COURSE STRUCTURE

B.TECH.

COMPUTER SCIENCE & ENGINEERING

Honors

Under

Choice Based Credit System (CBCS)

Credits Distributions

Sr. No.	Category	No. of Credits
1	Humanities and Social Sciences (HS)	22
2	Basic Sciences (BS)	24
3	Engineering Sciences (ES)	19
4	Professional Core (PC)	48
5	Professional Elective (PE)	24
6	Open Elective (OE)	18/16
7	Project Work (PW)	45
8	Mandatory Non-Credit Courses (MNC) (4 Courses)	-
Total		**200**

Program Core

S. NO.	CODE	SUBJECT	TEACHING SCHEME				CREDITS	CONTACTS	PRE-REQUISITES
			L	T	P	J			
THEORY									
1.	BCSC 0050	Internet Programming	3	0	0	0	3	3	
2.	BCSC 0051	Computer Programming Using C	3	1	0	0	4	4	
3.	BCSC 0006	Data Structures and Algorithms	3	1	0	0	4	4	
4.	BCSC 0020	Object Oriented Concepts Using Java	3	0	0	0	3	3	
5.	BCSC 0054	Advanced Database Management System	3	1	0	0	4	4	
6.	BCSC 0055	Operating System and Concepts	3	0	0	0	3	3	
7.	BCSC 0057	Software Engineering Methodology	3	0	0	0	3	3	
8.	BCSC 0058	Discrete Mathematical Structures	3	1	0	0	4	4	
9.	BCSC 0059	Algorithms Design & Analysis	3	1	0	0	4	4	
10.	BCSC 0060	Data Communication and Network System	3	0	0	0	3	3	
12.	BCSC 00xx	High Performance Computing	3	0	0	0	3	3	
13.	BCSC 00xx	Theory of Computation	3	1	0	0	4	4	
14.	BCSC 00xx	Emerging Technologies and Business Domains	3	0	0	0	3	3	
17.	BCSC 00xx	Optimization Techniques	3	1	0	0	4	4	
18.	BCSC 00xx	Computer Organization & Microprocessor	3	0	0	0	3	3	
PRACTICALS									
1.	BCSC 0850	Internet Programming Lab	0	0	2	0	1	2	
2.	BCSC 0851	Computer Programming Lab	0	0	4	0	2	4	
3.	BCSC 0805	Data Structures & Algorithms Lab	0	0	2	0	1	2	
4.	BCSC 0810	Object Oriented Concepts Lab	0	0	2	0	1	2	
5.	BCSC 0855	Advanced Database Management System Lab	0	0	2	0	1	2	
6.	BCSC 0856	Operating System and Concepts Lab	0	0	2	0	1	2	
7.	BCSC 0857	Algorithms Design & Analysis Lab	0	0	2	0	1	2	
8.	BCSC 00xx	High Performance Computing Lab	0	0	2	0	1	2	

9.	BCSC 00xx	Computer Organization & Microprocessor Lab	0	0	2	0	1	2	
Total			**45**	**7**	**20**	**0**	**62**	**72**	

PROGRAMME ELECTIVES

S. NO.	CODE	SUBJECT	TEACHING SCHEME				CREDITS	CONTACTS	PRE- REQUISITES
			L	T	P	J			
THEORY									
1.	BCSE 0450	Machine Learning using Python	3	0	0	0	3	3	
2.	BCSE 0451	Full Stack using Web Scripting Technology	2	0	0	0	2	2	
3.	BCSE 0452	Neural Networks and Deep Learning	2	0	0	0	2	2	
4.	BCSE 0453	Cloud Computing	3	0	0	0	3	3	
5.	BCSE 0454	Natural Language Processing	2	0	0	0	2	2	
6.	BCSE 0455	Full Stack using Server Side	3	0	0	0	3	3	
7.	BCSE 0456	Devops	2	0	0	0	2	2	
PRACTICALS									
1.	BCSE 0480	Machine Learning using Python Lab	0	0	2	0	1	2	
2.	BCSE 0481	Full Stack using Scripting Technology Lab	0	0	4	0	2	4	
3.	BCSE 0482	Neural Networks and Deep Learning Lab	0	0	4	0	2	4	
4.	BCSE 0483	Cloud Computing Lab	0	0	2	0	1	2	
5.	BCSE 0484	Full Stack using Server Side Lab	0	0	2	0	1	2	
6.	BCSE 0485	Natural Language Processing Lab	0	0	2	0	1	2	
7.	BCSE 0486	Devops Lab	0	0	2	0	1	2	
Total			**17**	**0**	**18**	**0**	**26**	**35**	

Projects

S. NO.	CODE	SUBJECT	TEACHING SCHEME				CREDITS	CONTACTS	PRE- REQUISITES
			L	T	P	J			
1.	BCSJ 0051	PROJECT – I	0	0	0	0	2	0	
2.	BCSJ 0052	PROJECT II	0	0	0	0	2	0	
3.	BCSJ 0053	PROJECT III	0	0	0	0	2	0	
4.	BCSJ 0054	PROJECT-IV	0	0	0	0	2	0	
5.	BCSJ 0991	INDUSTRIAL TRAINING	0	0	0	0	2	0	
6.	BCSJ 0055	PROJECT-V	0	0	0	0	4	0	
7.	BCSJ XXXX	PROJECT-VI	0	0	0	0	6	0	
8.	BCSJ 00xx	Capstone Project	0	0	0	0	25	0	
TOTAL			**0**	**0**	**0**	**0**	**45**	**0**	

Mandatory Non Graded Course

S. NO.	CODE	SUBJECT	TEACHING SCHEME				CREDITS	CONTACTS HR /WK	PRE- REQUISITES
			L	T	P	J			
1.	BCSC 00xx	MNG-I	2	0	0	0	0	2	
2.	BCSC 00xx	MNG-II	2	0	0	0	0	2	
3.	BCSC 00xx	MNG-III	2	0	0	0	0	2	
4.	BCSC 00xx	MNG-IV	2	0	0	0	0	2	
TOTAL			**8**	**0**	**0**	**0**	**0**	**8**	

Humanities and Social Sciences

S. NO.	CODE	SUBJECT	TEACHING SCHEME				CREDITS	CONTACTS HR/WK	PRE- REQUISITES
			L	T	P	J			
THEORY									
1.	BELH 0014	English for Professional Communication – I	3	0	0	0	3	3	
2.	BELH 0016	English for Professional Communication Ii	3	0	0	0	3	3	
3.	BELA 0001	English for Occupational Purposes-I	3	0	0	0	3	3	
4.	BELH 0017	Ethics and Values	2	0	0	0	2	2	
Practicals									
1.	BELA 0801	English for Occupational Purposes Lab	0	0	2	0	1	2	
2.	BTDH 0301	Soft Skills – I	0	0	2	0	1	2	
3.	BTDH 0302	Soft Skills – II	0	0	2	0	1	2	
4.	BTDH 0303	Soft Skills – III	0	0	8	0	4	8	
5.	BTDH 0304	Soft Skills – IV	0	0	8	0	4	8	
TOTAL			**11**	**0**	**30**	**0**	**22**	**41**	

Basic Sciences

S. NO.	CODE	SUBJECT	TEACHING SCHEME				CREDITS	CONTACTS HR/WK	PRE- REQUISITES
			L	T	P	J			
THEORY									
1.	BMAS 0104	Engineering Calculus	3	1	0	0	4	4	
2.	BPHS 0004	Engineering Physics	3	1	0	0	4	4	
3.	BMAS 0105	Linear Algebra and Differential Equations	3	1	0	0	4	4	
4.	BCSS 0051	Data Visualization	3	1	0	0	4	4	
5.	BCSS 0052	Probability and Applied Statistics	3	0	0	0	3	3	
6.	ONLS 0001	Environmental Studies	2	0	0	0	2	2	
Practicals									
1.	BPHS 0801	Engineering Physics Lab	0	0	2	0	1	2	
2.	BCSS 0851	Data Visualization Lab	0	0	2	0	1	2	
3.	BCSS 0852	Probability and Applied Statistics	0	0	2	0	1	2	
TOTAL			**17**	**4**	**6**	**0**	**24**	**27**	

Engineering Sciences

S. NO.	CODE	SUBJECT	TEACHING SCHEME				CREDITS	CONTACTS HR/WK	PRE- REQUISITES
			L	T	P	J			
THEORY									
1.	BMEG 0003	Introduction to Automotive System	3	0	0	0	3	3	
2.	BCSC 0053	Learning Python for Data Analysis and Visualization	3	0	0	0	3	3	
3.	BCSG 0051	Design Thinking	3	0	0	0	3	3	
4.	BECG 0004	Electrical and Electronics Engineering	3	1	0	0	4	4	
5.	BELG 0001	Creativity and Innovation	2	0	0	0	2	2	
PRACTICALS									
1.	BMEG 0804	Engineering Drawing and Modelling	0	0	2	0	1	2	
2.	BMEG 0805	Automotive System Lab	0	0	2	0	1	2	

	BCSC 0852	Competitive Learning Python for Data Analysis and Visualization Lab	0	0	2	0	1	2	
	BECG 0804	Electrical and Electronics Engineering Lab	0	0	2	0	1	2	
Total			**14**	**1**	**8**	**0**	**19**	**23**	

Open Electives

S. NO.	CODE	SUBJECT	TEACHING SCHEME				CREDITS	CONTACTS HRS/WK	PRE- REQUISITES
			L	T	P	J			
THEORY									
1.	BCSC 00xx	Open Elective-I	4	0	0	0	0	4	
2.	BCSC 00xx	Open Elective –II	4	0	0	0	0	4	
3.	BCSC 00xx	Open Elective –III	4	0	0	0	0	4	
4.	BCSC 00xx	Open Elective –IV	4	0	0	0	0	4	
Total			**16**	**0**	**0**	**0**	**0**	**16**	

First Semester

S. NO.	CODE	CAT	SUBJECT	TEACHING SCHEME				CREDITS	CONTACTS HRS/WK
				L	T	P	J		
1.	BCSC0050	PC	Internet Programming	3	0	0	0	3	3
2.	BCSC0051	PC	Computer Programming using C	4	0	0	0	4	4
3.	BMAS0104/ BMAS1104	BS	Engineering Calculus	3	1	0	0	4	4
4.	BELH0014	HS	English for Professional Communication – I	3	0	0	0	3	3
5.	BMEG0003	ES	Introduction to Automotive System	3	0	0	0	3	3
6.	BPHS0004/ BPHS1004	BS	Engineering Physics	3	1	0	0	4	4
PRACTICALS									
1.	BCSC0850	PC	Internet Programming Lab	0	0	2	0	1	2
2.	BCSC0851	PC	Computer Programming Lab	0	0	4	0	2	4
3.	BMEG0805	ES	Automotive System Lab	0	0	2	0	1	2
4.	BPHS0801	BS	Engineering Physics Lab	0	0	2	0	1	2
5.	BMEG0804	ES	Engineering Drawing and Modeling	0	0	2	0	1	2
			TOTAL	**19**	**2**	**12**	**0**	**27**	**33**

Second Semester

S. NO.	CODE	CAT	SUBJECT	TEACHING SCHEME				CREDITS	CONTACTS HRS/WK
				L	T	P	J		
1.	BCSC0006	PC	Data Structures and Algorithms	3	1	0	0	4	4
2.	BCSC0053	ES	Learning python for Data Analysis and Visualization	3	0	0	0	3	3
3.	BCSG0051	ES	Designing Thinking	3	0	0	0	3	3
4.	BECG0004	ES	Electrical and Electronics Engineering	3	1	0	0	4	4
5.	BELH0016	HS	English for Professional Communication II	3	0	0	0	3	3
6.	BMAS0105	BS	Linear Algebra and Differential Equations	3	1	0	0	4	4
PRACTICALS									
1.	BSCS0805	PC	Data Structures and Algorithms Lab	0	0	2	0	1	2
2.	BCSC0852	ES	Competitive Learning Python for Data Analysis and Visualization Lab	0	0	2	0	1	2
3.	BECG0804	ES	Electrical and Electronics Engineering Lab	0	0	2	0	1	2
4.	BCSC0853	PC	Competitive Programming Lab	0	0	2	0	1	2
5.	BCSJ0051	PW	Project –I	0	0	0	4	2	4
			TOTAL	**18**	**3**	**8**	**4**	**27**	**33**

Third Semester

S. NO.	CODE	CAT	SUBJECT	TEACHING SCHEME				CREDITS	CONTACTS HRS/WK
				L	T	P	J		
1.	BCSC1002/ BCSC0020	PC	Object Oriented Programming/ Object Oriented Concepts Using Java	3	0	0	0	3	3
2.	BCSC0054	PC	Advanced Database Management System	4	0	0	0	4	4
3.	BCSS 0051	BS	Data Visualization	3	1	0	0	4	4
4.	BCSS 0052	BS	Probability and Applied Statistics	3	0	0	0	3	3
5.	BELA 0001	HS	English for Occupational Purpose –I	3	0	0	0	3	3
6.	BELH 0017	HS	Ethics & Values	2	0	0	0	2	2
PRACTICALS									
1.	BCSC0810	PC	Object Oriented Concepts Lab	0	0	2	0	1	2
2.	BCSC0855	PC	Advanced Database Management System Lab	0	0	2	0	1	2
3.	BCSS 0851	BS	Data Visualization Lab	0	0	2	0	1	2
4.	BCSS 0852	BS	Probability and Applied Statistics Lab	0	0	2	0	1	2
5.	BELA 0801	HS	English for Occupational Purposes Lab	0	0	2	0	1	2
6	BTDH 0301	HS	Soft Skills–I	2	0	0	0	1	2
7.	BCSJ 0052	PW	Project – II	0	0	0	4	2	4
			TOTAL	**20**	**1**	**10**	**4**	**27**	**35**

Fourth Semester

S. NO.	CODE	CAT	SUBJECT	TEACHING SCHEME				CREDITS	CONTACTS HRS/WK
				L	T	P	J		
1.	BCSC 0055	PC	Operating System and Concepts	3	0	0	0	3	3
2.	BCSC 0057	PC	Software Engineering Methodology	3	0	0	0	3	3
3.	BCSC 0058	PC	Discrete Mathematical Structures	3	1	0	0	4	4
4.	BCSC 0059	PC	Algorithms Design & Analysis	3	1	0	0	4	4
5.	BCSE 0450	PE	Machine Learning Using Python	3	0	0	0	3	3
6.	ONLS0001/ 0002	BS	Environmental Study	2	0	0	0	2	**2**
7.	BELG0001	ES	Creativity and Innovation	2	0	0	0	2	2
PRACTICALS									
1.	BCSC 0856	PC	Operating System and Concepts Lab	0	0	2	0	1	2
2.	BCSC 0857	PC	Algorithms Design &Analysis Lab	0	0	2	0	1	2
3.	BCSE 0480	PE	Machine Learning Using Python Lab	0	0	2	0	1	2
4.	BCSJ0053	PW	Project – III	0	0	0	4	2	**4**
5.	BTDH0302	HS	Soft Skill – II	0	0	2	0	1	2
6.	BMEM0002	MNG	MNG - I (Waste to Energy)	2	0	0	0	0	2
			TOTAL	**21**	**2**	**8**	**4**	**27**	**35**

Fifth Semester

S. NO.	CODE	CAT	SUBJECT	TEACHING SCHEME				CREDITS	CONTACTS HRS/WK
				L	T	P	J		
1.	BCSC 0060	PC	Data Communication and Network System	3	0	0	0	3	3
2.	BCSE 0451	PE	Full Stack using Web Scripting Technology	2	0	0	0	2	2
3.	BCSE 0452	PE	Neural Networks and Deep Learning	2	0	0	0	2	2
4.	BCSE0453	PE	Cloud Computing	3	0	0	0	3	3
5.	OE1	OE	Open Elective – I	4	0	0	0	4	0
PRACTICALS									
1.	BCSC 0481	PE	Full Stack using Scripting Technology Lab	0	0	4	0	2	2
2.	BCSE 0482	PE	Neural Networks and Deep Learning Lab	0	0	4	0	2	2
3.	BCSE 0483	PE	Cloud Computing Lab	0	0	2	0	1	2
4.	BTDH 0303	HS	Soft Skill-III	0	0	4	0	4	4
5.	BCSJ 0991	PW	Industrial Training	0	0	0	2	2	2
6.	BCSJ0054	PW	Project-IV	0	0	0	4	2	4
7.	MNG-II	MNG	MNG- II	0	0	2	0	0	2
			TOTAL	**14**	**0**	**16**	**6**	**27**	**28**

Sixth Semester

S. NO.	CODE	CAT	SUBJECT	TEACHING SCHEME				CREDITS	CONTACTS HRS/WK
				L	T	P	J		
1.	BCSE 0454	PE	Natural Language Processing	2	0	0	0	2	3
2.	BCSE 0455	PE	Full Stack using Server Side	3	0	0	0	3	3
3.	BCSE 0456	PE	DevOps	2	0	0	0	2	3
4.	BCSE 00xx	OE	Open Elective – II	4	0	0	0	4	0
PRACTICALS									
1.	BCSE 0485	PE	Natural Language Processing Lab	0	0	2	0	1	2
2.	BCSE 0484	PE	Full Stack using Server Side Lab	0	0	2	0	1	2
3.	BCSE 0486	PE	DevOps Lab	0	0	2	0	1	2
4.	BTDH 0304	HS	Soft Skill-IV	0	0	8	0	4	8
5.	BCSJ0055	PW	Project-V	0	0	0	4	4	0
6.	MBAM 0001	MNG	MNG- III (Basic course in	0	0	2	0	0	2
			TOTAL	**12**	**0**	**16**	**4**	**22**	**27**

Seventh Semester

S. NO.	CODE	CAT	SUBJECT	TEACHING SCHEME				CREDITS	CONTACTS HRS/WK
				L	T	P	J		
1.	BCSC 00xx	PC	Theory of Computation	3	0	0	0	3	3
PRACTICALS									
1.	BCSC 00xx	PC	Competitive Programming Concepts Lab	0	0	4	0	2	4
2.	BCSJ 0056	PW	Project-VI	0	0	0	0	8	0
3.	BCSE 00xx	MNG	MNG- IV	0	0	2	0	1	0
			TOTAL	**3**	**0**	**6**	**0**	**14**	**07**

Eight Semester

S. NO.	CODE		SUBJECT	TEACHING SCHEME				CREDITS	CONTACTS HRS/WK
				L	T	P	J		
1.	BCSJ 0057	PW	Capstone Project	0	0	0	22	22	0
			TOTAL	**0**	**0**	**0**	**22**	**22**	**0**

SEMESTER -I
SYLLABUS

BCSC0050: INTERNET PROGRAMMING

Objective: *This course introduces the building of dynamic web solutions using PHP programming and its connectivity with database.*

Credits: 03 **L–T–P-J: 3–0–0-0**

Module No.	Content	Hours
I	**Introduction to Client Server Architecture**: Components of Client-Server Application, Client-Server Models and their Benefits, Static V/s Dynamic Websites. **Client-Side Implementation**: Introduction to HTML, formatting tags, Meta, Anchor, List, Table, Headers, Frames and iframes, Image, Form and other tags, their usage and implementation, Introduction to HTML5, Validations using HTML5. **CSS**: Introduction of Formatting using CSS, Introduction to CSS3. **Client-side scripting**: Basics of JavaScript, Statements, Functions in JavaScript, Integrating Javascript with Various Elements of HTML, Validating a form using Javascript. **Web Servers:** Introduction to prominent Web Servers, Installation of WAMP/XAMPP, Uploading Web applications on Web Server. **Amazon Web Services**: Introduction to AWS, Uploading Web applications in AWS. **PHP Basics**: Introduction to PHP, Basic Syntax of PHP, Embedding PHP in HTML, Comments, Variables, Constants, Managing Variables, isset() and unset() functions, Operators and Operator Precedence and String Manipulation functions. **Conditional Control Structures:** If statement, If- else statement, If- else if statement, Nested if, Switch statement. **Looping Control Structures:** For loop, While loop, Do- While loop, For-each, Break and Continue.	20
II	**Arrays**: Arrays and its types in PHP, Accessing Elements of an Array, Modifying Elements of an Array, Functions in array, Array Sorting, Multidimensional Array. **Functions in PHP**: Functions, User-Defined function, Understanding variable scope, Global Variables, Static Variables, Built-in functions in PHP. **Form Handling and Session Management in PHP**: Accessing and displaying Form data from different Form components, Differences among $_GET, $_POST and $_REQUEST variables, PHP super globals, Session management, Session operations, Session tracking mechanism, Clearing/Modifying data from session, Destroying a session. **PHP File Handling:** Introduction, File Open, File Creation, writing to files, reading from File, searching a record from a file, Closing a File. **Database Connectivity:** Storing data from a web application to a database, retrieving data from the database to use and display on a webpage. **Introduction to other Server-side Programming Languages**	20

Reference Books:

- Chris Bates: “Web Programming-Building Internet Application”, “Wiley, India”, 2008.
- Black Book: “HTML5, CSS3, JAVASCRIPT, XML, XHTML, AJAX, PHP AND JQUERY”, “Wiley, India”, 2ED, 2016
- Rasmus Lerdorf, Kevin Tatroe, Peter MacIntyre: “Programming PHP”, “O’Reilly Media, Inc.", Feb 2013
- Robin Nixon: “Learning PHP, MySQL and Javascript” “O’Reilly Media, Inc.", July 2009, Reprint 2015.

Outcome: Upon completion of this course, the students will be able to:

- CO1: Understand the basics of client server architecture and its components.
- CO2: Explain the basics of web development using PHP and HTML.

- CO3: Develop a program using functions, control structures and array.
- CO4: Demonstrate the concepts of object and exception handling in PHP.
- CO5: Demonstrate web application using PHP, XML and MYSQL.
- CO6: Develop a dynamic/static website with server side programming.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	**POs/PSOs**
CO1	PO1, PSO1
CO2	PO1, PSO2
CO3	PO3, PSO2
CO4	PO4, PO2, PSO4
CO5	PO4, PO5, PSO4
CO6	PO3, PSO4

BCSC 0051: COMPUTER PROGRAMMING USING C

Objective: *To impart adequate knowledge on the need of problem solving techniques and develop programming skills to implements applications using the concepts of C Language. Also by learning the programming constructs they can easily switch over to any other language in future.*

Credits:04 **L-T-P-J:4-0-0-0**

Module No.	Content	Teaching Hours
I	**Generation of Programming Languages:** Low, Assembly, High and 4GL. **Language Processors:** Compiler, Interpreter, Assembler, Linker and Loader. **Basics of C:** Overview, Structure of a C program, Identifier, Keywords, Variables, Datatypes, Formatted Input and output. **Operators and Expression:** Assignment, Unary, Arithmetic, Relational, Logical, Bitwise, Conditional, Special operators and their precedence & Associativity. L value and R value **Type Conversion:** Type Promotion in expression, Conversion by Assignment, Truncation and Casting Arithmetic expression. **Decision and Case Control Structure:** if, if-else, nested if-else, Decisions using switch, switch versus if-else ladder. **Loop Control Structure:** For loop, while loop, do-while loop, nesting of loops, break, and continue. **Arrays:** Introduction, one-dimensional Array-Declaration, Initialization, Address Calculation. **Operations on Arrays:** Insertion, Deletion, Linear Search & Bubble Sort.	28
II	**Arrays:** Introduction, two-dimensional Array-Declaration, Initialization, Address Calculation. **String:** Introduction, One dimensional and two dimensional Array-Declarations, Initialization **Operations on String:** Length, Copy, Reverse, Concatenate, Compare with & without built-in functions. **Functions:** Declaration and Definition, Category of Functions, Parameter Passing Techniques–Call by Value, Passing Arrays to Functions. **Introduction to Storage Classes:** Auto, Static, Extern and Register. **Pointers:** Declaration and Initialization of Pointer Variables, Accessing a Variable through its Pointer, Arrays and Pointers, Pointer and Strings, Pointer Arithmetic, Pointers to Pointers, Array of Pointers, Pointer to an Array, Two Dimensional Array and Pointers, Pointers to Functions, Dynamic Memory Allocation, void Pointer and Null Pointer. **User Defined Types:** enum, typedef, Union and Structure - Declaration, Initialization, Nested Structures , Arrays of Structures, Structure and Pointer, Passing Structure Through Function. Difference between Structures and Union. **File Handling:** Data and Information, File Concepts, File Organization, File Operations: Open, Read, and Close, Trouble in Opening a File. File Opening Modes, Working with Text Files. Random Access to Files of Records. Introduction to Command Line Arguments.	28

TextBooks:

- Behrouz A. Forouzanand Richard F. Gilberg, "Computer Science – A Structured Programming Approach Using C ", C Language Learning, 2007.

Reference Books:

- Herbert Schildt, " C: The Complete Reference", 5th Edition, Mc Graw Hill Education
- K.N.King, "C Programming a Modern Approach", W.W.Norton, 2nd Edition, 2008.
- Kernighan and Ritche, "The C Programming Language", PHI, 2nd Edition, 2011.
- P. Dey and M.Ghosh, " Programming in C", Oxford University Press 2nd Edition, 2013.

Outcome: After completion of course, the student will be able to:

- CO1: Understand the basic concepts of problem solving skills.
- CO2: Apply the basic principles of programming in C language.
- CO3: Understand the concepts of arrays and strings in C language.
- CO4: Apply the concepts of functions to solve real world problems.
- CO5: Illustrate the concepts of recursion.
- CO6: Understand the concepts of pointers in C language.
- CO7: Understand the basic concepts of file handling.
- CO8: Develop algorithmic solutions to simple computational problems.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)and Program Specific Outcomes (PSOs):

COs	**POs/PSOs**
CO1	PO1, PO2, PO4, PO12/PSO1, PSO3
CO2	PO1, PO2, PO3, PO10/PSO1, PSO3
CO3	PO1, PO2, PO3, PO4/PSO1, PSO3
CO4	PO1, PO3, PO12/PSO1, PSO2
CO5	PO1, PO2, PO4/PSO1, PSO3
CO6	PO1, PO2, PO3, PO4/PSO1, PSO2
CO7	PO1, PO3, PO6/PSO1
CO8	PO1, PO2, PO4, PO10, PO12/PSO1, PSO3

BMAS 1104: ENGINEERING CALCULUS

Course Objectives: *To make the students understand the concepts of differential calculus, integral calculus and vector calculus by giving more emphasis to their applications in engineering.*

Credits: 04 **L–T–P-J: 3–1–0-0**

Module No.	Contents	Teaching Hours (Approx.)
1	**Differential Calculus**: Calculation of n^{th} order derivatives, Leibnitz theorem, Partial derivatives, Euler's theorem for homogeneous functions, Composite functions, Total derivatives, Expansion of functions of several variables, Jacobian and its properties, Extrema of functions of several variables using Lagrange's method of multipliers.	20
2	**Integral Calculus**: Beta and Gamma functions, Double and Triple integrals, Change of order of integration, Change of variables. **Vector Calculus:** Gradient, Divergence and Curl of point functions, Vector identities, Line, Surface and Volume integrals, Green's theorem, Gauss' divergence theorem and Stoke's theorem (without proof).	20

Text Books:

- M. K. Jain, S. R. K. Iyengar and R. K. Jain, Advanced Engineering Mathematics, Narosa Publishing House, New Delhi, 2002.
- B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 2014.
- M. Goyal and N. P. Bali, A Textbook of Engineering Mathematics, Laxmi Publication, Delhi, 2014.

Reference Books:

- E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, Singapore, 2006.
- T. M. Apostol, Calculus, Volume I, John Wiley & Sons, Inc., USA, 1967.
- T. M. Apostol, Calculus, Volume II, Xerox Corporation, USA, 1969.
- G. B. Thomas and R. Finney, Calculus and Analytic geometry, Addison Wesley, USA, 1995.

Outcomes: After studying these topics, the student will be able to :

- CO1: Compute nth order derivative and study its application in Leibnitz theorem
- CO2: Understand partial differentiation and its applications
- CO3: Evaluate double and triple integrals and study their applications
- CO4: Learn the use of change of variables in solving multiple integrals
- CO5: Find the gradient of a scalar field and divergence, curl of a vector field
- CO6: Know various integral theorems related to line, surface and volume integrals

BELH0014: ENGLISH FOR PROFESSIONAL COMMUNICATION-I

Objective: *English for Professional Communication (EPC) aims to facilitate experiential training sessions and encourage participants to develop their communication skills and sustain high-quality working relationships. In addition, this course aims to assist students develop their English language skills, prepare and present messages, stimulate critical thinking, learn organizational communication, boost confidence and overcome communication barriers. Further, each session will establish a vision for resolving key issues in communication, identify students 'potential outputs and suggest remedies for the exceptional growth.*

Credits: 03 **L-T-P-J: 3-0-0-0**

Module No.	Content	Teaching Hours
I	**Listening and Speaking:** Introduction to English Speech Sounds: Articulation and Transcription, Self-Introduction, Exchange of Personal Information, Follow and Give Instructions and Directions, Narrating Real-Life Experience **Grammar:** Sentences, Parts of Speech **Reading and Writing:** Reading Unseen Passages, Reading Strategies, Write Short Texts using Engaging Words	20
II	**Listening and Speaking:** Conversation: Opening, Turn-Taking and Closing, Phone Call, Etiquette, Interpret a Picture, Presentation Skills, Interview Skills Skills, Debate **Grammar:** Tenses, Active and Passive Voice **Reading and Writing:** Writing Description of Gadgets and Processes, Preparing Checklist and Questionnaire, Writing Survey Report	20

Text Books:

- Raman Meenakshi and Sharma Sangeeta, "Professional Communication" (2 nd eds.). Oxford
- University Press, 2011
- Sharma S. & Binod B., "Communication Skills for Engineers and Scientists" PHI Publications, 2015
- Peter Wentworth, Jeffrey Elkner, Allen B. Downey, and Chris Meyers, "How to Think Like a Computer Scientist: Learning with Python", 2nd edition., Open Book Project, 2012.

Reference Books:

- Leech Geoffre & amp; Svartvik Jan. (2013). "A Communicative Grammar of English". (3 rd Eds.). Routledge Publications, 2013
- Rizvi Ashraf, "Effective Technical Communication". McGraw Hill Pvt Limited. 2015

Focus: This Course focuses on Employability under CO1, CO3.

Outcome: By the end of the class, students will learn to:

- CO1.Demonstrate critical and innovative thinking
- CO2. Display competence in Listening, Speaking, Reading and Writing
- CO3. Show an understanding of opportunities in the field of communication
- CO4. Demonstrate positive group communication exchanges

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/ PSOs
CO1	PO1 /PSO1
CO2	PO1, PO3/PSO1
CO3	PO2/PSO2
CO4	PO3/PSO1, PSO2

BMEG 0003: INTRODUCTION TO AUTOMOTIVE SYSTEMS

Prerequisites: *Thermodynamics & Fluid Mechanics*

Objective: *The objective of this course is to give the basic introduction to internal combustion engines with emphasis on their engineering applications. Another objective of this course is to study basic operation of automotive systems and their subsystem. The focus will be on the study of different vehicle layouts and to have basic idea about how automotive systems are developed.*

Credits: 03 **L-T-P-J: 3-0-0-0**

Module No.	Contents	Teaching Hours (Approx.)
I	Introduction to I.C. Engines: Engine Classification and Basic Terminology Two and four Stroke Engines & SI and CI Engines, Valve Timing Diagram for High Speed and Low Speed Engines. Electrical & Electronics Ignition System, Applications of Transducers & Sensors: Concept of general measurement system, Difference between Mechanical and Electrical/ Electronic Instruments, Advance Ignition System used in Honda Modern Spark Ignition system (e.g. CRDI, i-Vtech, i-Dtech) used in Honda Power Unit: Power and Torque Characteristics, Rolling Resistance, Air Resistance, Gradient Resistance. Transmission: Purpose, Necessity of Gear box, Constant Mesh Gear Box Sliding Mesh Gear Box, Synchromesh Gear Box Basic requirement of Sensors & their Functions, Vehicle speed Sensor, Rain Sensor & Rain Sensing Wiper.	22
II	Steering System: Purpose, Steering principles and layout, Castor, Camber, Toe-in, Toe-Out, Manual steering gears Hydraulic power-assisted steering Torque Convertors, Automatic Transmission Advancement in Engine and related components: Introduction & types of hybrid vehicle. Hybrid Drives Systems. Advance Safety Equipment: Seat Belts, Seat Belts pre-tensioners, Smart seatbelt Concepts of Crash test, Crash sensors. Introduction of Air Bags. Modern Features in Automobile: Electronic Stability and Skid-Control System Intelligent Parking Assist System, Self-Parking.	22

Text Books:

- Mathur & Sharma, "*A Course in Internal Combustion Engines*", Dhanpat Rai & Sons.
- R. Yadav, "*I.C Engine*", Central Publishing House, Allahabad.
- Ganeshan, "*I.C Engine*", Tata Mc Graw Hill Publishers.
- Singh Kripal, "Automobile Engineering", Standard Publisher New Delhi, Vol. 1 & Vol. 2
- Narang, "Automobile Engineering", S.Chand Publications, New Delhi.
- Motor Automotive technology, Anthony E. Schwaller, Delmar, Third Edition.
- Automotive suspension and steering systems, Thomas W. Birch, Delmar Cengage Learning, Third Edition.

Reference Books:

- Newton and Steeds, Joseph Heither, "Automotive Mechanics", C.B.S., Publisher & Distributors.
- "Automotive Mechanics- Crouse" – Mc. Graw Hill, 10th Edition, New York.
- Light and Heavy Vehicle Technology, M.J. Nunney, Elsevier, Fourth Edition.
- Automotive Technology, Jack Erjavec, Cengage Learning, Fifth Edition.
- Automotive Braking, Thomas W. Birch, Cengage Learning, Third Edition.

Course Outcomes: At the end of the course, a student will be able to:

- CO1: Formulate and solve problems Characteristic of homogeneous combustion in SI-engines and spray combustion in CI-engines. Fuel quality requirements of SI- and CI-engines. (Analyze)
- CO2: Derive recognize and understand the reasons for differences among operating characteristics of different engine types and designs. (Apply)
- CO3: Determine the need of Gear Box, Breaking System and Steering System. (Determine)
- CO4: Understand the various reasons for differences among operating characteristics of different engine types and designs(Understand)
- CO5: Understand the effect of Lubrication, Heating and Cooling Unit of Automobiles. (Understand)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	**POs/PSOs**
CO1	PO1, PO2, PO3, PO5/ PSO1
CO2	PO1, PO2, PO3/ PSO1
CO3	PO2, PO3, PO3/ PSO1
CO4	PO1, PO3, PO5/ PSO1
CO5	PO1, PO3, PO5/ PSO1

BPHS 1004: ENGINEERING PHYSICS

OBJECTIVE: *The Syllabus is designed and styled especially to give B. Tech (Hons.) I year students a sound base in fundamental physics as well as to give their exposure to a wide range of its utility in engineering and technology.*

Credits: 04

L–T–P-J: 3 –1–0-0

Module No.	Content	Teaching Hours (Approx.)
I	**Physical Optics:** Principle of superposition and coherence of light, Fresnel biprism experiment, Thin films, Newton's rings. Applications: Determination of wavelength and refractive index of medium, Antireflection coatings. Fraunhofer diffraction at a single slit and N-slits, Plane diffraction grating, Spread of Central diffraction maximum. Application: dispersive power of grating, Rayleigh's criterion and Resolving power of grating. Phenomenon of double refraction, Production and analysis of plane, circularly and elliptically polarized light, Quarter and half wave plates, Optical activity, Biquartz Polarimeter. Application: Specific rotation determination. **Quantum Mechanics:** Wave - particle duality, wave packet, Wave function and its Significance, Schrödinger's wave equation, Application: Particle in one dimensional potential box, Eigen values and Eigen function.	20
II	**Electromagnetics:** Maxwell's equations in integral and Differential forms, Equation of continuity, Inconsistency in Ampere's law: Displacement current, Propagation of E-M waves in free space and conducting medium, Application: Skin Depth. **Laser:** Principle, Spontaneous emission, Stimulated emission, Population inversion, Relation between Einstein Coefficients, Construction and working of Ruby Laser, Application: Holography **Fiber Optics:** Principle of communication through optical fiber, Classification of fibers, acceptance angle and acceptance cone, Numerical aperture, Propagation mechanism and attenuation in optical fiber.	20

Reference Books/ Text Books / Cases:

1. Optics - Ajoy Ghatak (TMH)
2. Optics-Brijlal & Subramaniam (S. Chand)
3. Optical Fibre & Laser - Anuradha De. (New Age)
4. Fundamental of Physics - Resnick, Halliday & Walker (Wiely)
5. Concept of Modern Physics - by Beiser (Tata Mc-Graw Hill)

Course Outcomes: At the end of the course, a student will be able to:

- CO1: Understand phenomena of Interference, Diffraction, Variation of intensities in them, and their applications in daily life.
- CO2 Discuss polarization of Light wave, double refraction, production and analysis of different polarized light waves and optical activity.
- CO3: Understand fundamentals of Quantum mechanics, Schrodinger's wave equations to deal with physics problem.
- CO4: Familiar with Maxwell equations and use them to study the Propagation of E-M waves in free space and conducting medium.
- CO5: Understand the principle and working of Lasers.
- CO6: Familiar with mechanism of communication through Optical Fiber Cables and signal losses.

BCSC0850: INTERNET PROGRAMMING LAB

Objective: *This course introduces the building of dynamic web solutions using PHP programming and OOPs concepts and its connectivity with database.*

Credits: 01 **L–T–P-J: 0–0–2-0**

Module No.	Content	Lab Hours
I	Static web applications using HTML/CSS, Web applications using HTML & JavaScript, Programs using Decision Control Structures, Programs using Loop Control Structures, Programs using user defined functions, Programs of Array handling and manipulation, Programs of File handling and manipulation, Web applications with Form handling at server, Web applications for managing sessions, Web application for uploading a file on Server	24

Reference Books:

- Chris Bates: "Web programming-Building Internet Application", "Wiley, India", May 2006.
- Black Book: "HTML5, CSS3, JAVASCRIPT, XML, XHTML, AJAX, PHP AND JQUERY", "Wiley, India", 2ED
- Rasmus Lerdorf, Kevin Tatroe, Peter MacIntyre: "Programming PHP", "O'Reilly Media, Inc.", Feb 2013
- Robin Nixon: "Learning PHP, MySQL and Javascript" "O'Reilly Media, Inc.", July 2009.

Outcome: By the end of the class, students will learn to:

- CO1: Understand to solve problems with smaller Lines of Code using PHP as compared to other programming languages.
- CO2: Build dynamic web-pages with the help of PHP programming.

BCSC 0851: COMPUTER PROGRAMMING LAB

Objective: *The objective is to provide a comprehensive study of the C programming language. It stress he strengths of C, which provide students with the means of writing efficient, maintainable, and portable code.*

Credits:02 **L-T-P-J:0-0-4-0**

Module No.	Content	Lab Hours
I& II	• Mapping of flowchart, Algorithm, Language • Simple C-program execution • Programs based on various operators • Programs based on Decision and case Control Structure • Programs based on Loop Control Structure • Program based on special control statement ➢ break ➢ continue • Programs based on Array Insertion, Deletion, Linear Search & Bubble Sort • Programs based on String ➢ Length, Copy, Reverse, Concatenate, Compare with & without built-in functions • Programs based on Functions. • Programs based on Storage Class. • Programs based on Recursion. • Programs based on Preprocessor. • Programs based on Pointers • Programs based on array • Programs based on string • Programs based on call by value and call by reference • Programs based on Dynamic Memory Allocation • Programs based on User Defined Datatypes ➢ Structure and Union ➢ Enum and Typedef • Programs based on File handling ➢ Opening a file ➢ Reading, writing and appending a file ➢ Closing file ➢ Random Access to Files of Records • Programs based on Command Line Argument.	52

Reference Books:

- Herbert Schildt, "C: The Complete Reference", 5thEdition, McGraw Hill Education
- K.N.King, "C Programming a Modern Approach", W.W.Norton, 2ndEdition, 2008.
- Kernighan and Ritche, "The C Programming Language", PHI, 2ndEdition, 2011.
- P.Deyand M.Ghosh, "Programmingin C", OxfordUniversityPress2ndEdition, 2013.

Outcome: On Completion of this course, students are able to:

- CO1: Design programs involving decision structures, loop sand functions.
- CO2: Understand the concepts of functions, recursion, pointers and file handling.
- CO3: Design programs involving structures, union and functions.

BMEG0805: AUTOMOTIVE SYSTEM LAB

Objective: The purpose of this lab is to enable the students to have the practical skills for Automotive system and to study the various subsystems e.g., Steering System, Differential Gear, Ignition System Braking System. The student will also have practical exposure with various safety precautions in automotive system practice lab.

Credits:01 **L-T-P-J:0-0-2-0**

Module No.	Content	Lab Hours
I	1. Performance Analysis of Four Stroke S.I. Engine- Determination of Indicated and Brake Thermal Efficiency, Specific Fuel Consumption at Different Loads, and Preparation of Energy Balance Sheet. 2. Performance Analysis of Four Stroke C.I. Engine- Determination of Indicated and Brake Thermal Efficiency, Specific Fuel Consumption at Different Loads, and Prepare Energy Balance Sheet. 3. Study of various types of Sensors used in Automobile. 4. Study the Working Principle of Gear Boxes. 5. Study the Working Principle of Steering System. 6. Trouble Shooting on Automobile Braking System. 7. Study of Chassis and Suspension System. 8. Comparative Study of Technical Specifications of Common Small Cars (Such As Maruti Swift, Hyundai I20, Chevrolet Aveo, Tata Indica, Ford Fusion Etc.) 9. Comparative Study & Technical Features of Common Scooters & Motorcycles Available in India. Design and Development of any Automobile Component (Anyone)	24

Course Outcomes: After course completion, the student will be able to:

- CO1 Calculate the all the performance parameter like Indicated and Brake Thermal Efficiency, Specific Fuel Consumption at Different Loads. **(Apply)**
- CO2 Acquire basic knowledge of Steering System, Breaking System and Gear Box. **(Understand)**
- CO3 Determine the need of different prototypes of MPFI System **(Determine)**
- CO4 Ability to design and model various basic prototypes of Fuel Supply System of S.I. Engines- Carburetor & CI Engines - Fuel Injector. **(Analyze)**
- CO5 Ability to understand various technical Specifications of Common Small Cars **(Understand)**
- CO6 Student will able to do Comparative Study & Technical Features of Common Scooters & Motorcycles **(Analyze)**

BPHS0801: ENGINEERING PHYSICS LAB

Objective: *14 no. of experiments based on theoretical aspects are set in laboratory to give B.Tech Students a sound practical knowledge in fundamental and applied physics.*

Credit 01 **L–T–P-J: 0–0-2-0**

<table>
<tr><th>Module No.</th><th>Content</th><th>Lab Hours</th></tr>
<tr><td>I</td><td>
Note: Any twelve experiments at least five from each group.
Group -A
1. To determine the wavelength of monochromatic light by Newton’s rings.
2. To determine the wavelength of monochromatic light with the help of Fresnel’s biprism.
3. To determine the specific rotation of cane sugar solution using polarimeter.
4. To determine the wavelength of spectral lines using plane transmission /diffraction grating.
5. To determine the wavelength of laser light by diffraction grating method.
6. To verify Stefan’s law by electrical method.
7. To determine high resistance by leakage method using digital D.C. micro voltmeter.
Group – B
8. To determine the specific resistance of the material of a given wire using Carey Foster’s
bridge.
9. To study the variation of magnetic field along the axis of current carrying circular coil and
then to estimate the radius of the coil.
10. To calibrate the given ammeter by potentiometer.
11. To calibrate the given voltmeter by potentiometer.
<table>
<tr><td>1</td><td>To study the Hall Effect and determine Hall coefficient, carrier density and given semiconductor.</td></tr>
</table>
13. To determine the energy band gap of a given semiconductor material.
14. Measurement of resistivity of semiconductor by four probe method at different temperatures
and determination of the band gap.
</td><td>24</td></tr>
</table>

Outcomes: **After completing the lab exercise:**

- CO1: B.Tech. Students learn about the applications of basic-laws, principles and concepts of Engineering Physics in the various fields of science and technology.
- CO2: Practical training of a student reinforces his/her theoretical knowledge adequately and make him confident in subject.

BMEG 0804: ENGINEERING DRAWING AND MODELING

Objectives :

- To learn initially the basic principles involved in the projection of points, lines, lamina and solids.
- This course is focused towards the interpretation of solids, development of surfaces, isometric drawings including fundamentals of computer aided drafting software.
- Understanding and Use of Any 3-D Modeling Software Commands.
- It is expected that a student should learn this subject in a very systematic way to develop the skill to express effectively his/her idea about an object to others through drawings.

Credits: 01 **L–T–P-J: 0–0–2-0**

Module No.	Contents	Teaching Hours (Approx.)
I & II	• Introduction to Engineering Drawing and need of Auto CAD in today's Engineering world. • Introduction to AutoCAD 2D: (A) Draw commands. • Introduction to AutoCAD 2D: (B) Modify commands (C) Toggle commands. • Construction of Various Geometrical figures using AutoCAD 2D. • Orthographic Projections and its application on CAD. • Dimensioning in AutoCAD and its implementation on CAD Drawings. • Projection of planes (2D objects) using AutoCAD and its practice. • Drawings of machines' Sub Components. • Projection of solids (3D objects) using AutoCAD. • Introduction to Creo Software. • Application of Creo Software • Creo Software Based Activity.	28

Text Books:

- Bhatt, N. D. and Panchal, V.M., 'Engineering Drawing', Pub- Charotar Publishing House.
- Natarajan, K. V., 'A text book of Engineering Graphics', Pub- Dhanalakshmi Publishers, Chennai.

Reference Books:

- Venugopal, K. and Prabhu Raja, V., 'Engineering Drawing and Graphics + AutoCAD', Pub- New Age International.
- Jolhe, D. A., 'Engineering drawing', Pub- Tata McGraw Hill.

Course Outcomes: After studying these topics, the student will be able to:

- CO1: Create, construct and Interpret views and sectional views and projections. (Understand)
- CO2: Read software based drawings of a 3D component. (Understand)
- CO3: Use common drafting tools to construct engineering drawings and apply dimensions on engineering drawings components. (Apply)

- CO4: Create isometric and oblique sketches and identify standard features. (Understand)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	**POs/PSOs**
CO1	PO1/PSO1
CO2	PO1/PSO1
CO3	PO3/PSO1
CO4	PO10/PSO1

SEMESTER -II
SYLLABUS

BCSC0006: DATA STRUCTURES AND ALGORITHMS

Objective: *The objective of this course is that students will construct and application of various data structures and abstract data types including lists, stacks, queues, trees and graphs.*

Credits: 04 **L–T–P-J: 3–1–0-0**

Module No.	Content	Hours
I	**Introduction:** Basic Terminology, Elementary Data Organization, Properties of an Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic Notations – Big-Oh; Operations on Data Structure, Abstract Data Types (ADT). **Linked Lists:** Implementation of Singly Linked Lists, Doubly Linked List, Circular Linked List, Operations on a Linked List - Insertion, Deletion, Traversal; Generalized Linked List, Polynomial Representation and Addition. **Stacks:** Primitive Stack Operations - Push & Pop, Array and Linked Implementation of Stack in C, Application of Stack: Prefix and Postfix Expressions, Evaluation of Postfix Expression, conversion of Infix to Postfix expression, Recursion, Principles of Recursion, Tail Recursion, Removal of Recursion, use of stack in Recursion, Tower of Hanoi Problem. **Queues:** Operations on Queue - Add, Delete operations, Implementation of Queue Using Array and Linked List, Circular Queues, Deque and Priority Queue. **Trees:** Basic Terminology, Array Representation and Dynamic Representation; Complete Binary Tree, Algebraic Expressions, Extended Binary Trees, Tree Traversal Algorithms - Inorder, Preorder and Postorder; Threaded Binary Trees, Traversing Threaded Binary Trees.	20
II	**Search Trees:** Binary Search Trees (BST), Insertion and Deletion in BST, AVL Trees, Introduction to M-Way Search Trees, B Trees. Searching: Sequential Search, Binary Search. **Sorting:** Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Two Way Merge Sort, and Heap Sort. **Graphs:** Terminology, Adjacency Matrices, Adjacency List, Graph Traversal - Depth First Search and Breadth First Search; Spanning Trees, Minimum Cost Spanning **Trees** – Prim's and Kruskal's Algorithm; Shortest Path Algorithm – Bellman-Ford and Dijkstra's Algorithm. **Hashing & Indexing:** Hash Function, Collision Resolution Strategies. Primary Indices, Secondary Indices, Indexing and Hashing Comparisons.	20

Text Book:

- Aaron M. Tanenbaum, Yedidyah Langsam and Moshe J. Augenstein, "Data Structures Using C and C++", 2nd Edition, PHI, 2009.

Reference Books:

- Horowitz and Sahani, "Fundamentals of Data Structures", 3rd Edition, W H Freeman & Co, 2004-05.
- Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with Applications", 2nd Edition, TMH, 2007.
- R. Kruse, "Data Structures and Program Design in C", 2nd Edition, Pearson Education, 2004.
- Lipschutz Schaum's Outline Series, "Data Structures", 12th Reprint, TMH, 2010.
- G A V Pai, "Data Structures and Algorithms", TMH, 2009.

Outcome: After completion of course, student will be able to:

- CO1: Understand the basic concepts of the data structure and algorithms.
- CO2: Understand the complexity representation in terms of Big Oh, Theta and Omega notations.
- CO3: Apply the associated operations in linear data structure like stack, Queue and link list.
- CO4: Apply the associated operations in Binary Search Tree, AVL Tree and M- Way Search Tree.
- CO5: Understand the basic algorithms such as heap sort, graph traversal, quick sort, AVL trees, and hashing.
- CO6: Select the appropriate data structure to solve the problem.
- CO7: Apply the shortest path algorithm to solve real life problem.

BCSC 0053: LEARNING PYTHON FOR DATA ANALYSIS AND VISUALIZATION

Objective: *The course is designed to provide an introduction to the Python Programming language. The focus of the course is to provide students with an introduction to programming Data analysis with Python, I/O and visualization methods using the Python Programming language.*

Credits: 03 **L–T–P-J: 3–0–0-0**

Module No.	Content	Teaching Hours
I	Introduction: History, Features, Object-Oriented Programming Concepts, Python Interpreters. Working with Python: Basic Syntax, Variable and Data Types, Operators. Control Structures: if-else, elif, Nested if, Iteration Control structures, break, Continue & Pass. String Manipulation: String Literals, Basic Operations, String slices, Multiline Strings and String Methods. Lists: Introduction, Accessing List, Operations, List Methods, List Comprehensions and nested list. Tuple: Introduction, Accessing tuples, Operations Working, Functions and Methods. Dictionary: Introduction, Accessing values in dictionaries, working with dictionaries, Properties and methods and dictionary Comprehensions. Input-Output: Printing on screen, Reading data from keyboard, Inbuilt-Functions. Functions: Defining & Calling a function, Passing arguments to functions – Mutable & Immutable Data Types, Different types of arguments, Recursion, Scope of Variables local, global and nonlocal, Anonymous functions. Modules and Packages: User-defined modules and Standard Modules, random, sys, math Module, Date & Time Module.	20
II	Data Visualization Modules: statistics, numpy, matplotlib and pandas. Object-Oriented Programming: Class, object, Attributes, constructor and destructor, Inheritance, Overloading, Overriding, Data hiding and object representation in Python. Exception Handling: Introduction, try-except, use of else clause, try and finally clause, User Defined Exceptions. Python File Handling: Create, Open, Append, Read, Write. Regular Expressions: Introduction, Regex Functions, Meta characters, sets and match objects. Database Programming (Python): Database Connectivity, Python - MySQL Database Access, MySQL. Connector, Retrieving Data from Database, Parameters Passing and Cursor Attributes, Invoke Stored Procedures and Invoke Stored Functions. Multithreading: Thread, Starting a thread, Threading module. GUI Programming: GUI Programming Toolkit, Overview of tkinter, Visual tkinter IDE.	20

Text Books:

- Paul Barry: "Head First Python "O'Reilly Media, Inc.".
- Learn Python the Hard Way: A Very Simple Introduction to the Terrifyingly Beautiful World of Computers and Code (Zed Shaw's Hard Way Series)
- Python Data Science Handbook: Essential Tools for Working with Data

Reference Books:

- Bret Slatkin: "Effective Python: 59 Specific ways to write better Python", Addison Wesley, 2015.

Outcome: After completion of course, the student will be able to:

- CO1: Solving the competitive Programming contest.
- CO2: Understand to solve problems with smaller Lines of Code using Python as compared to other programming languages.
- CO3: Use Object-Oriented Programming concepts while programming in Python.
- CO4: Use in-built packages defined in Python.
- CO5: Gain knowledge of Python visualization libraries.
- CO6: Create a plot of retrieved data.
- CO7: Work with Python using GUI.

BCSG0051: DESIGN THINKING

Objective: *The objectives of this course are to*

1. *To impart knowledge on design thinking process for understanding complex designs.*
2. *To provide design skills to analyze design thinking issues and apply the tools and techniques of design.*
3. *To inculcate attitude to solve societal problems using design thinking tools.*

Credits: 03 **L–T–P-J: 3–0–0-0**

Module No.	Content	Hours
I	**INTRODUCTION TO DESIGN THINKING** Design Thinking Process: Types of the thinking process, Common methods to change the human thinking process, Design thinking: Definition, Origin of design thinking, Importance of design thinking, Design vs Design thinking, Problem solving, understanding design thinking and its process model, Design thinking tools. **EMPATHIZE** Design thinking phases, How to empathize, Role of empathy in design thinking, purpose of empathy maps, Things to be done prior to empathy mapping, Activities during and after the session, Understanding empathy tools: Customer Journey Map, Personas. **IDEATION** Challenges in idea generation, need for systematic method to connect to user, Visualize, Empathize, and Ideate method, Importance of visualizing and empathizing before ideating, Applying the method, Ideation Tools: How Might We? (HMW), Story board, Brainstorming.	20
II	**PROTOTYPING** What is a prototype? -Prototyping as a mindset, prototype examples, prototyping for products; Why we prototype? Fidelity for prototypes, Process of prototyping-Minimum Viable prototype. **TESTING PROTOTYPES** Prototyping for digital products: What's unique for digital products, Preparation; Prototyping for physical products: What's unique for physical products, Preparation; Testing prototypes with users.	20

Text Book:

- Karmic Design Thinking by Prof. Bala Ramadurai, available at Amazon (paperback), Flipkart, halfpricebooks.in
- S. Salivahanan, S.Suresh Kumar, D.Praveen Sam, "Introduction to Design Thinking", Tata Mc Graw Hill, First Edition, 2019.
- Kathryn McElroy, "Prototyping for Designers: Developing the best Digital and Physical Products", O'Reilly, 2017.

Reference Books:

- Michael G. Luchs, Scott Swan, Abbie Griffin, "Design Thinking –New Product Essentials from PDMA", Wiley, 2015.
- Vijay Kumar, "101 Design Methods: A Structured Approach for Driving Innovation in Your Organization", 2012.
- The Design of Everyday Things by Don Norman, 2013 Available on Amazon.

Outcome: After completion of course, student will be able to:

- CO1: Analyze design thinking concepts and principles to perform human centered design process for creative problem solving.
- CO2: Create empathy maps to visualize user attitudes and behavior for gaining insights of customers.
- CO3: Develop innovative products or services for a customer base using ideation techniques.
- CO4: Build prototypes for complex problems using gathered user requirements.

- CO5: Apply design thinking tools techniques to produce good design and relevant products or services for a specific target market.
- CO6: Improve prototype by testing it with a specific set of users for making it sustainable by following ethics.

ADDITIONAL LEARNING RESOURCES:

1. https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process
2. https://www.ibm.com/design/thinking/page/toolkit3
3. https://www.interaction-design.org/literature/article/define-and-frame-your-design-challenge-by-creating-your-point-of-view-and-ask-how-might-we
4. https://hbr.org/2018/09/design-thinking-is-fundamentally-conservative-and-preserves-the-status-quo
5. https://hbr.org/2018/09/why-design-thinking-works
6. https://hbr.org/2015/09/design-thinking-comes-of-age
7. https://www.culturepartnership.eu/en/article/ten-tools-for-design-thinking
8. https://nptel.ac.in/courses/109/104/109104109/
9. https://nptel.ac.in/courses/110106124/
10. **Swayam Course:** https://onlinecourses.nptel.ac.in/noc22_mg32/preview
11. Course Book by Dr. Bala, IIT-Madras
    https://drive.google.com/file/d/1O34NfmtQHJgRBGXuXn4cvwDsqVvpV76X/view

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1		3	2								
CO2	1	3										
CO3	1			3	1							
CO4		3		3								
CO5					1	2	3					
CO6	1	3	1				1	1				

CO: Course Outcome; PO: Program Outcome
3-High mapping 2-Medium Mapping 1-Low Mapping

BECG0004: ELECTRICAL AND ELECTRONICS ENGINEERING

Objective: *Be familiar with electrical quantities such as current, voltage, power, energy, and frequency to understand the impact of technology in a global and societal context, understand basics of DC and AC circuits used in electrical devices, be familiar with the principle and theory of semiconductor materials and to facilitate understanding of Diodes, BJT, MOSFET and Operations Amplifiers.*

Credits: 04 **L–T–P-J: 3–1–0-0**

Module No.	Content	Hours
I	Basic of electrical elements, Kirchhoff's laws, mesh analysis, node analysis, The venin theorem, Norton Theorem, maximum power transfer theorem, Superposition theorem. Fundamental of AC, Average & rms values of different AC waveforms, Phasor algebra, analysis of series AC circuits, power triangle, Three phase system, star & delta connection, line & phase voltage/current relations.	20
II	**Semiconductor materials**; Intrinsic and Extrinsic semiconductors; Mass-action law, P-N Junction diode: construction, operation & characteristics; Zener and Avalanche breakdown mechanisms. Diode Applications: Rectifiers, Clippers, Clampers, Zener diode as voltage regulator, Regulated power supply. **Bipolar junction transistor**: construction & operation; CB, CE, CC configurations & their Characteristics Metal Oxide Field Effect Transistor (MOSFET): Depletion & Enhancement type MOSFET, Construction, operation, characteristics and biasing techniques. **Operational Amplifier (Op-Amp):** Block diagram, ideal and practical Op-Amp characteristics; Inverting, non-inverting and differential configurations (open loop and closed loop); Applications of Op-Amp as buffer, adder, subtractor, integrator and differentiator.	20

Text Book:

- Robert L. Boylestad and Louis sashelsky, "Electronic devices and circuit theory", Pearson Education/PHI, New Delhi.
- William H. Hayt, Jack Kemmerly, Steven M. Durbin."Engineering Circuit Analysis" 8th Edition, Tata McGraw Hill.

Reference Books:

- R.A. Gayakwad, "Op-amps & linear Integrated circuits", PHI.
- D.C. Kulshrestha, "Basic Electrical Engineering", Tata McGraw Hill.
- T.K. Nagsarkar&M.S.Sukhija, "Basic Electrical Engineering", Edition 2008, Oxford University Press.

Outcome: After completion of course, student will be able to:

- CO1: Understand the basic properties of electrical elements and solve DC circuit analysis problems. DC network theorems.
- CO2: Understand the fundamental behavior of AC circuits and solve AC circuit problems.
- CO3: Apply the knowledge gained to explain the behavior of the circuit at series & parallel resonance of circuit & the effect of resonance.
- CO4: Understand the operation and characteristics of electronic devices such as diode, BJT, MOSFETS, Op-Amp
- CO5: Design and analyze the circuits with the help of diode, BJT, MOSFETS, Op-Amp.

BELH0016: ENGLISH FOR PROFESSIONAL COMMUNICATION II

Objective: *English for Professional Communication (EPC) II aims to facilitate experiential training sessions and encourage participants to develop their communication skills and sustain high-quality working relationships. In addition, this course aims to assist students develop their English language skills, prepare and present messages, imbibe critical thinking, learn organizational communication, boost confidence and overcome communication barriers. Further, each session will establish a vision for resolving key issues in communication, identify students' potential outputs and suggest remedies for the exceptional growth.*

Credit: 3 **L–T–P-J: 3–0–0-3**

Module No.	Content	Teaching Hours
I	Listening and Speaking: Listening Two TED Talks, Extempore, Parliamentary Debate, Sounds of the English language not found in the Indian languages Developing the Sense of Grammaticality (Tenses, Active and Passive &Punctuations) Reading and Writing: Reading a Short Text (Water by C..V. Raman), Writing an Email	20
II	Listening &Speaking: Group Discussion, Presentation Skills, Interview Skills, Aspects of Effective Speech Developing the sense of Grammaticality (Prepositions, Determiners, Direct and Indirect Narration), Reading and Writing: Comprehension of Unseen Texts, Paraphrasing	20

Text Book:

- Raman, Meenakshi and Sharma, Sangeeta (2011), Professional Communication (2nd eds.). Oxford University Press, Oxford
- Sharma, S. & Binod, B. (2015). Communication Skills for Engineers and Scientists. PHI Publications. New Delhi

Reference Books:

- Leech, Geoffrey & Svartvik, Jan. (2013). A Communicative Grammar of English. (3rd Eds.). Routledge Publications. London
- Rizvi, Ashraf (2013). Effective Technical Communication. McGraw Hill Pvt Limited. New Delhi
- Sharma, S. & Binod, B. (2015). Communication Skills for Engineers and Scientists. PHI Publications. New Delhi
- Yadugiri, M.A. (2013). Making Sense of English Grammar. A textbook of Sounds, Words and Grammar. Viva Publications, New Delhi

Outcome:

- CO1: Demonstrate critical and innovative thinking
- CO2: Display competence in Listening, Speaking, Reading and Writing
- CO3: Show an understanding of opportunities in the field of communication
- CO4: Demonstrate positive group communication exchanges

BMAS 0105: LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS

Course Objectives: *To make the students understand the concepts of linear algebra, Fourier series and differential equations by giving more emphasis to their applications in engineering.*

Credits: 04 **L–T–P-J: 3–1–0-3**

Module No.	Contents	Teaching Hours (Approx.)
1	**Linear Algebra**: Introduction, Elementary transformations, Rank of a matrix, Consistency and solution of system of linear equations, Linear dependence and independence of vectors, Complex matrices. Eigen values, Eigen vectors, Cayley–Hamilton theorem and its applications. **Ordinary Differential Equations:** Introduction, Solution of n^{th} order linear differential equations with constant coefficients, Euler-Cauchy equations, Simultaneous differential equations, Method of variation of parameters.	20
2	**Fourier Series:** Half range sine and cosine series, Change of interval. **Partial Differential Equations**: Introduction, Solution of linear partial differential equations of n^{th} order, Classification of linear partial differential equations of second order, Method of separation of variables and its application in solving one-dimensional wave and heat flow equations.	20

Course Outcomes: After studying these topics, the student will be able to:

- CO 1: Know the rank of a matrix and its applications in solving systems of linear equations.
- CO 2: Find the Eigen values and Eigen vectors of a square matrix.
- CO 3: Solve ordinary and partial differential equations of higher orders.
- CO 4: Classify the linear partial differential equations as elliptic, parabolic and hyperbolic
- CO 5: Expand a function in half range Fourier sine and cosine series.
- CO 6: Apply the method of separation of variables to solve wave and heat flow equations of
- one dimension.

Text Books:

- M. Goyal and N. P. Bali, A Text Book of Engineering Mathematics, Laxmi Publication, Delhi, 2014.
- B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 2014.

Reference Books:

- W. E. Boyce and R. D. Prima, Elementary Differential Equations, John Wiley & Sons, 2009.
- M. K. Jain, S. R. K. Iyengar and R. K. Jain, Advanced Engineering Mathematics, Narosa Publishing House, Delhi, 2002.

BCSC0805: DATA STRUCTURES AND ALGORITHMS LAB

Objective: *The objective of this course is that students will understand and implement simple data structures, able demonstrate different sorting and searching techniques. and will be familiar with graphs and their applications.*

Credits: 01 **L–T–P-J: 0–0–2-0**

Module No.	Content	Hours
I/II	• Program to implement various operations in a singly linked list. • Program to implement insertion, deletion and traversal in a doubly linked List. • Program to implement polynomial addition using linked list. • Program to demonstrate the various operations on stack. • Program to convert an infix expression into postfix expression. • Program to evaluate a given postfix expression. • Program to implement Tower of Hanoi problem using Recursion. • Program to demonstrate the implementation of various operations on linear and circular queue. • Program to demonstrate the implementation of insertion and traversals on a binary search tree. • Program to implement Dijkstra's Algorithm to find the shortest path between source and destination. • Program to search a given element as entered by the user using sequential and binary search to search a given element as entered by the user. • Implementation of various sorting algorithms like Selection Sort, Bubble Sort, Insertion Sort, Merge Sort, Quick Sort and Heap Sort.	24

Outcome: After completion of course, student will be able to:

- CO1: Demonstrate the associated operations in linear data structure like stack, Queue and link list.
- CO2: Demonstrate the associated operations in Binary Search Tree and Dijkstra's Algorithm.
- CO3: Implementation the sorting algorithms like Selection Sort, Bubble Sort, Insertion Sort, Merge Sort, Quick Sort and Heap Sort.

BCSC 0852: LEARNING PYTHON FOR DATA ANALYSIS AND VISUALIZATION LAB

Objective: *The course is designed to provide an introduction to the Python Programming language. The focus of the course is to provide students with an introduction to programming, Data Analysis with Python, I/O, and visualization using the Python Programming language.*

Credits: 01 **L–T–P-J: 0–0–2-0**

Module No.	Content	Teaching Hours
I, II	**Programs based on the concepts of:** • Building Python Modules • Obtaining user Data • Printing desired output **Programs based on the concepts of:** • Conditional if statements • Nested if statements • Using else if and elif **Programs based on the concepts of Iteration using different kinds of loops** **Usage of Data Structures** • Strings • Lists • Tuples • Sets • Dictionary **Program based on the concepts of User-defined modules and Standard Library (** **Random, numpy, matplotlib, pandas, sys, math module, string module, list module etc.).** Program based on Input Output. Program based on exception Handling. Program based on Simple Data analysis. Program based on Pandas. Data Visualization graph plotting Create the GUIs using OO programming	28 hours

Text Books:

- Paul Barry: "Head First Python "O'Reilly Media, Inc.".
- Python Data Science Handbook: Essential Tools for Working with Data.

Reference Books:

- Bret Slatkin: "Effective Python: 59 Specific ways to write better Python", Addison Wesley, 2015.

Outcome: After completion of course, the student will be able to:

- CO1: Understand to solve problems with smaller Lines of Code using Python as compared to other programming languages.
- CO2: Use Object-Oriented Programming concepts while programming in Python.
- CO3: Gain knowledge of Python visualization libraries.
- CO4: Create a plot of retrieved data.
- CO5: Work with Python using GUI.

BECG0804: ELECTRICAL & ELECTRONICS ENGINEERING LAB

Objective:

- Verify The venin, Maximum power transfer and Superposition theorem.
- To Measure energy using single-phase energy meter.
- Evaluate the performance of PN junction diode, BJT and MOSFET.
- Analyze the operations of Rectifiers, clampers and clipper circuits.
- Verify the Op-Amp characteristics and application as adder and subtractor

Credits: 01 **L–T–P-J: 0–0–2-0**

Module No.	Content	Teaching Hours
I/II	1. To Verify the Thevenin's Theorem (DC Circuits). 2. To Verify the Maximum Power Transfer Theorem (DC Circuits). 3. To Verify the Superposition Theorem (DC Circuits). 4. To Study the Phenomenon of Resonance in R-L-C Series Circuit and to Draw Graph Between Frequency and Current. 5. To Study Single Phase (Analog & Digital) Energy Meter. 6. Study of DSO and Measurement of Voltage and Frequency Using DSO. 7. To determine the V-I characteristics of a semi-conductor diode. 8. To study the working of a Half-Wave & Full Wave (Bridge type) rectifier. 9. To study application of diode as clipper circuit and clamper circuit. 10. To study Zener diode as voltage regulator 11. To study V-I characteristic of MOSFET. 12. To verify characteristics of op-Amp and realization of Op-Amp as adder &subtract or.	24

Outcomes: At the end of the course students will be able:

- CO1: Construct basic circuits using rheostats and voltage sources.
- CO2: Use breadboard for constructing the basic circuits.
- CO3: Measure the various electrical quantities (like voltage, current, frequency and power
- CO4: Application of DMM in voltage, current, resistance and capacitance measurement
- CO5: Measure energy using single-phase energy meter.
- CO6: Evaluate the performance of PN junction diode, BJT and MOSFET.
- CO7: Analyze the operations of Rectifiers, clampers and clipper circuits.
- CO8: Design adder and subtractor circuits using Op-Amp (IC 741).

BCSC0853: COMPETITIVE PROGRAMMING LAB

Objective: *Learn about various Algorithms related to stack, Queue and Linked List. Learn how to solve Recursion and Backtracking problems. Implement various Algorithms related to Trees and Graphs. Implement Divide and Conquer and Greedy Algorithms. Understand the concept of Dynamic Coding by solving problems*

Credits:01 **L-T-P-J:0-0-2-0**

Module No.	Content	Lab Hours
I & II	• Arrays, Matrix, Strings, Recursion and Hash Table • **Sorting and Searching, Linked List, Stack and Queues** • Tree, Graph, Heap and Tries • Interval, Dynamic Coding, Binary, Math and Geometry • Greedy Approach and Backtracking	**26**

Reference Books:

- Introduction to Algorithms By Thomas H .Cormen, Charles E. Leiserson
- Competitive Programming 3 by Steven Halim
- Guide to Competitive Programming by Antti Laaksonen
- Programming Challenges by Steven S Skiena

Outcome: At the end of the course students will be able:

- CO1 : Learn about various Algorithms related to stack, Queue and Linked List.
- CO2 : Learn how to solve Recursion and Backtracking problems.
- CO3 : Implement various Algorithms related to Trees and Graphs
- CO4 : Implement Divide and Conquer and Greedy Algorithms.
- CO5: Understand the concept of Dynamic Coding by solving problems.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1, PO3/PSO1, PSO2
CO2	PO3, PO4/PSO1
CO3	PO3/PSO2, PSO4

SEMESTER -III
SYLLABUS

BCSC0020: OBJECT ORIENTED CONCEPTS USING JAVA

Objective: *This course introduces the Object-Oriented programming paradigm to students. It also teaches a student how to think objectively and model a Java program for solving real-world problems. Formal introduction to Java programming*

Credits-3 **L-T-P-J:3-0-0-0**

Module No.	Content	Teaching Hours
I	**Object-Oriented Programming:** Features of Object-Oriented Programming, Introduction to Object-Oriented Java Programming. Basics of Java programming. **Working with Java Primitive Data Types:** Strongly Typed nature of Java, Primitive Data Types in Java, The new 'var' keyword, Scope of a variable. **Accepting User Input in Java Programs:** using the Scanner class, using command line arguments. **Programming Constructs:** Sequence, Selection, Iteration & Transfer Statements, For-Each Loop. **Working with Java Arrays**: Declaring and Initializing One-Dimensional and Two-Dimensional Arrays in Java, Introduction to java. util. Arrays class. **The String API:** String Data Type, commonly used methods from the String API, String Tokenizer, String Builder & String Buffer. **Creating and Using Methods:** Signature of a method, Types of Methods, Overloading methods in a class, Static and Non-Static Methods. **Describing and Using Objects & Classes:** Declare the structure of a Java class, declaring members of a class (fields and methods), declaring and using Java Objects, lifecycle of an Object (creation, assignment, dereferencing and garbage collection), Constructors of a class, Overloading Constructors, Constructor chaining using 'this' and 'super' keyword. **Using Java Packages:** create and import Java packages and static imports, abstracting program logic to packages, creating executable main class, running the executable class inside a package. **Applying Encapsulation**: Using access modifiers with/in a class, principles of encapsulation. **Programming Abstractly Through Interfaces:** create and implement Interfaces for programs, private and default methods in Interfaces, declaring Abstract Classes, Constructors in Abstract Classes. Marker Interface, Functional Interfaces, Lambda Expressions in Java.	20
II	**Reusing Implementations using Inheritance:** Declaring Subclasses and Super classes, extend Abstract Classes, implementing Interfaces, exploring polymorphic behavior by overriding methods, Object Types vs Reference Types, differentiate overloading, overriding and hiding. **Exception Handling:** Exception Hierarchy, Need of Exception Handling, Checked Exceptions, Unchecked Exceptions and Errors, Try-Catch Blocks, Finally, Throw & Throws Keywords, creating and handling Custom Exceptions. **Threads in Java:** Life Cycle of a Thread, creating threads using Runnable and Thread, 'sleep ()', Thread Priorities. **Using Wrapper Classes:** Wrapper Classes in Java, Boxing-Unboxing-Auto Boxing-Auto Unboxing. **Generics & Collections:** Creating Generic classes, Generic Methods, Diamond Notation, Wildcards, Type Erasure, Collection Hierarchy, Base Interfaces, Lists, Sets and Maps. **The Stream API:** Introduction to the Stream API, using lambda expressions in Streams. **Regular Expressions:** Pattern and Matcher Class. **JDBC:** JDBC Drivers, Connecting to a MySQL Database, Driver Manager, Connection Interface, Statement Interface, Result Set Interface, Prepared Statements. **Event and GUI programming:** Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing	18

Text Book:

- Herbert Schildt, "The Complete Reference, Java Eleventh Edition", Oracle Press.2019.

Reference Book:

- Cay S Hosrtmann, "Core Java Volume I—Fundamentals, Eleventh Edition", Pearson, 2018.
- Rogers Cadenhead, "Sams Teach Yourself Java in 21 Days (Covers Java 11/12), 8th Edition", Pearson, 2020.

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

- CO1: Understand the basics of Object-Oriented Programming paradigm.
- CO2: Construct the logical flow of programs by using the sequence, selection, iterations and transfer statements.
- CO3: Apply the concepts of Object-Oriented Programming to model programs in Classes, Abstract Classes, Interfaces and Enums, and simplify program function by dissecting it into methods.
- CO4: Understand accessibility of members in a program unit and create packages to prevent namespace collisions.
- CO5: Predict run-time errors in a program by examining program functioning.
- CO6: Show the parallel processing capabilities of a program using a multithreading concept.
- CO7: Experiment with the predefined classes and interfaces defined in the Collections Framework.
- CO8: Develop a program using JDBC connectivity to demonstrate data persistence.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	**POs/PSOs**
CO1	PO1, PO3/PSO1, PSO2
CO2	PO1, PO3/PSO1, PSO2
CO3	PO1, PO2/PSO1, PSO2
CO4	PO1/PSO2, PSO4
CO5	PO1, PO2, PO4/PSO4
CO6	PO1, PO2, PO3/PSO2
CO7	PO1, PO2, PO11/PSO2
CO8	PO1, PO2, PO3/PSO1, PSO2

BCSC0054: ADVANCED DATABASE MANAGEMENT SYSTEM

Objective: *The objective of the course is to enable students to understand and use a relational database & NoSQL system. Students learn how to design and create a good database.*

Credits: 04 **L-T-P-J: 4-0-0-0**

Module No.	Content	Teaching Hours
I	**Introduction:** An Overview of Database Management System, Database System vs File System, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence, Database Language and Interfaces (DDL, DML, DCL), Database Development Life Cycle (DDLC) with case studies. **Data Modeling Using the Entity-Relationship Model:** ER Model Concepts, Notation for ER Diagram, Mapping Constraints, Keys, Specialization, Generalization, Aggregation, Reduction of an ER Diagram to Tables. **Relational Data Model and Language:** Relational Data Model Concepts, Integrity Constraints: Entity Integrity, Referential Integrity, Key Constraints, Domain Constraints, **Relational Algebra:** Selection, Projection, Union, Intersection, Set Difference, Cross Product, Joins: Inner Join (Theta Join, Equi Join, Natural Join), Outer join (Left, Right, Full Outer Join), Division. **Database Design & Normalization:** Functional Dependencies, Primary Key, Foreign Key, Candidate Key, Super Key, Normal Forms, First, Second, Third Normal Forms, BCNF, 4th Normal Form, 5th Normal Form	26
II	**Transaction Processing Concept:** Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Deadlock Handling. **Concurrency Control Techniques:** Concurrency Control, Locking Techniques for Concurrency Control, 2PL, Time Stamping Protocols for Concurrency Control, Validation Based Protocol. **Distributed Database:** Introduction of Distributed Database, Data Fragmentation and Replication. **Database Programming using Python**: Database connectivity, Retrieving Data from Database, Parameters Passing, Execute many Methods, Cursor Attributes, Invoke Stored Procedures, Invoke Stored Functions.	26

Text Books:

•Elmasri and Navathe, "Fundamentals of Database Systems", 6th Edition, Addison Wesley, 2010.
• Sadalage, P. & Fowler , "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Pearson Education, 2012.

References Books:

• Date C J, " An Introduction to Database Systems", 8th Edition, Addison Wesley.
• Korth, Silbertz and Sudarshan, "Database Concepts", 5th Edition, TMH, 1998.
• Redmond, E. &Wilson, "Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement", 1st Edition.

Course Outcome: After completion of course, student will be able to:

• CO1: Understand the concept of database management systems and Relational database.
• CO2: Identify the various data model used in database design.
• CO3: Design conceptual models of a database using ER modeling for real life applications and construct queries in Relational Algebra.
• CO4: Create and populate a RDBMS for a real life application, with constraints and keys, using SQL.
• CO5: Select the information from a database by formulating complex queries in SQL.
• CO6: Analyze the existing design of a database schema and apply concepts of normalization to design an optimal database.

- CO7: Discuss recovery system and be familiar with introduction to web database, distributed databases.
- CO8:Design and implement the database system with the fundamental concepts of DBMS using Python.

BCSS 0051: DATA VISUALIZATION

Objective: *The objective of this course to introduce the all kind of graph and chart that might be used to analyze the different business moment decision to attain their objective and getting the growth in the business.*

Credits: 4 **L-T-P-J:3-1-0-0**

Module No.	Content	Teaching Hours
I	1. Introduction to EDA 2. Data Analysis vs EDA 3. Understanding the Data 4. Univariate Analysis 5. Bivariate Analysis 6. Multi Collinearity 7. Missing Values Treatment 8. Outliers Treatment 9. Working on Imbalanced Dataset 10. Case Study	20
II	1. Introduction to Data Visualization Tools a. Introduction to Data Visualization b. Introduction to Matplotlib c. Basic Plotting with Matplotlib 2. Different types of Plots a. Line Plots b. Area Plots c. Histograms d. Bar Charts e. Pie Charts f. Box Charts g. Scatter Plots 3. Advanced Visualizations and Geospatial Data a. Waffle Carts b. Word Clouds c. Seaborn and Regression Plots Map with Markers 4. Creating Dashboards with Plotly and Dash a. Dashboarding Overview b. Introduction to Plotly c. Introduction to Dash d. Make interactive dashboards 5. Case Study Project for Data Visualization - COVID19 Data Storytelling	20

Text Books:

- Claus O. Wilke, Fundamentals of Data Visualization: A Primer on Making Informative and compelling Figures, Paperback.
- Andy Kirk, Data Visualization: A Handbook for Data Driven Design, Paperback.

Reference Books: Ken Black, Business Statistics: For Contemporary Decision Making.

Outcome: After completion of Lab, student will be able to:

- CO1: Apply the basic concepts of Data Visualization.
- CO2: List various business moment decisions.
- CO3: Apply the concept of data preprocessing.
- CO4: Differentiate Data types.
- CO5: Implement Data Preprocessing technique.

BCSS 0052: PROBABILITY AND APPLIED STATISTICS

Objective: *The objective of this course to introduce the application of statistics in the field of data science and how businesses are using these concepts to attain their objective and getting the growth in the business.*

Credits: 03 **L-T-P-J:3-0-0-0**

Module No.	Content	Teaching Hours
I	1. Various Research Methods 1. Introduction to Several Statistical Study Materials 2. Learn the positives and negatives of each 2. Visualizing Data a. Take your data and display it to the world b. Create the interpret histograms, bar charts, and frequency plots 3. Central Tendency a. Create and Interpret the 3 measures of center for distributions: the mean, median, and mode 4. Variability a. Quantify the spread of data using the range and standard deviation b. Identify outliers in data sets using the concept of the interquartile range 5. Standardizing a. Convert distributions into the standard normal distribution using the Z-Score b. Compute proportions using standardized distributions 6. Normal Distribution a. Use normalized distributions to compute probabilities b. Use the Z-table to look up the proportions of observations above, below, or in between values 7. Sampling Distributions a. Apply the concepts of probability and normalization to sample data sets.	20
II	1. Estimation a. Estimate population parameters from sample statistics using confidence intervals b. Estimate the effect of a treatment 2. Hypothesis Testing a. How to determine is treatment has changed the value of a population parameter. 3. T-tests a. How to test the effect of a treatment b. Compare the difference in means for two groups when there are small sample sizes. 4. ANOVA a. Learn how to test whether or not there are differences between three or more groups 5. Correlation a. Learn how to describe and test the strength of a relationship between two variables 6. Regression a. How changes in one variable are related to changes in a second variable 7. Chi-Squared Tests a. Learn how to compare and test frequencies for categorical data.	20

Text Books:

- Allen B. Downey, **Think Stats**. 'O' Reilly
- Peter Bruce and Andrew Bruce, **Practical Statistics for Data Scientists**, 'O' Reilly

Reference Books

Ken Black, Business Statistics: For Contemporary Decision Making

Outcome: After completion of Lab, student will be able to:

- CO1: List different kind of statistics for data analysis.
- CO2: Differentiate measure of central tendency and measure of variability.
- CO3: Define Normalization and Standardization.
- CO4: Conceptualize Probability distribution
- CO5: Apply statistics in various research methods.

BELA 0001: ENGLISH FOR OCCUPATIONAL PURPOSES- I

Objective: *The course is designed with specific purpose of acuminating the leaners with the fundamentals of Occupational English. The course would help the learners being through with the concepts of language in three skills- Reading, Writing and Speaking.*

Credits: 03 **L-T-P-J:3-0-0-0**

Module No.	Content	Teaching Hours
I	**Open classes and closed systems:** Morphological and syntactic features- Noun, Verb, Adjective, Adverbs **Grammar:** Grammatical units, Chain and choice factors, Grammatical structures, Grammatical features, Grammar and meaning Writing a **short reflective report** of an event - incident/meeting/ celebration **Mind-mapping** for advanced reading, making correlations across texts, extending author's point of view **Words in making**- Affixation, Conversion, Compounding, Back formation, Reduplication, Clipping, Acronym, Blends, Brand names	20
II	**Collaborative writing and presentation** in groups of 3-4 on topics that would require data collection and reading followed by recorded peer-reflection and peer-feedback, group presentation and feedback **Words in kinship-** Reference, Sense- synonymy, Antonym and Hyponymy; Polysemy and Homonymy **Collaborative and individual task:** planning, preparing (preparing an outline, structure, setting objectives and presenting the plan of action) and executing a mini-project, and submitting a brief report on the same Peer and instructor feedback after the planning stage and on completion of the mini project. **Evaluative and extrapolative reading** of a long/short text on a current topic related to technology and society, identifying and questioning the author's intention, post-reading discussion in small groups, maintaining group dynamics, arriving at a consensus **Modelling an interview:** with a panel of four judges (peers)	20

Text Books:

- Crystal, D.Making Sense: The Glamorous Story of English Grammar of English. Oxford University Press. NY. 2017.
- Huddleston, R, Pullum, G. K. The Cambridge Grammar of the English Language. Camridge. Cambridge University Press. 2002.

Reference Books:

- Geoffery L, Svartvik, J. London. Longman. Third Ed , 2003.

BELH0017: ETHICS AND VALUES

Objectives: *The course aims to develop a logical understanding of morality and society. It aims to develop a critical perspective of the assumptions and prejudices which we use in decision making process. It is to foster the understanding of professional ethics. It is to train students to rationalize the problems of life and profession to learn problem solving and decision making skills. It is to help students in identifying normative commitments of technological knowledge.*

Credits: 02 **L–T–P-J: 2–0–0-0**

Module No.	Content	Teaching Hours
I	Conceptual Foundations: Foundations of Morality; Professional Ethics; Professional Standards in Engineering Practice; Major Theories of Ethics and Different Ethical Approaches; Normativity of Science and Technology Professions and Moral Dilemmas: Contemporary Ethical Issues; Conflict of Interests; Contracts; Rights and Violations; Consent and Dissent; Privacy and Confidentiality; Consultancy; Allocation of Burdens and Benefits; Direct and Indirect Responsibility; Patents, Piracy and Clones	14
II	Decision Making : Theoretical Bases; Foundational Values; Greater Welfare Approach; Risk-Benefit Analysis; Right-based Approach; Priority Allocation; Binding Grounds of Decisions; Public Norms and Professional Guidelines	14
III	Social Responsibility: Individual and Collective Responsibility; Corporate Social Responsibility; Justice and Fairness; Beneficence and Safety; Respect for Humanity, Life, and Nature; Sustainable Development	11

Reference Book:

Sandel J. Michael, Justice: What's Right Thing to Do? , Penguin Press.

BCSC0810: OBJECT ORIENTED CONCEPTS LAB

Objective: *The objective of this course is that students will study and learn Object Oriented Modeling and programming.*

Credits:01 **L-T-P-J:0-0-2-0**

Module No.	Content	Teaching Hours
I & II	Programs in Java and python based on the concepts of: • Classes, Constructors, Polymorphism and Keyword Static. Programs based on the concepts of: • Inheritance, Multithreading Using Thread Class & Interface Runnable, String Handling, Generic Classes. Programs based on the concepts of: • Handling Database Connectivity. • Implementation of Collection Framework. Programs based on the concepts of: • Database Connectivity. • Retrieving Data from Database. • Parameters Passing, Execute many Method. • Cursor Attributes. • Invoke Stored Procedures. • Invoke Stored Functions.	24

Reference Books:

• Naughton, Schildt, "The Complete Reference JAVA2", 9th Edition, Oracle Press.
• Bhave&Patekar, "Programming with Java", Pearson Education
• Bret Slatkin: "Effective Python: 59 Specific ways to write better Python", Addison Wesley, 2015.

Outcome: After completion of course, the student will be able to:

• CO1: Implement object oriented language features.
• CO2: Design GUIs and Graphical programming.
• CO3: Design object oriented solutions for small systems involving database and event handling concepts.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1, PO2/PSO1
CO2	PO3, PO5/PSO2
CO3	PO3, PO5/PSO4

BCSC0855: ADVANCE DATABASE MANAGEMENT SYSTEM LAB

Objective: *The lab aims to develop an understanding of different applications and constructs of SQL, PL/SQL.*

Credits:01 **L-T-P-J:0-0-2-0**

Module No.	Content	Teaching Hours
I & II	• Write the SQL queries for data definition and data manipulation language. • To implement various operations on a table. • To implement various functions in SQL. • To implement restrictions on the table. • To implement the concept of the grouping of Data. • To implement the concept of Joins in SQL. • To implement the concept of sub-queries. • To implement the concept of views, sequence. • To implement the concept of Procedure function and Triggers.	24

References Books:

- Date C J, " An Introduction to Database Systems", 8th Edition, Addison Wesley.
- Korth, Silbertz and Sudarshan, "Database Concepts", 5th Edition, TMH, 1998.
- Majumdar& Bhattacharya, "Database Management System", TMH

Outcome: After the completion of the course, the student will be able to:

- CO1: Apply SQL queries for DML and DDL.
- CO2: Develop the SQL queries for real life scenarios.
- CO3: Implement the procedural language (PL/SQL) and Triggers.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1, PO2/PSO1, PSO4
CO2	PO1, PO2/PSO1, PSO4
CO3	PO2, PO3, PO5/PSO2, PSO3

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BCSC0851: DATA VISUALIZATION LAB

Objective: *The objective of this course is that students will understand and implement all kind of graph and plots for visualizing and analyzing different kind of data to attain the business objective.*

Credits: 01 **L–T–P-J: 0–0–2-0**

Module No.	Content	Hours
I/II	1.Use the company sales.csv data and do the following visualization: • Read total profit of all months and show it using a line plot • Read all product sales data and show it using a multiline plot • Read toothpaste sales data of each month and show it using a scatter plot • Read face cream and facewash product sales data and show it using the bar chart • Read the total profit of each month and show it using the histogram to see the most common profit ranges 2.Use case time series .csv data and do the following visualization for COVID cases. • Read the 'X' variable which has 'Dates' and 'Y' variable which has 'Daily Confirmed' to plot line plot. • Plot the Transmission Pie Chart to understand how the virus is spreading based on Travel, Place Visit and Unknown reasons. • Plot the bar plot district-wise coronavirus cases for a state. 3.Use matches.csv data and do the following visualization for ILP matches: • Plot to visualize the no. of matches held in each city. • Plot to visualize the no. of matches won by each team. • Plot to visualize the no. of matches held every season • Plot to visualize the top 10 players based on the no. of MOM awards won.	24

Outcome: After completion of course, student will be able to:

- CO1: Demonstrate the plot for continuous data.
- CO2: Demonstrate the univariate and bivariate plot for categorical data.
- CO3: Demonstrate the univariate and bivariate plot for time series data.

BCSC0852: PROBABILITY AND APPLIED STATISTICS LAB

Objective: *The objective of this course is that students will understand and implement all kind of graph and plots for visualizing and analyzing different kind of data to attain the business objective.*

Credits: 01 **L–T–P-J: 0–0–2-0**

Module No.	Content	Hours
I/II	1.Use the Q1_a.csv data and do the inferences on following calculation: • Mean, median and mode of the variables • Range, IQR, variance and standard deviation • Skewness and Kurtosis 2.A F&B manager wants to determine whether there is any significant difference in the diameter of the cutlet between two units. A randomly selected sample of cutlets was collected from both units and measured? Analyze the data and draw inferences at 5% significance level. Please state the assumptions and tests that you carried out to check validity of the assumptions. Dataset: cutlet.csv 3.Use matches.csv data and do the inferences on following calculation for ILP matches: • Match won by maximum wickets. • Match won by minimum margin of runs (not by 1 run). • Matches where D/L method was and wasn't applied. • Percentages of matches with and without D/L method (0 for no D/L and 1 for D/L method applied)	24

Outcome: After completion of course, student will be able to:

- CO1: Implement exploratory data analysis.
- CO2: Demonstrate hypothesis testing for statistical analysis.
- CO3: Apply stages of analytics.

BELA0801: ENGLISH FOR OCCUPATIONAL PURPOSES LAB

Credits: 01 **L–T–P-J: 0–0–2-0**

Module No.	Content	Teaching Hours
I & II	• **Debate in pairs** based on listening to two recorded contemporary speeches by well-known leaders in different fields. Peer feedback and instructor feedback. • **Expressing opinion on a short argumentative text** (e.g. a journal article or a newspaper editorial) and justifying one's opinion/stance; focus on the use of appropriate conventions of formal and polite speech, and managing bias • **Speaking on abstract and complex topics** beyond his/her own area of interest/field of study, using the language flexibly and effectively. • **Self-reflection on own speech** in context (recorded): tone, pitch, relevance, content; extending the reflections/ideas to others • **Role-play** (complex social and academic/professional situations): Focus on significant aspects of delivery including clarity, tone, and use of contextually appropriate vocabulary and conventions, observation, reflective discussion, and self-reflective writing • **Formal Group Discussion** on topics of current interest and relevance; focus on effective participation, reflection on control over argument/counter argument, and adherence to the conventions of formal GD • **Information transfer:** Verbal to visual and visual to verbal (unfamiliar context); demonstration by teacher, learners' task (guided with scaffolding), learners' task (free), presentation, question-answer(among students), modification and feedback before the final version is done • **Handling question and answer sessions after presentations:** justifying arguments, taking counter-arguments, agreeing and disagreeing with rationale	24

Text Book:

- King, P. Conversationally Speaking. London. Create Space. 2015

SEMESTER -IV
SYLLABUS

BCSE 0055: OPERATING SYSTEM AND CONCEPTS

Objective: *This course aims to introducing the concept of computer organization. In particular, it focuses on basic hardware architectural issues that affect the nature and performance of software.*

Credits: 03 **L–T–P-J: 3–0–0-0**

Module No.	Content	Theory Hours
I	*Introduction:* Operating System and its Classification - Batch, Interactive, Multiprogramming, Time sharing, Real Time System, Multiprocessor Systems, Multithreaded Systems, System Protection, System Calls, Reentrant Kernels, Operating System Structure- Layered structure, Monolithic and Microkernel Systems, Operating System Components, Operating System Functions and Services. *Processes:* Process Concept, Process States, Process State Transition Diagram, Process Control Block (PCB), Process Scheduling Concepts, Threads and their management. *CPU Scheduling:* Scheduling Concepts, Performance Criteria, Scheduling Algorithms, Multiprocessor Scheduling. *Process Synchronization:* Principle of Concurrency, Implementation of concurrency through fork/join and parbegin/parend, Inter Process Communication models and Schemes, Producer / Consumer Problem, Critical Section Problem, Dekker's solution, Peterson's solution, Semaphores, Synchronization Hardware. *Classical Problem in Concurrency:* Dining Philosopher Problem, Readers Writers Problem.	21
II	*Deadlock:* System model, Deadlock characterization, Prevention, Avoidance and detection, Recovery from deadlock, Combined Approach. *Memory Management:* Multiprogramming with fixed partitions, Multiprogramming with variable partitions, Paging, Segmentation, Paged segmentation. *Virtual memory concepts:* Demand paging, Performance of demand paging, Page replacement algorithms, Thrashing, Locality of reference. *I/O Management and Disk Scheduling:* I/O devices, I/O subsystems, I/O buffering, Disk storage and disk scheduling. *File System:* File concept, File organization and access mechanism, File directories, File allocation methods, Free space management	19

Text Books:

• Silberschatz, Galvin and Gagne, "Operating Systems Concepts", 9th Edition, Wiley, 2012.

Reference Books:

• Sibsankar Halder and Alex a Aravind, " Operating Systems", 6th Edition, Pearson Education, 2009.
• Harvey M Dietel, "An Introduction to Operating System", 2nd Edition, Pearson Education, 2002.
• D M Dhamdhere, "Operating Systems: A Concept Based Approach", 2nd Edition, 2006.
• M. J. Bach, "Design of the Unix Operating System", PHI, 1986.

Outcome: After completion of course, the student will be able to:

- CO1: Understand the classification of operating system environment.
- CO2: Understand the basic of process management.
- CO3: Apply the concept of CPU process scheduling for the given scenarios.
- CO4: Illustrate the process synchronization and concurrency process in operating system.
- CO5: Analyze the occurrence of deadlock in operating system.
- CO6: Describe and analyze the memory management and its allocation policies.
- CO7: Understand the concepts of disk scheduling.

BCSC0057: SOFTWARE ENGINEERING METHODOLOGIES

Objective: *Be employed in industry, government, or entrepreneurial endeavors to demonstrate professional advancement through significant technical achievements and expanded leadership responsibility.*

Credits: 03 **L–T–P-J: 3–0–0-0**

Module No.	Content	Teaching Hours
I	**Introductory Concepts**: The evolving role of software – characteristics, components and applications. The Human Side of Software Development. **Process Models:** Waterfall Model, Prototyping, Incremental, Spiral. **Agile software Development**: Introduction to Agile, Agile software development framework. Kanban model, DevOps. **Software Requirement Specification**: Requirement Process, SRS Components, Requirement Specifications with Use Cases Diagram. **Software Project Planning:** Project Planning Objectives. **Software Metrics:** Size, Function Point, Staffing, Project Estimation Methods– COCOMO Model. **Function-Oriented Design**: Problem Partitioning, Abstraction, Top Down and Bottom Up Design. **Module-Level Concepts:** Coupling, Cohesion, Design Notation and Specification - Structure Charts; Structured Design Methodology - Data Flow Diagram, Sequence Diagram.	20
II	**Tools:** Development Tools, Operations Management Tools, Testing Tools and Frameworks, Management and Monitoring Frameworks, Selecting Appropriate Tools. **OO Analysis and OO Design:** OO Concepts, Introduction to UML Design Patterns: Class Diagram, Activity Diagram, State Chart Diagram. **Coding**: Coding Process, Verification – Code Inspections, Software Metrics. **Testing Fundamentals**: Test Case Design, Black Box Testing Strategies, White Box Testing, Unit Testing, Integration Testing, System Testing. **Introduction to Automation Testing and Testing Tools:** Automated Testing Process, Framework for Automation Testing, Introduction to Automation Testing Tool. **Software Quality:** Models, ISO 9000 Certification for Software Industry, SEI Capability Maturity Model. SWEBOK, ISO 15504, CMM Integration (CMMI) **Software Maintenance**: Models Cost of Maintenance, Re-engineering, Reverse Engineering.	20

Text Books:

- R. S. Pressman , “Software Engineering: A Practitioners Approach”, 7thEdition, McGraw Hill, 2010.

Reference Books:

- K. K. Aggarwal and Yogesh Singh , “Software Engineering”, 3rd Edition, New Age International Publishers, 2008.
- Rajib Mall , “Fundamentals of Software Engineering”, 3rd Edition, PHI Publication, 2009.
- R.E Fairley , “Software Engineering”, McGraw Hill, 2004.
- Somerville, “Software Engineering”, 9th Edition, Pearson Education, 2010.

Outcome: After the completion of the course, the student will be able to:

- CO1: Understand the basic concepts of software engineering.
- CO2: Apply software processes to solve real world problems.
- CO3: Estimate the cost, effort and schedule of software using COCOMO Model.
- CO4: Analyze the software design techniques (structure chart, SDM, sequence diagram).
- CO5: Understand the basic concepts of OO analysis and design.
- CO6: Develop the test cases to validate the software.
- CO7: Understand the basic models of software Quality and maintenance.

BCSC0058: DISCRETE MATHEMATICAL STRUCTURES

Objective: *The objective is to introduce students to language and methods of the area of Discrete Mathematics. The focus of the module is on basic mathematical concepts in discrete mathematics and on applications of discrete mathematics in computer science.*

Credits: 4 **L–T–P-J: 3–1–0-0**

Module No.	Content	Teaching Hours
I	**Sets, Relations and Functions:** Introduction to Set Theory, Venn diagrams, algebra of Sets, Inclusion-Exclusion Principle, Partitions, Proof Techniques, Relations, Properties and their types, Function and their types. Recurrence Relations and Generating Functions **Introduction to Counting Principle**: Permutation, Combination, Permutation with Repetition, Combination with Repetition, Pigeonhole Principle. **Probability Theory**: Introduction to Probability Theory, Conditional Probability, Total Probability, Bayes' Theorem. **Proof Method:** Mathematical Induction	17
II	**Propositional Logic** - Logical Connectives, Truth Tables, Normal Forms (Conjunctive and Disjunctive), Validity; **Predicate Logic** - Quantifiers, Inference Theory. **Algebra**: Motivation of Algebraic Structures, Finite Groups, Subgroups and Group Homomorphism; Lagrange's Theorem; Commutative Rings and Elementary Properties; **Graph Theory:** Introduction to Graphs, Types: Planner, Directed, Complete, Bipartite Graph, Isomorphism, Euler Graph, Hamiltonian Graph, Operations on Graphs, Representation of graphs, Connectivity.	23

Text Book:

- Kenneth H Rosen (2012), "*Discrete Mathematics and Its Applications", 7th edition,* TMH.

Reference Books:

- J.P.Tremblay (1997), *"Discrete Mathematical Structures with Applications to Computer Science",* TMH, New Delhi.
- V. Krishnamurthy (1986), "*Combinatorics: Theory and Applications",* East-West Press, New Delhi.
- Ralph P. Grimaldi (2004), "*Discrete and Combinatorial Mathematics- An Applied Introduction"*, 5th Edition, Pearson Education.
- C.L.Liu (2000), "*Elements of Discrete Mathematics"*, 2nd Edition, TMH.

Outcome: After the completion of the course, the student will be able to:

- CO1: Understand the notion of mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem solving.
- CO2: Understand the basics of discrete probability and number theory, and be able to apply the methods from these subjects in problem solving.
- CO3: Use effectively algebraic techniques to analyze basic discrete structures and algorithms.

BCSC: 0059 ALGORITHMS DESIGN & ANALYSIS

Objective: *The objective of this course is that students will construct and application of various data structures and concepts including Trees, Recursion & Dynamic programing.*

Credits: 04 **L–T–P-J: 3–1–0-0**

Module No.	Content	Hours
I	**Introduction:** Algorithms, analysing 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: Radix sort, Bucket sort, Counting sort. Divide and Conquer Applications: Sorting, Matrix Multiplication, Convex hull and Binary search. **Advanced Data Structures:** Red-Black trees, B- trees, Binomial Heaps, Fibonacci Heaps.	20
II	**Greedy Approach Applications:** Job Sequence with Deadline, Fractional Knapsack, and Minimum Spanning trees – Prim's and Kruskal's algorithms, Single source shortest paths - Dijkstra's and Bellman Ford algorithms. **Dynamic programming Applications**:0/1 Knapsack. All pair shortest paths – Warshal's and Floyd's algorithms, Longest Common Subsequence, Matrix Chain Multiplication. **Backtracking, Branch and Bound Applications:** Travelling Salesman Problem, Graph Coloring, n-Queen Problem, Sum of subsets.	20

Text Book:

- Thomas H. Coremen, Charles E. Leiserson and Ronald L. Rivest (2008), "Introduction to Algorithms, Third edition", Prentice Hall of India.
- Aaron M. Tanenbaum, Yedidyah Langsam and Moshe J. Augenstein (2009), "Data Structures Using C and C++", 2nd Edition, PHI.

Reference Books:

- Gilles Brassard Paul Bratley (1996), " Fundamentals of Algorithms", Prentice Hall.
- Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran (2008), "Fundamentals of Computer Algorithms", Orien Longman Pvt. Ltd.
- Levitin (2008), "An Introduction to Design and Analysis of Algorithms", Pearson.

Outcome: After the completion of the course, the student will be able to:

- CO1: Learn good principles of algorithm design;
- CO2: Apply the algorithms and design techniques to solve problems;
- CO3: Analyze the complexities of various problems in different domains and estimate their worst-case, average-case and best case behavior.
- CO4: Discuss various searching, sorting and graph traversal algorithms.
- CO5: Understand NP completeness and identify different NP.
- CO6: Know how to design algorithms using the divide-and-conquer. Dynamic programming, greedy approach strategy and recite algorithms that employ these strategies.

BCSE 0450: MACHINE LEARNING USING PYTHON

Objective: *To introduce students to the basic concepts and techniques of Machine Learning. To develop skills of using recent machine learning software for solving practical problems. To gain experience of doing independent study and research.*

Credits: 03 **L–T–P-J: 3–0–0-0**

Module No.	Content	Theory Hours
I	**Introduction to Machine Learning** Introduction to Machine Learning and applications of Machine Learning in different fields such as health care, banking, telecommunication, Python for Machine Learning, Supervised vs Unsupervised. **Regression:** Introduction to Regression, Simple Linear Regression, Evaluation Metrics in Regression Models, Multiple Linear Regression, Polynomial Regression. Application of Linear Regression and Multiple Linear Regression on different real life datasets. **Classification:** Introduction to Classification, Intro to Logistic Regression, Logistic regression vs Linear regression, Logistic Regression Training, K-Nearest Neighbors, Evaluation Metrics in Classification, Introduction to Decision Trees, Building Decision Trees using ID3 algorithm. Support Vector Machine, Multiclass Classification. Application of SVM (Support Vector Machines) to classify human cells as benign or malignant.	20
II	**Clustering:** Intro to Clustering, k-Means clustering, apply k-means clustering for customer segmentation. **Artificial Neural Networks:** Introduction to Neural network, Gradient Descent Algorithm, Back-propagation, Vanishing Gradient, Activation Functions. **Deep Learning:** Introduction to Deep Learning, Shallow Versus Deep Neural Networks, Convolutional Neural Networks, Padding, Strided Convolutions, Pooling Layers, Fully Connected layer, Flattening, Building Blocks of Deep Neural Networks. Apply Convolutional Neural Network (CNN) for classifying handwritten digits using MNIST dataset.	20

Text Book:

- Tom M. Mitchell, "Machine Learning". Tata McGraw-Hill Education, 2013.
- Alpaydin, E. , " Introduction to machine learning". MIT press, 2009.
- Ian Goodfellow and Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press, 2016.

Reference Books:

- Harrington, P." Machine learning in action". Shelter Islan", NY: Manning Publications Co, 2012.
- Bishop, C. M., "Pattern recognition and machine learning (information science and statistics)" springer-verlag new york. Inc. Secaucus, NJ, USA, 2006.
- Charu C. Aggarwal, "Neural Networks and Deep Learning", Springer International Publishing, 2018.

Outcome: After completion of Lab, student will be able to:

- CO1: Apply the basic concepts of machine learning.
- CO2: Analyze the concepts of regression and classification methods.

- CO3: Design unsupervised learning based solutions.
- CO4: Analyze the concepts of artificial neural network methods.
- CO5: Identify the ways of feature extraction, reduction and selection.
- CO6: Design the applications of machine learning algorithms.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	**POs/PSOs**
CO1	PO1, PO2/PSO3, PSO4
CO2	PO1, PO2/PSO1, PSO3
CO3	PO1, PO3, PO5/PSO1, PSO3
CO4	PO1 /PSO1
CO5	PO2/PSO3
CO6	PO1, PO2, PO3/PSO1, PSO2, PSO4

BELG0001: CREATIVITY AND INNOVATION

Objectives: *The course aims to develop an understanding to creativity and innovation. It harness creativity and change leadership to develop professional and organizational skills. It develops contemporary and radical ways of thinking to develop problem solving skills with new possibilities. It structures innovation leadership skills to inspire and motivate others by some proven frameworks to apply innovative ideas to design new practices.*

Credits: 02 **L–T–P-J: 2–0–0-0**

Module No.	Content	Teaching Hours
I	**Creativity and Digital Transformations:** Basic concepts, Digital Experience, Business Run from the cloud, Data Driven Leadership, Internet of Things, Business Process with Automation. AI and the Digital Transformations, Cultural requirements for digital transformations, Digital Transformation Strategies.	9
II	**Autonomous Systems and Ethical Issues:** Foundational Developments, Automated Transportation, Ethical Implications of automated vehicles, Automation at Workplaces, Ethical issues in human-robot workforce, Autonomous systems in healthcare and ethical concerns, Autonomous system ventures at no human reach, Autonomous space exploration and ethical concerns, Autonomous systems: the future Innovation Management: what it is, impacts of innovation management, successful innovation management, implementing innovation management, innovate, create and ideate.	9

References:

1) https://www.cambridgeinternational.org/Images/426483-chapter-4-innovation-andcreativity.pdf
2) https://online.stanford.edu/your-guide-understanding-digital-transformationstrategy.
3) https://online.stanford.edu/guide-innovation-management
4) https://online.stanford.edu/5-cultural-requirements-successful-digitaltransformation
5) https://online.stanford.edu/digital-transformation-ebook-download
6) autonomous-systems-ebook (1).pdfhttps://online.stanford.edu/digitaltransformation-ebook-download
7) https://online.stanford.edu/leading-innovation-and-design-thinking
8) https://online.stanford.edu/how-to-build-strong-company-culture
9) https://online.stanford.edu/how-to-innovate-faster-better-during-COVID-19
10) https://online.stanford.edu/leadership-in-turbulent-times
11) https://online.stanford.edu/data-driven-storytelling
12) https://online.stanford.edu/how-to-lead-digital-transformation
13) https://online.stanford.edu/what-makes-a-leader-great-during-a-crisis
14) https://online.stanford.edu/drive-innovation-in-large-enterprises
15) https://online.stanford.edu/turning-data-value-building-ai-enabled-organization
16) https://online.stanford.edu/responsible-ai-keeping-machines-absorbing-humanbiases

Outcome: After completion of Lab, student will be able to:

- CO1: Profound skills for creativity and innovation in automated organizational systems.
- CO2: The enhanced ability to understand the creativity and innovation at workplace.
- CO3: Well-constructed professional approach to understand the digital transformation and its ethical implications.

- CO4: Improved Decision Making Ability for the successful leadership and innovation management skills.

BCSC0856: OPERATING SYSTEMS AND CONCEPTS LAB

Objective: *The lab aims to develop understanding the operation of UNIX operating system.*

Credits:01 **L-T-P-J:0-0-2-0**

Module No.	Content	Teaching Hours
I & II	• Implement the following basic commands (with options) used in UNIX/LINUX OS. • Write and implement the basic vi editor commands. • Shell scripts that use simple commands. • Decision based Shell scripts. • Shell scripts related to strings. • Shell scripts using pipes. • Shell scripts with loop statements. • Demonstration and solution for race condition. • Demonstration and use of System Calls. • Implement the basics of IPC in UNIX.	24

Reference Books:

- Sibsankar Halder and Alex a Aravind, " Operating Systems", 6th Edition, Pearson Education, 2009.
- Harvey M Dietel, "An Introduction to Operating System", 2nd Edition, Pearson Education, 2002.
- D M Dhamdhere, "Operating Systems: A Concept Based Approach", 2nd Edition, 2006.
- M. J. Bach. , "Design of the Unix Operating System", PHI, 1986.

Outcome: After completion of course, the student will be able to:

- CO1: Implement the basic operations on UNIX operating systems.
- CO2: Demonstrate the working of systems calls.
- CO3: Demonstrate message passing in Unix operating system.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1, PO3, PO4/PSO1
CO2	PO1, PO2/PSO1
CO3	PO1, PO4, PO5/PSO1, PSO2

BCSC: 0857 ALGORITHMS DESIGN AND ANALYSIS LAB

Objective: *The objective of this course is that students will understand and implement simple data structures, able demonstrate different sorting and searching techniques and will be familiar with graphs and their applications.*

Credits: 01 **L-T-P-J:0-0-2-0**

Module No.	Content	Hours
I&II	• Implementation of sorting algorithms: o Insertion Sort o Bubble Sort o Selection Sort o Divide and conquer approach: • Quick Sort • Merge Sort o Heap Sort o Counting Sort • Implementation of Searching Techniques: o Linear Search o Binary Search • Implementation of Matrix Multiplication • Implementation of Convex Hull • Implementation of Breadth First Search • Implementation of Depth First Search • Implementation of Greedy approaches: o Fractional Knapsack. o Job Sequencing with Deadlines. o Minimum Spanning trees: • Prim's and Kruskal's algorithms. o Single source shortest paths – • Dijkstra's and Bellman Ford algorithms. • Implementation of Dynamic Programming: o Longest Common Subsequence. o Matrix Chain Multiplication o 0/1 Knapsack Problem o Sum of Subset Problem	32

Outcome: After the completion of the course, the student will be able to:

- CO1: Implementation the sorting algorithms like Selection Sort, Bubble Sort, Insertion Sort, Merge Sort, Quick Sort and Heap Sort.
- CO2: Demonstrate and use the appropriate data structures for a given problem
- CO3: Implement the algorithms based on Greedy approach and Dynamic Programming

BCSE 0480: MACHINE LEARNING USING PYTHON LAB

Credits: 01 **L–T–P-J: 0–0–2-0**

Module No.	Content	Teaching Hours
I& II	• Introduction to python, numpy and pandas • Implementation of Simple linear regression • Implementation of Multiple linear regression • Implementation of logistic regression • Implementation of regression models with regularization • Implementation of dimensionality reduction using PCA • Implementation of SVM • Implementation of Decision tree on real word data set • Implementation of Naïve Bayes Classifier • Implementation of k-means clustering • Implementation of ANN	20

Text Book:

- Alpaydin, E., ". Introduction to machine learning", MIT press, 2009.
- Bishop, C. M. , "Pattern recognition and machine learning" , (information science and statistics) springer-verlag new york. Inc. Secaucus, NJ, USA, 2006.

Reference Books:

- Harrington, P., " Machine learning in action. Shelter Island" , NY: Manning Publications Co., 2012.

Outcome: After completion of Lab, student will be able to:

- CO1: Implement the basic concepts of machine learning including bias-variance tradeoff.
- CO2: Analyze data using regression and re-sampling methods.
- CO3: Perform supervise learning for classification.
- CO4: Applyand perform dimensionality reduction.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1, PO2/PSO3
CO2	PO2, PO3/PSO1, PSO3
CO3	PO1, PO4/PSO3, PSO4
CO4	PO4/PSO1, PSO3

SEMESTER -V
SYLLABUS

BCSC 0060: DATA COMMUNICATION AND NETWORK SYSTEM

Objective: *The objective is to understand fundamental underlying principles of computer networking, details and functionality of layered network architecture.*

Credits: 03 **L–T–P-J: 3–0–0-0**

Module No.	Content	Teaching Hours
I	**Introduction Concepts**: Goals and Applications of Networks, Network structure and architecture, The OSI reference model, services, Network Topology Design, Physical Layer Transmission Media, Transmission impairment and Line coding scheme (Unipolar, Polar and Biphase), switching methods (circuit switching, Packet switching). **Data Link Layer**: Error detection and correction (CRC, Checksum, Hamming code), Flow control (sliding window protocol) **Medium Access sub layer**: Medium Access sub layer - Channel Allocations, LAN protocols - ALOHA protocols, CSMA, CSMA/CD, Overview of IEEE standards.	20
II	**Network Layer**: Network Layer – IP addressing, subnet, CIDR, VLSM, Internetworking, Address mapping, Interdomain and Intra domain Routing- (RIP, OSPF and BGP), MPLS **Introduction to IPv6, transition from IPv4 to IPv6** Simulation of IP Configuration through packet tracer. **Transport Layer**: Transport Layer - Design issues, connection management, Flow control, TCP window management, congestion control-slow start algorithm, TCP variants. **Application Layer**: File Transfer, DNS, HTTP, SMTP, TELNET.	20

Text Book:

- Forouzan B. A. , "Data Communication and Networking", 4th Edition, McGraw Hill, 2004.

References:

- Kurose, J.F. and Ross K.W., "Computer Networking: A Top-Down Approach Featuring the Internet", 3rd Edition, Addison-Wesley, 2005.
- A.S. Tanenbaum, "Computer Networks", 2nd Edition, Prentice Hall India, 2006.

Outcome: After the completion of the course, the student will be able to:

- CO1: Understand the concept of OSI and TCP/IP reference model.
- CO2: Understand the basics of data transmission at physical layer.
- CO3: Understand the channel allocation using ALOHA, CSMA and CSMA/CD.
- CO4: Apply error detection and correction technique to eliminate transmission error.
- CO5: Analyze the fixed and variable length address (IPv4) subnetting for the given scenarios.
- CO6: Understand the implementation of IPv4 through Simulation.
- CO7: Understand the design issues and congestion control of the transport layer.
- CO8: Understand the mechanism of protocols at application layer such as FTP, HTTP, Telnet, DNS.

BCSE 0451: FULL STACK USING SCRIPTING TECHNOLOGY

Objective:.

Credits:02 **L-T-P-J: 2-1-4-0**

MODULE	CONTENT	Teaching Hours
I	Hyper Text Mark-up Language (5): Introduction, Basics of HTML Elements, Semantic, Attributes, Headings, Paragraph, tables, dropdown, Quotations, Lists, Blocks, Classes, Layout, Responsive, iframes, Head, Entities and URI Code, Frames, Charset and Forms elements, securities. Cascading Style Sheets: Introduction, Syntax, Types CSS, Colors, Backgrounds, Boarders, Padding, Height/Width, Gradients, Shadows, Selectors, Transformations, Typography, Box Model, Outline, Transitions, Navigation Bar, Dropdowns, Tooltips, Images, Selectors, Forms, Counters, Button, Animations, User Interface, Box Sizing, Filters, responsive web designs, Cheat Sheets. Bootstrap: Introduction to Bootstrap, Bootstrap Basics, Bootstrap Grids, Bootstrap CSS, Bootstrap JS.	18
II	JavaScript: Scope, Events, Strings, Math, Arrays, Boolean, Comparisons, Conditions, Switch, Loops, Type Conversion, Errors, Debugging, Hoisting, Strict Mode, Functions, Objects, Forms, DOM. React Js: Introduction to React Js, Introduction to components, getting to know JSX and Babel, Creating a React component, Passing components and properties, Custom component building, Building with forms and states in React, Routers in React Js. jQuery: Introduction to jQuery, jQuery Syntax, jQuery Selectors, jQuery Events, jQuery Effects, jQuery , jQuery Traversing, jQuery AJAX	22

Text Book:

HTML:

1. "HTML and CSS: Design and Build Websites" by Jon Duckett.
2. "HTML, XHTML and CSS All-in-One for Dummies" by Ed Tittel.
3. CSS: The Definitive Guide" by Eric A. Meyer.
4. "CSS3: The Missing Manual" by David Sawyer McFarland.

JavaScript:

1. "JavaScript: The Definitive Guide" by David Flanagan.
2. "Eloquent JavaScript: A Modern Introduction to Programming" by Marijn Haverbeke.
3. React Js: The Road to Learn React: Your journey to master plain yet pragmatic React.js by Robin Wieruch.

Course Outcome: After completion of course, student will be able to:

- CO1: Summarize the basics of web development using HTML5, CSS3 and JavaScript.
- CO2: Develop a web page with paragraphs, divs, images, links, and lists.
- CO3: Develop a web page using CSS IDs and classes.
- CO4: Develop JavaScript functions to implement real life problem.
- CO5: Understand the basic concepts of boot strap including grids, themes, CSS and React JS.
- CO6: Apply the concepts of jQueries to implement Java Script functions.

BCSE0452 : NEURAL NETWORKS AND DEEP LEARNING

Objective: *To introduce students to the basic concepts and techniques of Neural Networks and Deep Learning. To develop skills of using recent deep learning models for solving practical problems. To gain experience of doing independent study and research.*

Credits: 02 **L–T–P-J: 2–0–4-0**

Module No.	Content	Theory Hours
I	**Neural Networks:** Introduction to Neurons, Neural Network. Artificial and biological Neural Network, Weights, Bias, Variance, Activation functions – Sigmoid, tanh, ReLU, Softmax, Leaky ReLU, Hyperparameters, Dropout, Gradient Descent, Stochastic Gradient Descent Vanishing Gradient Descent, Loss function, Optimization- Adagrad, Adadelta, RMSProp, over-fitting, under-fitting, Cross-validation, Single Layer Perceptron- Learning curve, Learning rate, Multilayer Neural Network- Backpropagation, Chain Rule, L1 and L2 Regularization. **Deep Learning:** Introduction, Deep Neural Network architecture, Difference between Artificial Intelligence, Machine Learning and Deep Learning, Hidden Layers, Techniques to select number of hidden layers and number of neurons, Training Neural Networks.	20
II	**Recurrent Neural Networks (RNN):** Introduction, Need of RNN, Difference between feedforward and RNN, Limitations of RNN, Vanishing Gradient, Use of RNN in time-series analysis, Seq2Seq architecture, Long Short-Term Memory (LSTM)- Input, Forget, Output Gate, Long-term dependencies, Activation functions in LSTM, Applications of LSTM, Gated Recurrent Unit (GRU)- Reset, Update Gate, Attention Mechanism, Encoder-Decoder architecture **CNN:** Introduction, Convolution, Pooling types, Padding, Kernel, Flattening, Filters, Strides, Softmax, Applications of CNN, Classification of images using CNN, Data augmentation. **Generative Models:** Introduction, Architecture of Generative Adversarial Network (GAN), Generator, Discriminator, Use of GAN to generate data and images, Training and evaluation of GAN, AutoEncoders- Introduction, Variational, Contractive, Regularized, Denoising AutoEncoder. Pretrained Models: BERT, GPT, MobileNet, VGGNet, GoogleNet, ResNet, ResNeXt, DenseNet, CycleGAN, StarGAN.	20

Text Book:

- A Kevin, L. Priddy, and Paul E. Keller, “Artificial Neural Networks: An Introduction”, PHI, 2007.
- S. Haykin, “Neural Networks and Learning Machines”, Pearson Education, 3rd Ed., 2009.
- Ian Goodfellow and Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT Press, 2016.

Reference Books:

- Charu C. Aggarwal, “Neural Networks and Deep Learning”, Springer International Publishing, 2018.
- Josh Patterson and Adam Gibson “Deep Learning: A Practitioner’s Approach”, O'Reilly Media 2017.

BCSE 0453: CLOUD COMPUTING

Objective: *To introduce students to the basic concepts and techniques of Cloud. To develop skills of using recent deep learning models for solving practical problems. To gain experience of doing independent study and research.*

Credits:02 **L-T-P-J: 2-0-4-0**

MODULE	CONTENT	Teaching Hours
I	**Overview of Computing Paradigm:** Recent trends in Computing, Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing, Evolution of cloud computing **Introduction to Cloud Computing:** Cloud Computing - NIST Model, Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers, Properties, Characteristics & Disadvantages, Role of Open Standards **Cloud Computing Architecture:** Cloud computing stack, Role of Networks in Cloud computing, protocols used, Role of Web services, Service Models- Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), XaaS, Deployment Models -Public cloud, Private cloud, Hybrid cloud, Community cloud **Infrastructure as a Service(IaaS):**Introduction to IaaS, IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM), Resource Virtualization, Server, Storage, Network, Virtual Machine(resource) provisioning and manageability, storage as a service, Data storage in cloud computing(storage as a service).	18
II	**Platform as a Service(PaaS):** Introduction to PaaS, Service Oriented Architecture (SOA) Microsoft Azure **Software as a Service(SaaS):** Introduction to SaaS, Web services, Web 2.0, Web OS, Case study: **Service Management in Cloud Computing:** Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously **Managing Data:** Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing **Cloud Security:** Infrastructure Security- Network level security, Host level security, Application level security, Data security and Storage- Data privacy and security Issues, Jurisdictional issues raised by Data location, Identity & Access Management	22

Reference Book:

- Anthony T. Velte, Toby J. Velte, and Robert Elsenpeter Cloud Computing: A Practical Approach, 2010.
- McGraw Hill. Rittinghouse, John, W, Cloud computing: Implementation, management and security.
- Barrie Sosinsky, Cloud Computing Bible, Wiley 2011.
- Rhoton, John, Cloud Computing Architected: Solution Design Handbook.
- Krutz, Ronald L.; Vines, Russell Dean, Cloud Security, A comprehensive Guide to Secure Cloud Computing.

Course Outcome: After successful completion of this student will be able to:

- CO1: Describe importance of virtualization along with their technologies like system, network, and storage virtualizations.
- CO2: Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, XaaS, Public Cloud, Private Cloud, Hybrid Cloud and the core issues of cloud computing such as security, privacy, and interoperability.

- CO3: Justify the need of new technology of Virtualization & Cloud Computing and its ecological impact.
- CO4: Identify the known threats, risks, vulnerabilities and privacy issues associated with Cloud based IT services.
- CO5: Apply fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost.
- CO6: Describe the key components of Amazon Web Service and Azure.

BCSE:0482 NEURAL NETWORKS AND DEEP LEARNING LAB

Objective: *To introduce students to the basic concepts and techniques of Neural Networks and Deep Learning. To develop skills of using recent deep learning models for solving practical problems. To gain experience of doing independent study and research.*

Credits: 01 **L–T–P-J: 0–0–2-0**

Module No.	Content	Lab Hours
I & II	1. Implementation of Neural Network for binary classification- Logistic Regression 2. Implementation of Neural Network for multi classification(MNIST) 3. Implementation of Neural Network for Regression 4. Implementation of Neural Network for Word Embedding (CountVectorizer, TFIDFVectorizer) 5. Implementation of K-fold and stratified k-fold cross validation 6. Implementation of Neural Network for dropout 7. Implementation of Recurrent Neural Network 8. Implementation of Long Short-Term Memory (LSTM) model. 9. Implementation of LSTM for stock price prediction. 10. Implementation of Gated Recurrent Unit (GRU). 11. Implementation of Convolutional Neural Network. 12. Implementation of Convolutional Neural Network using IRIS dataset. 13. Implementation of Convolutional Neural Network for Hand digit recognition. 14. Implementation of Generative Adversarial Network 15. Implementation of pre-trained model for Natural Language Processing 16. Implementation of pre-trained model for Image Processing 17. Implementation of AutoEncoder	32

Reference Book:

- A Kevin, L. Priddy, and Paul E. Keller, “Artificial Neural Networks: An Introduction”, PHI, 2007.
- S. Haykin, “Neural Networks and Learning Machines”, Pearson Education, 3rd Ed., 2009.
- Ian Goodfellow and Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT Press, 2016.

Outcome: After completion of Lab, student will be able to:

- CO1: Implementation of Regression, Classification using Neural Network.
- CO2: Implement Recurrent Neural Network and LSTM.
- CO3: Implement Convolutional Neural Network.
- CO4: Fine-tune pre-trained model.

BCSE:0483 CLOUD COMPUTING LAB

Objective: *This lab aims to understand the concept of cloud and virtualization by the help of VMware.*

Credits: 01 **L–T–P-J: 0–0–2-0**

Module No.	Content	Lab Hours
I/II	• 1. a) Introduction to Packet Tracer. • b) Network Topologies. (Including explanation of Simple PDU & Complex PDU.) • 2. Connecting 3 netwoks using routers. Also, configure DHCP and DNS server. • 3. Configuration of different Application services (SMTP, FTP, HTTP, TFTP, DHCP & DNS) • 4. Configuration of Vlan and Inter- Vlan Routing. • 5. Configure GRE over IP tunnel (VPN). • 6. Static NAT configuration. • 7. Configure Wireless network. • 8. Configure different IoT devices. • 9. Management of cloud resources using Cloud Analyst. • 10. Simulation of large scale Cloud computing data centers with Cloud Analyst • 11. Study on VMware • a. Creating a VM • b. Networking on VM • c. Merging and splitting disk on VM • d. Cloning the guest OS • e. Deploying VM with template • f. Creating Snapshots • g. Managing Users, Groups, Permissions and Roles • 12. Creating a EC2 instance on AWS • 13. Configuration of db in AWS. • 14. Creation of S3 bucket with single IAM user in AWS. • 15. Creating a AWS infrastructure for an organization on cloudcraft	12*2=24

Reference Book:

- Raj Kumar Buyya, James Broberg, Andrezei, M. Goscinski," Cloud Computing": Principles and paradigms,2011.

Outcome: After completion of Lab, student will be able to:

- CO1: Understanding about the virtualization by the help of VMware.
- CO2: Understanding of CISCO packet tracer to build a cloud network infrastructure.
- CO3: Explain the key components of Amazon web Service and Microsoft Azure.

SEMESTER -VI
SYLLABUS

BCSE: Full Stack Using Server Side Technology

Credits: 03 **L-T-P-J: 2-0-2-0**

MODULE	CONTENT	Teaching Hours
1	J2EE: Feature of java 1.8 Functional Interface, Default method in Interface, Method reference, constructor method reference, Date time API, Stream, API, Collectors. JDBC: Introduction, Architecture, Basics, MYSQL with CRUD Operations java application using, connectivity, Driver Manager, Result Set, Statements and types, operations, Servlet and integration. Angular JS: Introduction, Expressions, Modules, Data Binding, Scopes, Directives & Events, Controllers, Filters, Services, HTTP, Tables, Validation. FRAMEWORK: Hibernate: Introduction to, Basics, Session, Session Factory, Configuration, Configuration Offline, with Annotation, validator, CRUD, Association Mapping, Named Queries, Application with Mysql DB-CRUD.	20
2	**Spring:** Spring Framework intro, basics of spring, inversion of control, dependency Injection, Beans Scope, Auto Wiring, SpringAnnotations. **Spring MVC:** Spring MVC basics, MVC Annotations, MVCRestful Web Services Basics, Spring MVC without Maven, spring MVC with maven. **SpringBoot:** SpringBoot, REST APIs, Postman App, Intellij IDEA, Git, CRUD App with SpringBoot, SpringBoot with H2 Database, SpringBoot with MySQL database, Springboot with Mongo DB, Testing with Mockito and Junit 5, Creatinga RESTAPI with springBoot, Testing API with Postman App, Dockerizing a SpringBoot Application, Microservices. **Spring Security:** Security in a Springboot Application, Usingthird-Party libraries in Spring Boot. **MongoDB:** Introduction to Mongo DB, Features, Mongo DB database, Mongo DB collection, Spring Boot with Mongo DB CRUD applications, Spring Boot with Mongo DB API Creation,	20

TEXT BOOKS:

- Full Stack Java Development with Spring MVC, Hibernate, jQuery, andBootstrap by Mayur Ramgir.
- Hands-on Application Development using Spring Boot: BuildingModern Cloud Native Applications by Learning Restful API.
- Micro services, CRUD Operations, Unit Testing, and Deployment by Shagun Bakliwal.
- Java for Web Development: Create Full-Stack Java Applications with Servlets, JSP Pages, MVC Pattern and Database Connectivity by Sarika Agarawal.

COURSE OUTCOMES: After successful completion of this student will be able to:

- CO1: Injecting dependencies using the Spring bean factory.
- CO2: Aspect-oriented programming with Spring.
- CO3: Implementing a presentation tier with Spring MVC.
- CO4: Integrate Spring with Java EE Web applications.
- CO5: Build Web applications with Spring MVC, includingconfiguration using Java config capabilities.
- CO6: Understand and use the core capabilities of Spring's Reactive programming support.
- CO7: Understand REST, and use Spring MVC to build RESTfulservices.
- CO8: Simplifying database access.
- CO9: Best practices in using Spring to implement a Micro service Architecture (MSA).
- CO10: Creating RESTful Web Services.
- CO11: Containerize an MSA application with Docker and DockerCompose.

SEMESTER -VII
SYLLABUS

BCSC XXXX: THEORY OF COMPUTATION

Objective: *The objective of this course is that students will study and compare different models and views of the abstract notion of computation and its various aspects.*

Credits:04 **L-T-P-J: 3-1-0-0**

Module No.	Content	Teaching Hours
I	**Introduction:** Basic concepts of finite automata and languages, deterministic finite automaton, nondeterminism, equivalence between DFA & NFA, ε-NFA, Minimization of Finite Automata, FA with Output- Moore and Mealy machine and their equivalence. **Regular expression (RE):** regular expression, algebraic laws for regular expressions, equivalence to FA, Arden Theorem, Closure Properties of Regular Languages, Pumping Lemma for Regular Languages and its applications. **Push Down Automata (PDA):** Introduction, Language of PDA, Acceptance by Final State, Acceptance by Empty Stack, 2-Stack PDA.	20
II	**Context-free Languages**: Context-free Grammars, Derivations, Leftmost, Rightmost, Ambiguity Inherent Ambiguity, Parse Trees, Normal Forms – CNF and GNF, Equivalence of PDA and CFG. **Turing machines (TM):** Basic Model, Variants of Turing Machine, Recursive and Recursively Enumerable Languages, Decidability, Undesirability, Universal TM, The Halting Problem, Undesirability of the Halting Problem, Church's Thesis, Computable Functions. **Introduction to Computational Complexity:** The Class P, NP, NP Complete and NP Hard	20

Text Books:

• John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory, Languages
and Computation", 3rd Edition, Pearson Education, 2013.
• Peter Linz, "An Introduction to Formal Languages and Automata", 6th Edition, 2016

Reference Books:

• Martin J. C , " Introduction to Languages and Theory of Computations", 4th Edition, TMH, 2011.
• K.L.P. Mishra and N. Chandra Sekaran, "Theory of Computer Science: Automata, Languages and Computation", 3rd Edition, PHI, 2006

Outcome: After completion of course, the student will be able to:

• CO1: Understand formal machines, languages and computations
• CO2: Design finite state machines for acceptance of strings
• CO3: Analyze the process to convert regular expression to DFA, DFA to regular expression, and minimization of DFA.
• CO4: Design context free grammars for formal languages
• CO5: Develop pushdown automata accepting strings
• CO6: Design the Turing machine for the real world applications
• CO7: Distinguish between decidability and undesirability

BCSC XXXX: OPTIMIZATION TECHNIQUES

Course Objectives: To make the students understand the concept of linear programming, transportation and assignment problems, sequencing, network analysis and inventory control.

Module No.	Contents	Teaching Hours (Approx.)
I	**Linear Programming Problem:** Construction of LPP, Feasible and Basic feasible solutions, Optimal solution, Unbounded solution, Infeasible solution, Infinite solutions, Graphical method. **Transportation Problem**: Introduction, Basic feasible solution by North West Corner rule, Row Minima method, Column Minima method, Least Cost method, VAM, Optimal solution by MODI method, Degeneracy. **Assignment Problem**: Introduction, Hungarian method (Balanced and Unbalanced).	20
II	**Sequencing:** Introduction, Jhonson's rule, Problems with n jobs and k machines, Total elapsed time, Problems with 2 jobs and k machines (Graphical solution). **Network Analysis:** Introduction, Rules and guidelines for drawing network, Fulkerson's rule, Dummy activity, CPM and Concept of float, PERT and Concept of slack. **Inventory Control:** Introduction, Types of inventory, Inventory decisions, Economic order quantity, Deterministic inventory problems, EOQ problems with price breaks.	20

Learning Outcomes:

After studying these topics, the student will be able to

CO1: Describe at an intuitive level the process of artificial intelligence and operations research: a real-time cycle of problem understanding, formulation, solution and implementation

CO2: Formulate simple reasoning, learning and optimization problems, in terms of the representations and methods presented

Text Book:

- P. K. Gupta and D. S. Hira, Operations research, S. Chand & Co. Ltd., Delhi, 2014.

Reference Books:

- (Col.) G. S. Cheema, Operations Research, Laxmi Publications Pvt. Ltd, 2011.
- V. K. Kapoor, Operations research, Sultan Chand & Sons, Delhi, 2014.
- S. D. Sharma, Operations research, Kedar Nath & Ram Nath Publications, Meerut, 2008.
- H. A. Taha, Operations research: An introduction, Pearson Education, New Jersey, 2003.