp algorithm.

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	Computer Graphics				
Course Code	BCSE9002				
Prerequisite	CPPS in C				
Corequisite	NA				
Antirequisite	NA				
		L	**T**	**P**	**C**
		2	0	2	3

Course Outcomes

CO1	**To develop a facility with the relevant mathematics of computer graphics, e.g., 3Drotations are using vector algebra, geometrical transformations and projections using homogeneous co-ordinations.**
CO 2	Apply principles and techniques of computer graphics, e.g., the graphics pipeline, andBresenham algorithm for speedy line and circle generation.
CO 3	Apply computer graphics concepts in the development of computer games, informationvisualization, and business applications.
CO 4	To develop a facility with the relevant mathematics of computer graphics, e.g., 3D rotations are using vector algebra, geometrical transformations and projections usinghomogeneous co-ordinations.
CO 5	Apply principles and techniques of computer graphics, e.g., the graphics pipeline, andBresenham algorithm for speedy line and circle generation.

Introduction and Line Generation 9 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 ofthese algorithms.
Unit-2: Transformations 9 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 CohenSutherland 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-3 : Three Dimensional 9 Hours

3-D geometric primitives, 3-D Object representation, 3-D Transformation, 3-D viewing, projections, 3-D Clipping.
Unit-4 : Curves and Surfaces 9 Hours
Quadric surfaces, Spheres, Ellipsoid, Blobby objects, Introductoryconcepts of Spline, Bspline and Bezier curves and surfaces.
Unit-5 : Hidden Lines and Illumination models 9 Hours
Hidden Lines and Surfaces: Back Face Detection algorithm, Depth buffer method, A-buffermethod, 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: 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.

List of Experiments (Compute

r G r a p h i c s L a b)
Implementation of Algorithms for drawing 2D Primitives – Line (DDA, Bresenham) –all slopes Circle (Midpoint)
2D Geometric transformations – Translation Rotation Scaling Reflection ShearWindow-Viewport
Composite 2D Transformations
3D Transformations - Translation, Rotation, Scaling.
3D Projections – Parallel, Perspective.
Creating 3D Scenes.
Image Editing and Manipulation - Basic Operations on image using any image editingsoftware, Creating gif animated images, Image optimization.
2D Animation – To create Interactive animation using any authoring tool

S.No.	**Professional Elective-II**	L	T	P	C
1	**Internet of Things**	2	0	2	3
2	Data Sciences	2	0	2	3
3	Data Mining and Data Warehousing	2	0	2	3
4	Bio Informatics	2	0	2	3
5	Network Design and Management	2	0	2	3

Name of The Course	**Internet of Things (IOT)**
Course Code	

Prerequisite	Theoretical understanding of basic electronics.				
Co requisite	Understand general theoretical concepts of Internet of Things.				
Antirequisite	None				
	L	**T**	**P**	**C**	
	0	**0**	2	1	

UNIT - I Introduction to Internet of Things –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 – 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 - 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, SMTP Lib. R16 B.TECH CSE.
UNIT - IV IoT Physical Devices and Endpoints - 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 – 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

Name of The Course	**Internet of Things (IOT) Lab**				
Course Code					
Prerequisite	Theoretical understanding of basic electronics.				
Co requisite	Understand general theoretical concepts of Internet of Things.				
Antirequisite	None				
	L	**T**	**P**	**C**	

	0	**0**	2	1

Course Objectives:
To be able to design IOT frameworks for automation system applications using arduino, IntelGalileo Gen 2 and raspberry pi boards.

Course Outcomes

CO 1	Recognize various devices, sensors, and their applications.
CO 2	Apply design concept to IoT solutions.
CO 3	Analyze various IoT architectures.
CO 4	Evaluate design issues in IoT applications.
CO 5	Create IoT solutions for modern problems using sensors, actuators and Devices.

Text Book (s)
Reference Book (s)
1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos,David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a NewAge of Intelligence”, 1st Edition, Academic Press, 2014.
2. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-onApproach)”, 1stEdition, VPT, 2014
3. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to ConnectingEverything”, 1st Edition, Apress Publications, 2013
4. Cuno Pfister, Getting Started with the Internet of Things, O‟Reilly Media, 2011, ISBN:978-1-4493- 9357-1

1. Introduction to various sensors and various actuators & its Application (Students have toprepare Report for the same).
a) PIR Motion Sensor.
b) Rain Drop Sensor.
c) Moisture Sensor.
d) Temperature Sensor.
e) Touch Sensor.
f) Infrared Sensor.
g) Servo Moto.
h) RFID Sensor.
i) Bluetooth Module.
j) Wi-Fi Module.
2. Perform Experiment using Arduino Uno to measure the distance of any object usingUltrasonic Sensor.
3. Create a circuit using Arduino and sensors. Perform experiment using Arduino Uno toLearn Working of Servo Motor
4. Conduct an experiment with a temperature sensor connected to Arduino which is connected to Raspberry Pi.
5. Execute a LED operation with different names remotely wireless operation using Respberry Pi
6. Demonstrate an operation using interfacing angle rotary sensor with Intel Galileo Gen 2 Controlled Brightness of LED

7. Creating a webpage and display the values available through Arduino.
8. Experiment on interfacing temperature sensor with Intel Galileo Gen 2 Controlled when temperature above threshold
9. Experiment on Interfacing Ultrasonic sensor with Intel Galileo Gen 2 and send data to mobile phone
10. Experiment on Body health condition monitor with Respberry Pi and BP, Glucometer etc. sensors.
11. Experiment on Interfacing light sensor with Intel Galileo Gen 2 and sending data to mobile application via Bluetooth.

Theory	**Practical**	

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Data Science**
Course Code	BCSE3056
Prerequisite	PYTHON BASICS, STATISTICS, LINEAR ALGEBRA
Co requisite	DBMS, MACHINE LEARNING.

Antirequisite				
	L	T	P	C
	3	0	0	3

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

CO 1	To acquire good introducing knowledge of the essentials in StatisticalFundamentals used in Data science.
CO 2	An ability to apply algorithmic principles and Programing knowledge using Pythonlanguage on Data Science .
CO 3	Understand the fundamentals of statistics and probability used in data science.
CO 4	To establish basic knowledge about optimization techniques in Data Virtualization.
CO 5	Apply and Implement ML processing principles using Probability and Statistics .

Text Book (s)

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 learningwith applications in R. Springer, 2013.
3	Han, J., Kamber, M., Pei, J. Data mining concepts and techniques. MorganKaufmann, 2011.

Reference Book (s)

1	"Data Science for business", F. Provost, T Fawcett, 2013
2	Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and PresentingData, EMC Education Services , 2015.

3	Murphy, K. Machine Learning: A Probabilistic Perspective. - MIT Press, 2012

Course Contents:

Unit-1: Introduction with Statistical Fundamentals 9 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 9 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 9 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 9 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 learning9 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: 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.

LIST OF PRACTICALS:
1. Write a programme in Python to predict the class of the flower based on availableattributes.
2. Write a programme in Python to predict if a loan will get approved or not.
3. Write a programme in Python to predict the traffic on a new mode of transport.
4. Write a programme in Python to predict the class of user.
5. Write a programme in Python to indentify the tweets which are hate tweets and which arenot.
6. Write a programme in Python to predict the age of the actors.
7. Mini project to predict the time taken to solve a problem given the current status of theuser.

Continuous Assessment Pattern:

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	Data Warehousing and Data Mining
Course Code	**BCSE3004**
Prerequisite	
Co requisite	

Antirequisite				
	L	T	P	C
	0	0	2	1

COURSE OBJECTIVE: To gain knowledge on various Data Mining tasks	Data Warehousing and applicationoriented Data Mining concepts.

COURSE OUTCOME:

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.

Unit –I**: Overview**, 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:** 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:** 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:** 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**: 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: 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.

REFRENCES:
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. I. Singh, Data Mining and Warehousing, Khanna Publishing House
4. Margaret H. Dunham, S. Sridhar,”Data Mining: Introductory and Advanced Topics” Pearson Education 5. Arun K. Pujari, “Data Mining Techniques” Universities Press
6. Pieter Adriaans, Dolf Zantinge, “Data-Mining”, Pearson Education

Data Warehousing & Data Mining Lab:
It is expected that student should implement concept of Data Mining and Warehousing. The open source Data Mining Tools like Rapid Miner, Weka etc. can be used to implement the concept of Data Mining and Warehousing. Some examples are as follows (Subject Teacher may add more):
1. Implementation of OLAP operations

2. Implementation of Varying Arrays
3. Implementation of Nested Tables
4. Demonstration of any ETL tool
5. Write a program of Apriority algorithm using any programming language.
6. Create data-set in .arff file format. Demonstration of preprocessing on WEKA data-set.
7. Demonstration of Association rule process on data-set contact lenses.arff /supermarket (orany other data set) using apriori algorithm.
8. Demonstration of classification rule process on WEKA data-set using j48 algorithm.
9. Demonstration of classification rule process on WEKA data-set using Naive Bayes algorithm.
10. Demonstration of clustering rule process on data-set iris.arff using simple k-means.

Name of The Course	**Bioinformatics**				
Course Code	**PE13**				
Prerequisite					
Co-requisite					
Anti-requisite					
	L	**T**	**P**	**C**	
	3	0	0	3	

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

Course Outcomes

CO 1	Extract information from different types of bioinformatics data (gene, protein, disease, etc.), including their biological characteristics and relationships

CO 2	Employ different data representation models and formats used for bioinformatics data representation, including markup languages such as SBML and CellML, andontologies such as GO ontology

CO 3	Apply the different approaches used for data integration and data management, including data warehouse and wrapper approaches
CO 4	Analyze processed data with the support of analytical and visualization tool
CO 5	Interact with non-bioinformatics professionals, such as biologists and biomedicalresearchers, to better understand their bioinformatics needs for improved supportand service delivery

Text Book (s)
1.D E Krane & M L Raymer, " Fundamental concepts of Bioinformatics", PerasonEducation.
2. Rastogi, Mendiratta, Rastogi, "Bioinformatics Methods & applications, Genomics, Proteomics & Drug Discovery" PHI, New Delhi

Reference Book (s):
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 Contents:

Unit I: Bioinformatics	**9 lecture 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	**8 lecture 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	**7 lecture 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	**8 lecture hours**
Genome, Genomic sequencing, expressed sequence tags, gene expression, transcription factor binding sites and single nucleotide polymorphism. Computational representations of molecular biological 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	**8 lecture hours**
Macromolecular structures, chemical compounds, generic variability and its connection to clinicaldata. Representation of patterns and relationships: sequence alignment algorithms, regular	

expressions, hierarchies and graphical models, Phylogenetics BLAST.
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	**Bioinformatics Lab**
Course Code	
Prerequisite	
Co-requisite	
Anti-requisite	

List of Experiments
1. Get five nucleotide and five protein sequences in FASTA format from NCBI and EMBL.
2. To find out five similar sequences for any nucleotide and protein query sequence usingBLAST and FASTA.
3. Access and use of different online nucleotide and protein alignment tools (Pairwise andMultiple sequence alignment).

4. Genes and Exons identification related search for a given genome sequence in order topredict the gene.
5. ORF prediction in the given nucleotide sequence.
6. Secondary structure prediction for given amino acid sequences of a given protein usingChou Fasman, GOR method and Neural Network method.
7. Visualize tertiary structure of any given protein sequence.
8. Carry out the alignment of genomes of given organisms.
9. Predict the homology model of any protein sequence.

Name of The Course	**Network Design and Management**			
Course Code				
Prerequisite				
Co requisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	**0**	2	1

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

CO 1	Describe Computer network topologies.
CO 2	Describe the various layers of ISO-OSI model
CO 3	Describe different protocols and their features.
CO 4	Distinguish different security techniques.
CO 5	State the various digital signature schemes.

Text Book (s)
Reference Book (s)
1. “Data and Computer Communication” by William Stallings
2. “Data Communication and Networking” by Behrouz A Forouzan
3. “Computer Networks” by Andrew S Tanenbaum
4. “Internetworking with TCP/IP, Volume 1” by Douglas Comer
5. “TCP/IP Illustrated” by W Richard Stevens

Name of The Course	**Network Design and Management Lab**
Course Code	
Prerequisite	
Co requisite	
Antirequisite	

List of Experiments:
1. To Study LAN transmission Medias and Topologies.
2 To Study various commands for webpage design using HTML
3 To study ISO-OSI Model using Simulation Tools.
4 To study TCP-IP model using Simulation Tools.
5 To Study Local Area Network and its specifications (RJ45 connector).
6 To Study Design and analysis of network using Network simulation Tools
7 To study ARP and RARP protocols using Simulation Tools.
8 To study FTP, SMTP and SNMP protocols.
9 To Study Error Correction and Detection Techniques.
10 To Study digital Signatures.

S.No.	**Professional Elective-IV**	L	T	P	C
1	Cloud Application Development	2	0	2	3
2	Adhoc & Sensors Networks	2	0	2	3
3	Statistical Analysis using R	2	0	2	3
4	Block Chain	2	0	2	3

5	Software Defined Network	2	0	2	3

Name of The Course	**Cloud Application Development**
Course Code	**BCSE3061**
Prerequisite	

Co requisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	0	3

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

CO 1	Develop cloud based applications
CO 2	To analyze and trouble shoot the problems while deploying application on cloud
CO 3	Use web application based technologies for developing application using cloud
CO 4	Use public cloud like IBM Blue mix, Amazon AWS, Google cloud platform or Microsoft Azure for developing an application
CO 5	Deploy the application on real cloud

Text Book (s)

	Chris Hay, Brian Prince, “Azure in Action” Manning Publications [ISBN: 978- 1935182481],2010.
	Henry Li, “Introducing Windows Azure” Apress; 1 edition [ISBN: 978-1- 4302-2469-3],2009
	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 Book (s)

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

Course Contents:

Unit-1: Cloud Based Applications	**9 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	**9 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	**9 Hours**
Building Ajax controls, introduction to Javascript using JQuery, 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	**9 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 persistance.	
Unit V : USE CASE 2	**9 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: 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	**Cloud Application Development Lab**
Course Code	**BCSE3061**
Prerequisite	
Co requisite	
Antirequisite	

No.	List of Experiments
1	Install Oracle Virtual box and create two VMs on your laptop.
2	Install Turbo C in guest OS and execute C program.
3	3 Test ping command to test the communication between the guest OSand Host OS
4	Install Hadoop single node setup.
5	5 Hopkinson‘s test on DC shunt machines.

6 Develop hadoop application to count no of characters, no of words andeach character frequency.
7 Develop hadoop application to process given data and produce resultssuch as finding the year of maximum usage, year of minimum usage.
8 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.
9 Establish an AWS account. Use the AWS Management Console tolaunch an EC2 instance and connect to it.
10 Design a protocol and use Simple Queue Service(SQS)to implement thebarrier synchronization after the first phase .
11 Use the Zookeeper to implement the coordination model in Problem ;
12 Develop a Hello World application using Google App Engine.
13 Develop a Guestbook Application using Google App Engine
14 Develop a Windows Azure Hello World application using.
15 15 Create a Mashup using Yahoo! Pipes.

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Adhoc & Sensor Networks**			
Course Code	**BCSE3062**			
Prerequisite	**Wireless Sensor Networks**			
Corequisite	**Interfacing Methods - Protocols**			
Antirequisite	**Requisite Organization**			
L	**T**	**P**	**C**	
3	**0**	0	3	

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

CO 1	Know the basics of Ad hoc and Sensor Networks
CO 2	Apply this knowledge to identify the suitable routing algorithm based on the network and user requirement
CO 3	Apply the knowledge to identify appropriate physical and MAC layer protocols
CO 4	Understand the transport layer and security issues possible in Ad hoc and sensor networks.
CO 5	Be familiar with the OS used in Sensor Networks and build basic modules

Text Book (s)

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.

:	C. Siva Ram Murthy, and B. S. Manoj, "Ad hoc Wireless Networks: Architectures and Protocols ", Prentice Hall Professional Technical Reference, 2016.

Reference Book (s)

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, SubirKumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2018.

Course Contents:

Unit-1: Introduction **9 hours**
Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio
Unit II: MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS **9 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 **9 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 **9 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 **9 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: 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	**Adhoc & Sensor Networks Lab**			
Course Code	**BCSE3062**			
Prerequisite	**Wireless Sensor Networks**			
Corequisite	**Interfacing Methods - Protocols**			
Antirequisite	**Requisite Organization**			
	L	**T**	**P**	**C**
	3	**0**	0	3

Ad Hoc and Sensor Networks Lab Experiments based on syllabus. At least 10 Experiments from the syllabus must be done in the semester.

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	***Statistical Analysis using R***				
Course Code	**BCSE3063**				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	3	**0**	0	3	

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

CO 1	Understand the basic R programming.
CO 2	Understand the basic frequency distribution.
CO 3	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.
CO 4	Interpretation of different error detection and correction.
CO 5	Apply an advanced R programming ecosystem.

Text Book (s)

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

Reference Book (s)

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

Course Contents:

Unit-1: Introduction	**9 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	**9 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	**9 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.	**9 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.	**9 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: 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.	

Continuous Assessment Pattern:

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	Block Chain Technology
Course Code	BCSE3064
Prerequisite	Programming and Data structures, Advanced Data structures andAlgorithm

Co requisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	0	3

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.

CO 1	Familiarise the functional/operational aspects of crypto currency ECOSYSTEM
CO 2	Understand emerging abstract models for Blockchain Technology
CO 3	Analyse the concept of bit coin and mathematical background behind it
CO 4	Apply the tools for understanding the background of crypto currencies
CO 5	Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain

Text Book (s):

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 Book (s)

1	Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and crypto currency, IEEE Symp security and Privacy, 2015
2	J.A.Garay et al, The bitcoin backbone protocol - analysis and applications EUROCRYPT 2015 LNCS VOl 9057, (281-310.

3	R.Pass et al, Analysis of Block chain protocol in Asynchronous networks , EUROCRYPT 2017

Course Contents:

Unit I: Introduction	**9 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	**9 hours**
cryptographic basics for cryptocurrency - a short overview of Hashing, signature schemes, encryption schemes and elliptic curve cryptography	
Unit III: Bitcoin	**9 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	**9 Hours**
Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts.	
Unit V: Block chain-Recent trend	**9 Hours**
Zero Knowledge proofs and protocols in Block chain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves - Zcash.	

LIST OF PRACTICALS
1. Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on Cloud to run. https://github.com/hyperledger/ https://docs.docker.com/get-started/https://console.ng.bluemix.net/docs/services/block chain/index.html.
2.Create and deploy a block chain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your block chain network (https://developer.ibm.com/patterns/create-and-deploy-block chain-network-using- fabric-sdk-java/)

3. Interact with a block chain network. Execute transactions and requests against a block chain network by creating an app to test the network and its rules (https://developer.ibm.com/patterns/interacting-with-a-block chain-network/)

4. Deploy an asset-transfer app using block chain. Learn app development within a Hyperledger Fabric network (https://developer.ibm.com/patterns/deploy-an-asset-transfer-app-using-block chain/).

5. Use block chain to track fitness club rewards Build a web app that uses Hyperledger Fabric to track and trace member rewards (https://developer.ibm.com/patterns/fitness-club-rewards-points-iot-and- retail-integration/)

6. Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Block chain Starter Plan. Use Hyperledger Fabric to invoke chaincode while storing results and data in the starter plan (https://developer.ibm.com/patterns/car-auction-network-hyperledger-fabric-node-sdk- starter-plan/)

7. Develop an IoT asset tracking app using Block chain. Use an IoT asset tracking device to improve a supply chain by using Block chain, IoT devices, and Node-RED (https://developer.ibm.com/patterns/develop-an-iot-asset-tracking-app-using-block chain/)

8. Secure art using block chain digital certificates. Node.js-based auction application can help democratize the art market (https://developer.ibm.com/patterns/securing-art-using-block chain-digital- certificates/)

9. Mini projects such as :

(i) Block chain for telecom roaming, fraud, and overage management. See how communication service providers use block chain to enhance their value chains. https://developer.ibm.com/patterns/block chain-for-telecom-roaming-fraud-and-overagemanagement/

(ii) Use IoT dashboards to analyze data sent from a Block chain network. Build an IoT app and IoT dashboards with Watson IoT Platform and Node-RED to analyze IoT data sent from a Block chain network https://developer.ibm.com/patterns/iot-dashboards-analyze-data-block chain-network/) (iii) Create an Android app with Block chain integration. Build a Block chain enabled health and fitness app with Android and Kubernetes https://developer.ibm.com/patterns/create-an-android-app-with- block chain-integration/

(iv) Create a global finance block chain application with IBM Block chain Platform Extension for VS Code. Develop a Node.js smart contract and web app for a Global Finance with block chain use case https://developer.ibm.com/patterns/global-financing-use-case-for-block chain/

(v) Develop a voting application using Hyperledger and Ethereum. Build a decentralized app that combines Ethereum's Web3 and Solidity smart contracts with Hyperledger's hosting Fabric and Chaincode EVM https://developer.ibm.com/patterns/voting-app-hyperledger-ethereum/

(vi) Create a block chain app for loyalty points with Hyperledger Fabric Ethereum Virtual Machine. Deploy Fabric locally with EVM and create a proxy for interacting with a smart contract through a Node.js web app https://developer.ibm.com/patterns/loyalty-points-fabric-evm/

Continuous Assessment Pattern:

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	Software Defined Network
Course Code	BCSE3065
Prerequisite	
Corequisite	
Antirequisite	

L	T	P	C
3	**0**	0	3

Course Objectives:

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

Course Outcomes

CO 1	Differentiate between traditional networks and software defined networks
CO 2	Understand advanced and emerging networking technologies
CO 3	Obtain skills to do advanced networking research and programming.

CO 4	Learn how to use software programs to perform varying and complex networking tasks
CO 5	Expand upon the knowledge learned and apply it to solve real world problems.

Text Book (s)

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

Reference Book (s)

	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.
	Kreutz, Diego, et al. "Software-defined networking: A comprehensive survey." Proceedings of the IEEE 103.1 (2015): 14-76..
	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
	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
	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.
	https://www.coursera.org/learn/sdn# http://www.cs.fsu.edu/~xyuan/cis5930/

Course Contents:

Unit I: Introduction to SDN	**9 hours**
SDN Origins and Evolution – Introduction – Why SDN? - Centralized and Distributed Control and Data Planes - The Genesis of SDN	
Unit II: SDN Abstractions	**9 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	**9 Hours**
Network Programmability - Network Function Virtualization - NetApp Development, Network Slicing	
Unit IV : SDN Applications And Use Cases	**9 Hours**
SDN in the Data Center - SDN in Other Environments - SDN Applications - SDN Use Cases - The Open Network Operating System 3	
Unit V : SDN'S Future And Perspectives	**9 Hours**
SDN Open Source - SDN Futures - Final Thoughts and Conclusions.	
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.	

Custom Topologies in POX, ODL, Floodlight 3 Click, ONOS,
Northbound – Southbound Interfacing,
ONOS deployment ONOS – OPNFV – SDN Application development 3

Continuous Assessment Pattern:

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

SEMESTER V

Name of The Course	**English Proficiency and Aptitude Building -5**
Course Code	**SLBT3001**
Prerequisite	
Co requisite	
Antirequisite	

24 sessions of 100 minutes each, 12 hours of online tests	L	T	P	C
	3	0	4	2

Course Objectives:

- Enhance formal writing skills
- To understand soft-skills pertaining to industry

Course Outcomes

CO1	Able to develop a logical thought process related to every aspect of life
CO2	Able to widen the horizon of one's thought process and data analysis skill

CO3	Able to interpret data and convert it into information

Text Book (s)
SLLL own text book
Reference Book (s):
• CommunicationSkillsforEngineers, Mishra,Sunita&C.Muralikrishna,,Pearson
• CorporateSoftskills,SarveshGulati,2006.
• Effective Communication, JohnAdair,MacmillanLtd.1997.
• DevelopingCommunicationSkills,KrishnaMohanandMeeraBannerji,Macmillan IndiaLtd.1990

Name of The Course	**Design & Analysis of Algorithms**			
Course Code	**BCSE3001**			
Prerequisite	Data Structure & Algorithms			
	L	**T**	**P**	**C**
	3	**0**	0	3

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

CO 1	Analyze the complexity of the algorithms and use technique divide and conquer to solve the problems
CO 2	Identify feasible solutions for different problems through greedy method and minimize the solutions space and to solve the problems through dynamic programming.
CO 3	Solve the problems through graph algorithms.
CO 4	Justify that a certain problem is NP-Complete
CO 5	Understand and apply linear programming concepts to real time applications.

Text Book (s)

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

Reference Book (s)

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

Course Contents:

Unit-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: Tree	**9 hours**

Advanced Data Structures: Red-Black trees, B – trees, Binomial Heaps, Fibonacci Heaps.
Unit III : 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 : 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 : Computations **9 Hours**
Selected Topics: Algebraic Computation, String Matching, Theory of NP-completeness, Approximation algorithms and Randomized algorithms.
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	**Design & Analysis of Algorithms Lab**

Course Code	BCSE3006			
Prerequisite				
Co requisite				
Antirequisite				
	L	T	P	C
	0	0	2	1

Course Objectives:

To identify and apply the concept of computational intractability.

Course Outcomes

CO 1	To analyze the running time of asymptotic algorithm.
CO 2	To develop algorithms for sorting, searching, insertion and matching.
CO 3	To identify and apply the concept of computational intractability.
CO 4	Apply the algorithms and design techniques to solve problems
CO 5	Analyze the complexities of various problems in different domains.

Text Book (s)

Reference Book (s)
1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, “Introduction to
Algorithms”, Printice Hall of India.
2. RCT Lee, SS Tseng, RC Chang and YT Tsai, “Introduction to the Design and Analysis
of Algorithms”, Mc Graw Hill, 2005.
3. E. Horowitz & S Sahni, "Fundamentals of Computer Algorithms",
4. Berman, Paul,” Algorithms”, Cengage Learning.
5. Aho, Hopcraft, Ullman, “The Design and Analysis of Computer Algorithms” Pearson
Education, 2008.

List of Experiments:
1. Write a program to sort given set of numbers in ascending/descending order using Bubblesort and also search a number using binary search.
2. Write a program to sort given set of numbers in ascending/descending order usingInsertion sort and also search a number using linear search.
3. Write a program to sort given set of numbers in ascending/descending order using Quicksort and any other sorting algorithm. Also record the time taken by these two programs and compare them.
4. Write a program to sort given set of numbers using Heap sort.
5. Write a program to sort given set of numbers Merge Sort.
6. Write a program to sort given set of numbers Counting Sort.
7. Write a program to implement Strassen's Matrix Multiplication by Divide and Conquer
8. Write a program to implement Knapsack using Greedy technique.
9. Write a program to implement Knapsack using Dynamic programming.

10. Write a program to implement Dijkstra’s Algorithm.
11. Write a program to implement n-Queen Problem using backtracking.
12. Write a program to implement String Matching using Rabin-Karp algorithm.

Continuous Assessment Pattern:

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Software Engineering & Testing Methodologies**			
Course Code	**BCSE3003**			
Prerequisite				
L	**T**	**P**	**C**	
3	**0**	0	3	

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:

CO 1	Understand the key concerns that are common to all software development processes.
CO 2	Able to select appropriate process models, approaches and techniques to manage a given software development process.
CO 3	Able to elicit requirements for a software product and translate these into a documented design.
CO 4	Recognize the importance of software reliability and how we can design dependable software, and what measures are used.
CO 5	Understand the principles and techniques underlying the process of inspecting and testing software and making it free of errors and tolerable.

Text Book (s)

	Software Engineering: A practitioner's Approach, Roger S Pressman, Sixth Edition. McGraw- Hill International Edition, 2005.
	Software Engineering: Ian Summerville, Seventh Edition, Pearson Education, 2004.

Reference Book (s)

	Fundamentals of Software Engineering: Rajib Mall, PHI, 2005.
	Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010.
	Software Engineering: A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008.

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: 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 Engineering & Testing Methodologies Lab**
Course Code	**BCSE3008**

Prerequisite				
	L	T	P	C
	0	0	2	1

Course Objectives:

Course Outcomes

CO 1	Understanding and knowledge of the foundations, techniques, and tools in the areaof software testing and its practice in the industry.
CO 2	Discuss the distinctions between validation testing and defect testing.
CO 3	Understand the principles and need for various types of testing.
CO 4	Describe strategies for generating system test cases.
CO 5	Understand the essential characteristics of tool used for test automation.

Text Book (s)
Reference Book (s)
1. S. Desikan and G. Ramesh, “Software Testing: Principles and Practices”, Pearson Education.
2. Aditya P. Mathur, “Fundamentals of Software Testing”, Pearson Education.
3. Naik and Tripathy, “Software Testing and Quality Assurance”, Wiley
4. K. K. Aggarwal and Yogesh Singh, “Software Engineering”, New Age International Publication.

	Title of Lab Experiments
1.	Demonstration on Manual testing a. Write Programs in „C‟ Language to demonstrate the working of the following constructs: i)do…while ii) while…do iii)if…else iv)switch v)for b. Write a program in "C" language to demonstrate the working of palindrome usingdo…while.
2.	Demonstration on Unit testing a. Create a test plan document for any application (e.g. Library Management System). b. Study of any testing tool (e.g. Win runner). c. Create a test plan document for cellular phone.
3.	Demonstration on Integration testing Take a mini project (e.g. University admission, Placement Portal) and execute it. Duricycle of the mini project create the various testing documents and final test report docu

4.	Demonstration on System testing a.Take any system (e.g. ATM system) and study its system specifications and report thevarious bugs. b. Write down the test cases for any known applications (e.g. Banking Application).
5.	Demonstration on Blackbox testing a. Design a usecase diagram for an ATM system. b. Design a class diagram for an ATM system.

	c. Design a use case diagram for Library system.
6.	Demonstration on White Box testing a. Create various testing document for robot control system. b.“A Program written in „C“ Language for Matrix Multiplication fails” Introspect thecauses for its failure and write down the possible reasons for its failure. c. Write a Program in „C“ Language to demonstrate the working of Addition of diagonalelements in a matrix.
7.	Demonstration on Regression testing a. Study of any web-testing tool (eg. Selenium). b. Study of any bug-tracking tool (eg. Bugzilla, bug bit). c. Study of any test management tool (eg. Test Director). d. Compare different testing tools.
8	Demonstration on Mutation testing Write down the test cases for any known applications (e.g. Banking Application).
9	Demonstration on Alpha testing. Make a Case Based study on the experiment
10.	Demonstration on Beta testing. Make a Case Based study on the experiment
11.	Demonstration on User Acceptance testing. Make a Case Based study on the experiment

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**

20	15	30	15	20	100

Name of The Course	Computer Graphics
Course Code	**BCSE3011**
Prerequisite	

Co requisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives:

This course focuses on 2D and 3D interactive and non-interactive graphics. This course studies the principles underlying the generation and display of 2D and 3D computer graphics. In this course topics include geometric modeling, 3D viewing and projection, lighting and shading, color, and the use of one or more technologies and packages such as OpenGL, and Blender. Course requirements usually include exam and several programming or written homework assignments.

Course Outcomes

CO 1	**To understand the principles, commonly used paradigms and techniques ofcomputer graphics. e.g. the graphics pipeline, and Bresenham's algorithm for speedy line and circle generation.**
CO 2	Be able to understand 2D graphics concepts in the development of computer games,information visualization, and business applications.
CO 3	To develop a facility with the relevant mathematics of 3D graphics like projection,clipping and transformation

CO 4	Be able to understand the representation of non linear shapes. E. g. Curves, hiddensurfaces.
CO 5	Be able to develop animations like motion sequence, morphing and illustratingmodels for lighting/shading.

Text Book (s)

	Donald Hearn and M Pauline Baker, "Computer Graphics C Version", Pearson Education, India; 2 edition 2002.
	Computer Graphics Principles and Practice, Second Edition in C, James D.Foley, Andries Van Dam, Steven K.Feiner, JhonF.Hughes, Addison Wesley, Third Edition, 2014.

Reference Book (s)

	Steven Harrington, "Computer Graphics: A Programming Approach" , McGraw-Hill Inc.,US; 2nd Revised edition edition, 1983.
	David Rogers, "Procedural Elements of Computer Graphics", McGraw Hill Education; 2 edition, 2017.

Unit-1 Introduction	9 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-2Transformations	9 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 Barsky algorithm, Line clipping against non rectangular clip windows;	
Polygon clipping – Sutherland Hodgeman polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Text clipping.	
Unit-3Three Dimensional	9 hours
3-D geometric primitives, 3-D Object representation, 3-D Transformation, 3-D viewing, projections, 3-D Clipping.	

Unit-4Curves and Surfaces 9 hours
Quadric surfaces, Spheres, Ellipsoid, Blobby objects, Introductory concepts of Spline, Bspline and Bezier curves and surfaces.
Unit-5Hidden Lines and Illumination models 9 hours
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 someof the latest products available in the market based on the areas covered in the courseand patents filed in the areas covered in the course.

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

S.No.	**Professional Elective-V**	L	T	P	C
1	Digital Signal Processing	2	0	2	3
2	Object Oriented Analysis & Design	2	0	2	3

3	E-Business	2	0	2	3
4	Network Operating System	2	0	2	3
5	Robotics Process automation	2	0	2	3

Name of The Course	**Digital Signal Processing**			
Course Code				
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	0	3

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

CO 1	Formulate engineering problems in the field of digital signal processing
CO 2	Analyse digital and analog signals and systems
CO 3	Analyse discrete time signals in frequency domain and Design digital filters
CO 4	Identify the need of adaptive filters in communication applications.
CO 5	Apply Architectural features of Digital Signal Processor in various areas.

Text Book (s)

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

Reference Book (s)

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

Course Contents:

Unit-1: Introduction 9 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 9hours
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 9 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 9 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 **9 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: 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	**Object Oriented Analysis & Design**			
Course Code				
Prerequisite	Before you start proceeding with this tutorial, it is assumed that you have basic understanding of computer programmingand related programming paradigms.			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	0	3

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

CO 1	be able to use an object-oriented method for analysis and design
CO 2	be able to analyse information systems in real-world settings and to conduct methods such as interviews and observations
CO 3	know techniques aimed to achieve the objective and expected results of a systems development process
CO 4	know different types of prototyping

CO 5	know how to use UML for notation

Text Book (s)

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

Reference Book (s)

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

Course Contents:

Unit I: UML DIAGRAMS	**9 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	**9 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	**9 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	**9 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	**9 Hours**
Mapping design to code – Testing: Issues in OO Testing – Class Testing – OO Integration Testing –	

GUI Testing – OO System Testing.
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	**Network Operating System**			
Course Code				
Prerequisite	Operating Systems			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**

	3	0	0	3

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

CO1	**To understand basic operating systems features, setup and management.**
CO2	To understand the concepts involved in network operating system: REDHAT
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

Text Book (s)

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 Book (s)

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

Unit-1	**9 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-2 **9 Hours**
Network Operating System: 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-3 **9 Hours**
Connecting to Internet: Network Configuration Tool. Connecting to LAN. DNS. Installing Software: RPM. Meaning, RPM Management Tool. Adding & Removing Packages. Querying RPM Packages.
Unit-4 **9 Hours**
File System: 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-5 **9 Hours**
FTP Server: 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: 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.

Continuous Assessment Pattern

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MT**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**

	E)				
20	15	30	15	20	100

Name of The Course	Robotic Process Automation			
Course Code	BCSE9011			
Prerequisite	None			
		L	**T**	**P**
		3	0	0

The objective of this course is to:
1. Familiarize the students with the basic of Robotics & Automation
2. Design how to automate the process using RPA

Course Outcomes: **At the end of the course student 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.

Text Book (s)
Alok Mani Tripathi, “Learning: Robotic Process Automation”, Kindle Edition.
Reference Book (s)
Richard Murdoch, "Learning: Robotic Process Automation”, Kindle Edition.

Module I
Programming Concepts Basics –: 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,
Module II

Introduction to UiPath: 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 Dialog, Type into, Click, Send HotKey, Write line, Read text File, Write Text File. Types of Button.
Module III
Control Flow: 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
Module 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
Module 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.

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**

	M T E)				

20	15	30	15	20	100

Name of The Course	**English Proficiency and Aptitude Building 4**			
Course Code	LLL312			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	2	0	0	2

Course Objectives:
1. Enable students to develop verbal reasoning skills.
2. Enable students to effectively participate in Group Discussions.
3. Enable students to implement logical approach in problem solving..

Course Outcomes

CO 1	**Interpret the logical structure of an argument and apply the influence of emotional and figurative persuasion in the given argument.**
CO 2	Evaluate an argument objectively and skillfully by analyzing and assessing it.
CO 3	Appreciate and employ the thinking for self, and the development of confidence in

	one's own thinking.
CO 4	Contribute in dialogue in a way that enables the students to experience and reflect upon their own thinking as it is expressed in communication with others.
CO 5	Interpret the data and develop a deeper understanding of the problems.
CO 6	Improves on one's managerial skills by interpreting the ideas effectively.
CO 7	Develop advanced level techniques in problem solving and decision-making ability.
CO 8	Gaining useful insight into the "why" and "how" of a problem and also differentiating between relevant and irrelevant information.

Text Book (s)
SLLL's own text book
Reference Book (s)
1. Communication Skills for Engineers, Mishra, Sunita & C. Muralikrishna, , **Pearson**
2. Corporate Soft skills, Sarvesh Gulati, 2006.
3. Effective Communication, John Adair , Macmillan Ltd.1997.
4. Developing Communication Skills, Krishna Mohan and Meera Bannerji, MacmillanIndia Ltd. 1990
5. Quicker Maths , M Tyra

6. Quantitative Aptitude, Abhijeet Guha

Unit I: Verbal Reasoning 5 lectures • Paragraph Jumbles • Analogies • Critical Reasoning
Unit II: Group Discussion 3 lectures • Group Discussion- Concepts • Group Discussion - Practice
Unit III: Quantitative Aptitude 10 lectures • Crypto Mathematics • Introduction to Algebra • Set Theory • Permutation & Combination • Probability • Pie Chart & Mixed Graphs • Logical Reasoning • Data Sufficiency • Calendar and Clocks

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50		50	100

S i n o .	Professional Elective-III	L	T	P	C
1	Microprocessor	2	0	2	3
2	Quantum Computing	2	0	2	3
3	Soft Computing	2	0	2	3
4	Machine Learning	2	0	2	3
5	Modeling and Simulation	2	0	2	3

Name of The Course	**Microprocessor & Interfacing Lab**				
Course Code	**BCSE3009**				
Prerequisite					
Co requisite					
Antirequisite					
	L	**T**	**P**	**C**	
	0	**0**	2	1	

Course Objectives:
This course facilitates the students to familiar with Micro Processor (MP) based system design which includes hardware, software and interfacing. After completing this course, the student should be able to design a complete Microprocessor based system for a real-world application. Course covers the introduction to basic digital devices and microcomputer components, Architecture and programming of 8086 Microprocessors, Interrupts, peripheral interfacing and direct memory access.

Course Outcomes

CO 1	Write assembly language program for basic mathematical and logical operations.
CO 2	Explain the interrupts of 8086 microprocessor
CO 3	Explain the 8086 based system with programmable peripheral interface, programmable timer interface and Programmable interrupt controller interface.
CO 4	Summarize the concept of peripheral / interfacing
CO 5	Analyze the 8086 based system with DMA.

Text Book (s)

	Brey Barry B. & C R Sarma The Intel Microspore,: Arch, Prog. & Interfacing Pearson Edu.,8thEdition, 2008.

Reference Book (s)

	The x86 processors, Architecture, programming and interfacing. Lyla B Das, Pearson 2010.
	Morris Mano, Digital Design, PHI, 5th edition, 2012.

	List of Experiments
	Arithmetic operation – Multi byte Addition and Subtraction, Multiplication and Division Signed and unsigned Arithmetic operation, ASCII – arithmetic operation.
	Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.
	By using string operation and Instruction prefix: Move Block, Reverse string, Sorting,
	Inserting, Deleting, Length of the string, String comparison.
	Reading and Writing on a parallel port.
	Timer in different modes.
	Serial communication implementation.
	8259 – Interrupt Controller: Generate an interrupt using 8259 timer.
	8279 – Keyboard Display: Write a small program to display a string of characters.
10	Traffic Controller Interface.
1	ADC & DAC Interface.

1	
12	8255- Interface.
13	8251- UART Interfacing

Continuous Assessment Pattern:

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Quantum Theory**
Course Code	
Prerequisite	Linear Algebra, Discrete Mathematics and Computer Science.
Corequisite	
Antirequisite	

	L	T	P	C
	3	0	0	3

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

CO 1	Understand the basic principles of quantum computation and quantum mechanics.
CO 2	Understand the model of quantum computation to design quantum circuits.
CO 3	Analyze the behavior of basic quantum algorithms.
CO 4	Be familiar with basic quantum protocols such as teleportation and superdense coding and quantum cryptography.
CO 5	Simulate a simple quantum error-correcting code.

Text Book (s)

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

Reference Book (s)

	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)
	Pittenger A. O., **An Introduction to Quantum Computing Algorithms (2000).**

Course Contents:

Unit-1: Introduction	**8 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	**8 hours**
The model of quantum computation. Quantum circuits: single qubit gates, multiple qubit gates, design of quantum circuits.	
Unit III : Quantum Algorithms	**10 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	**10 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	**9 Hours**
Introduction, Shor code, Theory of Quantum Error –Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation.	

Name of The Course	**Machine Learning**

Course Code	**BCSE3004**
Prerequisite	

Co requisite					
Antirequisite					
	L	**T**	**P**	**C**	
	0	**0**	2	1	

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
At the end of the course students will be able to:
1. Understand learning systems.
2. Apply learning and classification algorithms.
3. Use regression techniques.
4. Apply unsupervised learning algorithms.
5. Understand reinforcement learning techniques.

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 I: Introduction 8 Lecture 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 2 Learning and Classification 8 Lecture 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 3 Regression

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.

UNIT4 Unsupervised learning 9 Lecture 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-5 Reinforcement Learning 9 Lecture hours
MDPs. Bellman equations, Value iteration and policy iteration, Linear quadratic regulation (LQR). LQG, Q-learning, Value function approximation, Policy search, Reinforce, POMDPs

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

VI SEM

Name of The Course	**Web Technology**
Course Code	**BCSE3012**
Prerequisite	CSE121 - Object Oriented Programming, CSE312 – DatabaseManagement Systems
Corequisite	CSE101 – Computer Programming and Problem Solving
Antirequisite	

L	**T**	**P**	**C**
3	0	2	4

Course Objectives:
• **Acquire knowledge and skills for creation of web site considering both client andserver side.**

- **Gain ability to develop responsive web applications.**
- **Acquire the knowledge to develop dynamic web pages.**
- **Obtain the ability to develop server side application.**

Course Outcomes

CO 1	Understand the web development strategies and identify the problem
CO 2	**Develop the SRS document of the project**
CO 3	**Design a visual representation of web application**
CO 4	**Implement and establish database connectivity with front end.**
CO 5	**Validate the web page using testing methodology**

Text Book (s)

T1. Xavier, C, " Web Technology and Design" , New Age International Publishers.

T2. Uttam/Roy," WEB Technology", Oxford Publication.

Reference Book (s)

R1. IvanBayross -Web Enabled Commercial Application Development Using HTML,DHTML, Java Script, Perl, CGI-2000.

R2. Raj Kamal, "Internet and Web Technologies", McGraw Hill Eduction.

R3. Jackson, "Web Technologies" Pearson Education

R4. Patel and Barik, "Introduction to Web Technology & Internet", Acme Learning.

R5. Steve Suehring, Tim Converse, Joyce Park, "PHP 6 and MySQL 6" WILLEY.

Unit-1 : Introduction to web and HTML **hours**	**8**
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-2: 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-3: JAVA SCRIPT **8 hours**	
Java script: Introduction, documents, forms, statements, functions, objects; Event andevent handling; Error handling; validation.	
Unit-4: 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 javabeans in Jsp, data base action with JSP.
Unit-5: 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: 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 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.

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

S. No.	Professional Elective-IV	L	T	P	C
1	Cloud Application Development	3	0	0	3
2	Adhoc & Sensors Networks	3	0	0	3
3	Statistical Analysis using R	3	0	0	3
4	Block Chain	3	0	0	3
5	Software Defined Network	3	0	0	3

Name of The Course	**Cloud Application Development**
Course Code	**BCSE3061**
Prerequisite	

Co requisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	0	3

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

CO 1	Develop cloud based applications
CO 2	To analyze and trouble shoot the problems while deploying application on cloud
CO 3	Use web application based technologies for developing application using cloud

CO 4	Use public cloud like IBM Bluemix, Amazon AWS, Google cloud platform or Microsoft Azure for developing an application
CO 5	Deploy the application on real cloud

Text Book (s)

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 Book (s)

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

Course Contents:

Unit-1: Cloud Based Applications	**9 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	**9 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	**9 Hours**
Building Ajax controls, introduction to Javascript using JQuery, 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	9 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 persistance.	
Unit V : USE CASE 2	**9 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: 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.	

Continuous Assessment Pattern:

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Adhoc & Sensor Networks**
Course Code	**BCSE3062**

Prerequisite	**Wireless Sensor Networks**			
Corequisite	**Interfacing Methods - Protocols**			
Antirequisite	**Requisite Organization**			
	L	**T**	**P**	**C**
	3	**0**	0	3

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**

CO 1	Know the basics of Ad hoc and Sensor Networks
CO 2	Apply this knowledge to identify the suitable routing algorithm based on the network and user requirement
CO 3	Apply the knowledge to identify appropriate physical and MAC layer protocols
CO 4	Understand the transport layer and security issues possible in Ad hoc and sensor networks.
CO 5	Be familiar with the OS used in Sensor Networks and build basic modules

Text Book (s)

1	Ad Hoc and Sensor Networks — Theory and Applications, Car/os Corderlo Dharma R Aggarwal,World Scienti Publications /Cambridge University Press, March 2018
2	Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas,Elsevier Scien imprint, Morgan Kauffman Publishers, 2005, rp 2017.

3	C. Siva Ram Murthy, and B. S. Manoj, "Ad hoc Wireless Networks: Architectures and Protocols ",Prentice H Professional Technical Reference, 2016.

Reference Book (s)

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

Course Contents:

Unit-1: Introduction 9 h c u r s
Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.
Unit II: MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS 9 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 9 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 9 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 9 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.

Continuous Assessment Pattern:

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	Statistical Analysis using R

Course Code	BCSE3063			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	0	3

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

CO	Understand the basic R programming.

1	
CO 2	Understand the basic frequency distribution.
CO 3	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.
CO 4	Interpretation of different error detection and correction.
CO 5	Apply an advanced R programming ecosystem.

Text Book (s)

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

Reference Book (s)

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

Course Contents:

Unit-1: Introduction	**9 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	**9 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	**9 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. **9 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. **9 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: 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.

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment)**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	Block Chain Technology			
Course Code	BCSE3064			
Prerequisite	Programming and Data structures, Advanced Data structures and Algorithm			
Co requisite				
Antirequisite				
L	**T**	**P**	**C**	
3	**0**	0	3	

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

CO 1	Familiarise the functional/operational aspects of crypto currency ECOSYSTEM
CO 2	Understand emerging abstract models for Blockchain Technology
CO 3	Analyse the concept of bit coin and mathematical background behind it
CO 4	Apply the tools for understanding the background of crypto currencies
CO 5	Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain

Text Book (s):

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 Book (s)

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 Contents:

Unit I: Introduction	**9 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	
cryptographic basics for cryptocurrency - a short overview of Hashing, signature schemes, encryption schemes and elliptic curve cryptography	
Unit III: Bitcoin	
Bitcoin - Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bit coin.	

Unit IV: Ethereum	
Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts.	
Unit V: Block chain-Recent trend	**9 Hours**
Zero Knowledge proofs and protocols in Block chain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves - Zcash.	
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.	

LIST OF PRACTICALS
1. Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on Cloud to run. https://github.com/hyperledger/ https://docs.docker.com/get-started/https://console.ng.bluemix.net/docs/services/block chain/index.html.
2.Create and deploy a block chain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your block chain network (https://developer.ibm.com/patterns/create-and-deploy-block chain-network-using- fabric-sdk-java/)
3. Interact with a block chain network. Execute transactions and requests against a block chain network by creating an app to test the network and its rules (https://developer.ibm.com/patterns/interacting-with-a-block chain-network/)
4. Deploy an asset-transfer app using block chain. Learn app development within a Hyperledger Fabric network (https://developer.ibm.com/patterns/deploy-an-asset-transfer-app-using-block chain/).
5. Use block chain to track fitness club rewards Build a web app that uses Hyperledger Fabric to track and trace member rewards (https://developer.ibm.com/patterns/fitness-club-rewards-points-iot-and- retail-integration/)
6. Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Block chain Starter Plan. Use Hyperledger Fabric to invoke chaincode while storing results and data in the starter plan (https://developer.ibm.com/patterns/car-auction-network-hyperledger-fabric-node-sdk- starter-plan/)
7. Develop an IoT asset tracking app using Block chain. Use an IoT asset tracking device to improve a supply chain by using Block chain, IoT devices, and Node-RED (https://developer.ibm.com/patterns/develop-an-iot-asset-tracking-app-using-block chain/)
8. Secure art using block chain digital certificates. Node.js-based auction application can help democratize the art market (https://developer.ibm.com/patterns/securing-art-using-block chain-digital- certificates/)
9. Mini projects such as :
(i) Block chain for telecom roaming, fraud, and overage management. See how communication service providers use block chain to enhance their value chains. https://developer.ibm.com/patterns/block chain-for-telecom-roaming-fraud-and-overagemanagement/
(ii) Use IoT dashboards to analyze data sent from a Block chain network. Build an IoT app and IoT dashboards with Watson IoT Platform and Node-RED to analyze IoT data sent from a Block chain network https://developer.ibm.com/patterns/iot-dashboards-analyze-data-block chain-network/) (iii) Create an Android app with Block chain integration. Build a Block chain enabled health and fitness app with Android and Kubernetes https://developer.ibm.com/patterns/create-an-android-app-with- block chain-integration/
(iv) Create a global finance block chain application with IBM Block chain Platform Extension for VS Code. Develop a Node.js smart contract and web app for a Global Finance with block chain use case

https://developer.ibm.com/patterns/global-financing-use-case-for-block chain/
(v) Develop a voting application using Hyperledger and Ethereum. Build a decentralized app that combines Ethereum's Web3 and Solidity smart contracts with Hyperledger's hosting Fabric and Chaincode EVM https://developer.ibm.com/patterns/voting-app-hyperledger-ethereum/
(vi) Create a block chain app for loyalty points with Hyperledger Fabric Ethereum Virtual Machine. Deploy Fabric locally with EVM and create a proxy for interacting with a smart contract through a Node.js web app https://developer.ibm.com/patterns/loyalty-points-fabric-evm/

Continuous Assessment Pattern:

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of the Course	Cyber Security				
Course Code	**BCSE3540**				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	3	0	0	3	

Course Objective

This course provides knowledge on the various cyber threats and attacks. To learn the cyber security policies and crime laws.

Course Outcome

CO 1	**Know the fundamental mathematical concepts related to security.**
CO 2	Understand and implement the cryptographic techniques and know the real time applications ofvarious cryptographic techniques.
CO 3	Comprehend the authenticated process and integrity, and its implementation.
CO 4	Know fundamentals of cybercrimes and the cyber offenses.
CO 5	Understand the cyber threats, attacks and vulnerabilities and its defensive mechanism.

Text Book (s)

	Cryptography and Network security, William Stallings, Pearson Education, 7th Edition, 2016.

	Cyber Security, Understanding cyber crimes, computer forensics and legal perspectives, NinaGodbole, Sunit Belapure, Wiley Publications, Reprint 2016.
	Writing Information Security Policies, Scott Barman, New Riders Publications, 2002.

Reference Book (s)

	Cybersecurity for Dummies, Brian Underdahl, Wiley, 2011
	Cryptography and Network security, Behrouz A. Forouzan , Debdeep Mukhopadhyay, Mcgraw Hill Education, 2 nd Edition, 2011.

Unit-1 Introduction 9 hours
Finite Fields and Number Theory: Modular arithmetic – Euclidian Algorithm – PrimalityTesting – Fermat's and Euler's theorem –Chinese Reminder theorem – Discrete Logarithms
Unit-2 Cryp

tographic Techniques 9 hours
Symmetric key cryptographic techniques: Introduction to Stream cipher – Block cipher:DES – AES- IDEA. Asymmetric key cryptographic techniques: principles – RSA – ElGamal - Elliptic Curve cryptography – Key distribution and Key exchange protocols.
Unit-3 Authentication and Cy

bercrimes 9hours
Hash functions – Secure Hash Algorithm (SHA) Message Authentication – Message Authentication Code (MAC) – Digital Signature Algorithm: RSA & ElGamal based Classification of cybercrimes – planning of attacks – social engineering: Human based –Computer based – Cyber stalking – Cybercafé and Cybercrimes
Unit-4 CyberThreats, Attacks and Preve

n t i o n 9 h o u r s	
	Phishing – Password cracking – Key loggers and Spywares – DoS and DDoS attacks –SQL Injection. Identity Theft (ID) : Types of identity theft – Techniques of ID theft.
U n i t - 5 C y b e r s e c u r i t y P o l i c i e s a n d P r a c t i c e s 9	

h o u r s
What security policies are – determining the policy needs – writing security policies – Internet and email security policies – Compliance and Enforcement of policies- Review
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.

LIST OF PRACTICALS
1. Implementation to gather information from any PC's connected to the LAN usingwhois, port scanners, network scanning, Angry IP scanners etc.
2. Implementation of Symmetric and Asymmetric cryptography.
3. Implementation of Steganography.
4. Implementation of MITM- attack using wire shark/ network sniffers
5. Implementation of Windows security using firewall and other tools.
6. Implementation to identify web vulnerabilities, using OWASP project
7. Implementation of IT Audit, malware analysis and Vulnerability assessment and generatethe report.
8. Implementation of OS hardening and RAM dump analysis to collect the Artifacts andother information's.
9. Implementation of Mobile Audit and generate the report of the existing Artiacts.
10. Implementation of Cyber Forensics tools for Disk Imaging, Data acquisition, Dataextraction and Data Analysis and recovery.

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**

20	15	30	15	20	100

Name of The Course	Software Defined Network			
Course Code	BCSE3065			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	**0**	0	3

Course Objectives:

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

Course Outcomes

CO 1	Differentiate between traditional networks and software defined networks
CO 2	Understand advanced and emerging networking technologies
CO 3	Obtain skills to do advanced networking research and programming.
CO 4	Learn how to use software programs to perform varying and complex networking tasks
CO 5	Expand upon the knowledge learned and apply it to solve real world problems.

Text Book (s)

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

Reference Book (s)

	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.
	Kreutz, Diego, et al. "Software-defined networking: A comprehensive survey." Proceedings of the IEEE 103.1 (2015): 14-76..
	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
	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
	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.
	https://www.coursera.org/learn/sdn# http://www.cs.fsu.edu/~xyuan/cis5930/

Course Contents:

Unit I: Introduction to SDN	**9 hours**
SDN Origins and Evolution – Introduction – Why SDN? - Centralized and Distributed Control andData Planes - The Genesis of SDN	
Unit II: SDN Abstractions	**9 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	**9 Hours**
Network Programmability - Network Function Virtualization - NetApp Development, NetworkSlicing	
Unit IV : SDN Applications And Use Cases	**9 Hours**
SDN in the Data Center - SDN in Other Environments - SDN Applications - SDN Use Cases - TheOpen Network Operating System 3	
Unit V : SDN'S Future And Perspectives	**9 Hours**
SDN Open Source - SDN Futures - Final Thoughts and Conclusions.	

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.

For Lab:

Custom Topologies in POX, ODL, Floodlight 3 Click, ONOS,
Northbound – Southbound Interfacing,
ONOS deployment ONOS – OPNFV – SDN Application development 3

Continuous Assessment Pattern:

Theory			Practical		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Digital System Design using VHDL**	
Course Code		
Prerequisite		
Corequisite		
Antirequisite		
	L	**T**
	3	**0**

Course Objectives:

This course instructs the students in the use of VHDL (Very High Speed Integrated Circuit Hardware Description Language) for describing the behaviour of digital systems. VHDL is a standardized design language used in computer/ semiconductor industry. This course will teach students the use of the VHDL language for representation of digital signals, design description, design of arithmetic, combinational, and synchronous sequential circuits.

Course Outcomes

CO 1	Students must be able to simulate and debug digital systems described in VHDL
CO 2	Program any VHDL code for practical implementation
CO 3	Students must demonstrate the use and application of Boolean Algebra in the areas of digital circuit reduction, expansion, and factoring.
CO 4	Students must be able to synthesize complex digital circuits at several level of abstractions
CO 5	Students must be able to implement logic on an FPGA and a CPLD

Text Book (s)

	Fundamental of Digital Logic with VHDL Design, 3th edition, Stephen Brown and Zvonko Vranesic, McGraw-Hill, 2008.
	Mark Zwolinski, Digital System Design with VHDL, Second Edition, Pearson Education.2007

Reference Book (s)

1	A Anandakumar, Digital Electronics, Prentice Hall India Feb 2009.

2	John F Wakerly, Digital Design, Pearson Education, Delhi, 2002. Digital systems design using VHDL, Charles H. Roth, JR.
3	Morris Mano, Digital Design, Pearson Education, Delhi, 2002

Course Contents:

Unit-1	Introduction	**8 hours**
VHDL description of combinational networks, Modeling flip-flops using VHDL, VHDL models for a multiplexer, Compilation and simulation of VHDL code, Modeling a sequential machine, Variables, Signals and constants, Arrays, VHDL operators, VHDL functions, VHDL procedures, Packages and libraries, VHDL model for a counter.		
Unit-2	Designing With Programmable Logic Devices	**9 hours**
Read-only memories, Programmable logic arrays (PLAs), Programmable array logic (PLAs), Other sequential programmable logic devices (PLDs), Design of a keypad scanner. Static RAM, A simplified 486 bus model, Interfacing memory to a microprocessor bus.		
Unit-3	Design Of Networks For Arithmetic Operations	**9 hours**
Design of a serial adder with accumulator, State graphs for control networks, Design of a binary multiplier, Multiplication of signed binary numbers, Design of a binary divider. Representation of floating-point numbers, Floating-point multiplication, Other floating-point operations.		
Unit-4	Digital Design with SM Charts	**9 hours**
State machine charts, Derivation of SM charts, Realization of SM charts. Implementation of the dice game, Alternative realization for SM charts using microprogramming, Linked state machines.		
Unit-5 Designing With Programmable Gate Arrays And Complex Programmable Logic Devices **9 hours**		
Xlinx 3000 series FPGAs, Designing with FPGAs, Xlinx 4000 series FPGAs, using a one-hot state		

assignment, Altera complex programmable logic devices (CPLDs), Altera FELX 10K series COLDs.
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.

LIST OF EXPERIMENTS:
1. Design all gates using VHDL.
2. Write VHDL programs for the following circuits, check the wave forms and the hardwaregenerated a. half adder b. full adder
3. Write VHDL programs for the following circuits, check the wave forms and the hardwaregenerated. a. multiplexer b. demultiplexer
4. Write VHDL programs for the following circuits, check the wave forms and the hardwaregenerated a. decoder b. encoder
5. Write a VHDL program for a comparator and check the wave forms and the hardware generated. 6. Write a VHDL program for a code converter and check the wave forms and thehardware generated.
7. Write a VHDL program for a FLIP-FLOP and check the wave forms and the hardwaregenerated .
8. Write a VHDL program for a counter and check the wave forms and the hardware generated.
9. Write VHDL programs for the following circuits, check the wave forms and the hardwaregenerated. a. register b. shift register 10. Implement any three (given above) on FPGA/CPLDkit

Continuous Assessment Pattern:

Theory			**Practical**		
Internal Assessment (IA)	**Mid Te**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total**

	rm Test (MTE)				Marks
20	15	30	15	20	100

Name of The Course	Advanced Computer Networks			
Course Code				
Prerequisite	Computer Networks			
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

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

CO1	**To understand advanced concepts of physical layer transmission media.**
CO2	Analyze various implementation concepts in congestion control and error detections
CO3	To understand wireless networks and the way access is controlled in these types of networks

CO 4	Analyze various fields of mobile and social networks in different perspectives.
CO 5	Design of cryptographic algorithms for Enterprise networks.

Text Book (s)

1	**Douglas E. Commerce, Internetworking with Principles, Protocols, Architecture. 6th Edition, 2013**
2	Andrew S. Tanenbaum, J.Wetherall, "Computer Networks" 5th Edition, 2010.
3	Thomas D. Nadeau, Ken Gray, SDN: Software Defined Networks 2013

Reference Book (s)

	J.F. Kurose and K.W. Ross, Computer networking: A top-down approach, 6th edition, Adison Wesley.
	L.L. Peterson and BS. Davie, Computer Networks ISE: A System Approach, 5th edition, Morgan Kaufman.
	B.A. Frozen, Data communication & networking, 5th Edition, Tata Mc-Graw Hills.

Unit-1	**9 hours**
Introduction: Internet architecture and performance modeling: Review of Basic Network Architectures: OSI reference model, TCP/IP reference model, ATM reference model. Physical Layer: Different types of transmission media, and errors in transmission: attenuation, noise. Repeaters. Traffic Characterization (CBR, VBR);	
Unit-2	**9 Hours**
Switching Paradigms; Multiplexing. Error Control, Flow Control, FTH, DTH, PON, ISDN, DSL, CATV, SONET, Optical Networks. Link. layer: switching, multiple access, error recovery: Data Link Layer MAC Layer: Local Area Network Technologies: Fast Ethernet, Gigabit Ethernet, IEEE 802.11 WLAN, Bluetooth, Connecting LANs, VLANS, STP.	
Unit-3	**9 Hours**
Network Device, Routing algorithms, BGP, Advanced routing concepts, Router architectures, internetworking: Inter domain Routing, BGP, IPv6, Multicast Routing Protocols, Multi Protocol Label Switching, and Virtual Networks. Transport layer Transport protocols, TCP mechanics, congestion control, resource allocation UDP mechanics. Socket Programming.	
Unit-4	**9 Hours**

Overlay networks: RON, P2P, CDN, Web caching, cross-layer optimizations, Emerging network types: data centre, DTN, 4G mobile networks (LTE, Wi-Max), Online social networks (OSN), wireless sensor networks (WSN) – cross-layer sensor data dissemination
Unit-5 **9 Hours**
Internet Telephony- 1st Generation Protocols, Compression Techniques, 2nd Generation Systems, H.320

Standards, Directory Systems, IRC, LDAP, Integration with the PSTN, Gateways, VoIP Consortium, ETSI TIPHON-Skype-Enterprise Network Security, SNAT, DNAT.
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 The Course	**Advanced Computer Networks LAB**			
Course Code				
Prerequisite	Computer Networks			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	0	0	3

List of Experiments:

1. Configuration and logging to a CISCO Router and introduction to the basic user Interfaces. Introduction to the basic router configuration and basic commands.
2. Configuration of IP addressing for a given scenario for a given set of topologies.
3. Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS Binaries based on client MAC address.
4. Configure, implement and debug the following: Use open source tools for debugging and diagnostics. a. ARP/RARP protocols b. RIP routing protocols c. BGP routing d. OSPF routing protocols e. Static routes (check using net stat)
5. Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterise traffic when the DNS server is up and when it is down. 6. Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client

characterise file transfer rate for a cluster of small files 100k each and a video file of 700mb.Use a TFTP client and repeat the experiment
. 7. Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive mails.
8. Implement Open NMS+ SNMPD for checking Device status of devices in community MIB of a Linux PC. Using yellow pages and NIS/NFS protocols implement Network Attached Storage Controller (NAS). Extend this to serve a windows client using SMB. Characterise the NAS traffic using wireshark.

Theory			**Practical**		
Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Enterprise Resource Planning**			
Course Code	**PE16**			
Prerequisite				
Co-requisite				
Anti-requisite				
		L	**T**	**P**
		3	0	0

Course Objectives:
1. Describe the concept of ERP and the ERP model; define key terms; explain the transitionfrom MRP to ERP; identify the levels of ERP maturity.
2. 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 ERPimplementation.
3. Describe the elements of a value chain, and explain how core processes relate; identifyhow the organizational infrastructure supports core business processes; explain the effect

of a new product launch on the three core business processes.

Course Outcomes

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.

Text Book (s)
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 Book (s):
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 – AConcepts and Practice", PHI.

Course Contents:

Unit I:	**8 lecture hours**

ERP Introduction, Benefits, Origin, Evolution and Structure: Conceptual Model of ERP, theEvolution of ERP, the Structure of ERP.
Unit II: 8 lecture hours
Business Process Reengineering, 16SCSE101084, Data Mining, Online Analytic Processing(OLAP), Product Life Cycle Management (PLM), LAP, Supply chain Management.
Unit III: 8 lecture hours

ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, theChanging ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications.
Unit IV: 8 lecture hours
ERP Implementation Basics, ERP Implementation Life Cycle, Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees.
Unit V: 8 lecture 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: 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 availablein the market based on the areas covered in the course and patents filed in the areas covered inthe course.

Name of The Course	**Enterprise Resource Planning Lab**			
Course Code	**PE16**			
Prerequisite				
Co-requisite				
Anti-requisite				
		L	**T**	**P**
		3	0	0

LIST OF EXPERIMENTS:
This laboratory will be self-exploratory in nature with the undertaking of case studies such asby culling information from the Internet on
a) Pay roll
b) Back office accounting
c) Supply chain
d) Order Processing

e) Shipments
f) Web and Value addition to traditional business
g) Study of packages such as SAP oracle.
At the end of the laboratory a student is expected to make a presentation of his exploration inthe area of e-commerce and ERP

Name of The Course	**Deep Learning**
Course Code	**BCSE**
Prerequisite	
Co requisite	
Antirequisite	
	L
	0

Unit I: Basics: 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:** 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: 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: Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs, Convolutional Neural Networks**:** LeNet, AlexNet.

Unit –V Generative models: 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: 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	**Deep Learning Lab**				
Course Code	**BCSE**				
Prerequisite					
Co requisite					
Antirequisite					
		L	**T**	**P**	**C**
		0	**0**	2	1

Course Objectives: To implement Deep Learning neural networks.

Course Outcomes

CO 1	To Implement Neural Network

CO 2	To analyse Performance of neural network
CO 3	To implement CNN for image classification
CO 4	To implement Alex Net and Google Net.
CO 5	To implement and Analyse RNN and LSTM

List of Experiments:

1	**Implement AND gate using Neural Network.**
2	Implement XOR gate using Neural Network
3	Implement PCA to analyse a Data Table
4	Implement Singular value decomposition
5	Implement Convolution Neural Network
6	Analyse classification performance of CNN.
7	Implement Alex Net
8	Implement Google Net
9	Analyse and Compare the Performance of CNN, Alex Net and Google Net.
10	Implement Recurrent Neural Network for text.
11	Implement LSTM
12	Analyse and compare performance of RNN and LSTM.

Name of The Course	**UI UX**				
Course Code					
Prerequisite					
Corequisite					
Antirequisite					
		L	**T**	**P**	**C**
		3	**0**	0	3

Course Objectives:
By the end of this course, 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:

CO 1	**Understand** the definition and principles of UI/UX Design in order to design with intention.
CO 2	**Achieve** a deep understanding of the entire life-cycle of design—the process, purpose, and tools.
CO 3	**Learn** the basics of HCI (human-computer interaction) and the psychology behind user decision-making.
CO 4	**Discover** the industry-standard tools and specific project deliverables in UI/UX.
CO 5	**Explain** why you made design decisions, through presentations of assignments and your personal portfolio.

Text Book (s)

	A Project Guide to UX Design, Second Edition. Russ Unger and Carolyn Chandler. New Riders. 1249 Eighth Street. Berkeley, CA 94710. (510) 524-2178.
	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.
	User Interface and User Experience (UI/UX) Design. Article (PDF Available), Nov 17, 2017.

Reference Book (s)

	Interaction Design: Beyond Human-Computer Interaction, by Rogers, Sharp, and Preece, ISBN-10 # 0470665769
	The Design of Everyday Things, by Norman, ISBN-10 # 0465050654.

	Sketching User Experiences: Getting the Design Right and the Right Design, by Buxton, ISBN- 10 # 0123740371.

Course Contents:

Unit-1: Introduction	**9 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	**9 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	**9 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	**9 Hours**
UI Principles, UI Analysis, Figma UI Part 1, Color and Font, UI Design in 3 Sprints, Refactoring UI.	
Unit V : Style Guide	9 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: 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 The Course	**UI UX**			
Course Code				
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
		0	2	1

Course Objectives:

To identify and apply the concept of UI Design and UI Interface.

Course Outcomes

CO 1	**Understand** the definition and principles of UI/UX Design in order to design with intention.
CO 2	**Achieve** a deep understanding of the entire life-cycle of design—the process, purpose, and tools.
CO 3	**Learn** the basics of HCI (human-computer interaction) and the psychology behind user decision-making.
CO 4	**Discover** the industry-standard tools and specific project deliverables in UI/UX.
CO 5	**Explain** why you made design decisions, through presentations of assignments and your personal portfolio.

UX Design Module - Research, User flow, Competitor analysis, Persona, Process models, Navigations, Information Architecture, Sketching, Prototyping, Wire framing, Testing, Google Material design etc.

UI Design Module - Photoshop, Illustrator, XD, Sketch, Figma.

UI Development Module - Overview of HTML5, CSS3, JavaScript, Equerry, Bootstrap.

Experiments:
1: Visual design

Visual design
Creating storyboards
Product design
Colour theory
Layouts
Typography
Iconography
Info graphics
Branding design
Image editing
Web template design
Creating UI elements
UI Kits & Image widgets
Mock-up
Basic interaction.

2: HTML5 & CSS3
Design Engineering
Building web pages
Creating responsive layouts
Designing buttons, tooltips etc.
Interactive prototype
MVC pattern
Usability testing
Cross browser compatibility
Creating Visual Mock-ups.
3: JavaScript, J Query, Bootstrap
Basic principles & functionalities.

Continuous Assessment Pattern:

Theory	**Practical**	

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**(Continuous Assessment) IA**	**ETE**	**Total Marks**
20	15	30	15	20	100

Name of The Course	**Design and Innovation**				
Course Code	BOC253				
Prerequisite					
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	3	1	0	3	

Course Objectives:
• To introduce the idea of design thinking in product development • To understand the practice of design thinking • To leverage use of tools for the design process • To learn the application of design thinking for the IT industry • To design using the methodology

Course Outcomes

CO1	Apply design thinking for product development
CO2	Use design thinking tools
CO3	Identify need for products and disruption
CO4	Design innovative products
CO5	Apply design thinking to improve on existing products in IT
CO6	Facilitate design thinking workshop

Text Book (s)

- Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press , 2009.
- Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011 (Unit III).

Reference Book (s)

Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013. (Unit IV)

Unit-1 Introduction Module-I **Hours: 6**
Understanding Design thinking – Shared model in team based design – Theory and practice in Design thinking – Exploring work of Designers across globe – MVP or Prototyping
Unit-2 Module-II **Hours: 8**
Tools for Design Thinking – Real-Time design interaction capture and analysis – Enabling efficient collaboration in digital space – Empathy for design – Collaboration in distributed Design
Unit-3 Module-III **Hours: 9**
Design Thinking in IT – Design Thinking to Business Process modeling – Agile in Virtual collaboration environment – Scenario based Prototyping
Unit-4 Module-IV **Hours: 9**
DT For strategic innovations – Growth – Story telling - Predictability – Strategic Foresight - Change – Sense Making - Maintenance Relevance – Value redefinition - Extreme Competition – experience design - Standardization – Humanization - Creative Culture – Rapid prototyping, Strategy and Organization – Business Model design.
Unit-5 Module-V **Hours: 10**
Design Thinking Work shop Empathize, Design, Ideate, Prototype and Test.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Professional Communication Lab**			
Course Code	BHS251			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	1	0	3

Course Objectives:
• Enhance the Employability and Career Skills of students
• Orient the students towards grooming as a professional
• Make them Employable Graduates
• Develop their confidence and help them attend interviews successfully.

Course Outcomes

CO1	Make effective presentations
CO2	Participate confidently in Group Discussions.
CO3	Attend job interviews and be successful in them.
CO4	Develop adequate Soft Skills required for the workplace

Text Book (s)
1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015 2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
Reference Book (s)
1. 3. Interact English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016. 2. 4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014 3. 5. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

Unit-1 Introduction Module-I Hours: 6
Introduction to Soft Skills– Hard skills & soft skills – employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs
Unit-2Module-II Hours: 8
Self-Introduction-organizing the material – Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice—presenting the visuals effectively – 5 minute presentations
Unit-3 Module-III Hours: 9
Introduction to Group Discussion— Participating in group discussions – understanding group dynamics – brainstorming the topic -– questioning and clarifying –GD strategies-activities to improve GD skills
Unit-4 Module-IV Hours: 9
Interview etiquette – dress code – body language – attending job interviews–telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews
Unit-5 Module-V Hours: 10
Recognizing differences between groups and teams- managing time-managing stress-networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Application Programming using Python**			
Course Code	BCS251			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	1	0	3

Course Objectives:
• To know the basics of algorithmic problem solving • To read and write simple Python programs. • To develop Python programs with conditionals and loops. • To define Python functions and call them. • To use Python data structures –- lists, tuples, dictionaries. • To do input/output with files in Python

Course Outcomes

CO1	Develop algorithmic solutions to simple computational problems
CO2	Read, write, execute by hand simple Python programs.
CO3	Structure simple Python programs for solving problems
CO4	Decompose a Python program into functions.
CO5	Represent compound data using Python lists, tuples, dictionaries

Text Book (s)
• Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think- python/)
• Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

Reference Book (s)
Charles Dierbach, “Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
• John V Guttag, “Introduction to Computation and Programming Using Python’’, Revised and expanded Edition, MIT Press , 2013
• Kenneth A. Lambert, “Fundamentals of Python: First Programs”, CENGAGE Learning, 2012

Unit-1 Introduction Module-I **Hours: 6**
Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.
Unit-2 Module-II **Hours: 8**
Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points
Unit-3 Module-III **Hours: 9**
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.
Unit-4 Module-IV **Hours: 9**
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.
Unit-5 Module-V **Hours: 10**

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Disruptive Technology				
Course Code	BCSE901				
Prerequisite	Basic programming Languages				
Corequisite					
Antirequisite	No Antirequisite for Disruptive technology				
	L	**T**	**P**	**C**	
	3	0	0	3	

Course Objectives:	
i)	Able to outline the strength of various systems and their role in an Industry 4.0world
ii)	Learners will gain deep insights into the fundamental concepts of disruptivetechnologies, their promises as well as their current limitations
iii)	To provide an overview with the fundamental techniques and principles in theexciting growing field of big data analytics.
iv)	To understand the state of the art of Arduino architecture and Sensors
v)	To study about different tools like Python, Tableau and Arduino

Course Outcomes

CO 1	**Understand the drivers and enablers of Industry 4.0 and how organizations and individuals should handle challenges to reap the benefits.**
CO 2	Build the deep insight into the main methods used in machine learning (ML) andartificial intelligence (AI) Utilize the potential impact of Artificial Intelligence and machine learning
CO 3	Acquire fundamental enabling techniques and scalable algorithms to Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
CO 4	Analyse basic IOT protocols and its characteristics to determine the performance
CO 5	Implement the basic IoT applications on embedded platform

Unit-1	**Introduction to Industry 4.0**	**9 hours**
Introduction - Business and IT Trends - Enterprise Software Trends- Key Emerging, Invention & Innovation, Industry 4.0, Industry Evolution, Key Technologies - AR/VR- Digital currencies and Block chain Technology- Intelligent Computing AI and Autonomous Robots– Data Science and Deaplearning- Computer Vision – Industrial IoT.		
Unit-2	**Introduction AI & ML using Python**	**8 Lectures**
Introduction, Scope of AI & ML, Applications, Challenges, Types of learning: Supervised, Unsupervised, Reinforcement. Preparation of Data-Training and Testing. Introduction to Python, Data types, Variables, Conditions, Loops, List, Dictionary, Functions, Class and Objects, NumPy array and operations, Pandas Dataframe and operations, Matplotlib Visualization, Scikit-Learn usage, installation of Anaconda distribution, End-to-end AI & ML Project.		
Unit-3	**Introduction Data Analytics using Tableau**	**9 lecture hours**

Introduction - Big data, challenges, applications, Big data analytics algorithms , Big data system, Big Data Life Cycle, data representation, cleansing, validation, Data analysis and visualization. Tableau Introduction- Installation, connecting to data, Aggregate functions, sorting, Calculation, grouping, Set, Action, Dashboard creation.
Unit IV: Introduction to Embedded system & arduino 9 lecture hours
Overview of Embedded Systems, Components of Embedded Systems, about arduino IDE ,Arduino architecture and pin details, Digital & Analog I/O's, Types of Arduino boards, Installing and Setting up the Arduino development environment and simulation software, Software simulation on LED and switches, Software simulation on motor with driver, Software simulation on analog and digital sensors .
Unit V: Introduction to IoT & Programming Concepts 9 lecture hours
Introduction to IoT , IoT Protocols, IoT open source platform and sensors, Basic programming Structure, Variables, constants and data types, Operators, Control Structure, Library Functions, Creating account in open source IoT platform, Configuring and programming Wi-Fi module with MCUs, Interfacing switches and LEDs with MCUs , Interfacing motor and driver with MCUs , Interfacing analog and digital sensors with controller. Line follower robot.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100