

On completion of this programme (B.Sc Computer Science) the student will be able to

- PSO 1 Understand the basic principles and concepts and integrate the gained knowledge in the domain relevant to the needs of the society.
- PSO 2 Apply appropriate mathematical models to solve computational tasks on how to collect and correlate the given data
- PSO 3 Obtain strong programming skills in solving simple to complex problems in an efficient way using both procedural and object oriented programming.
- PSO 4 Apply FOSS to identify, analyse and solve the real world problems
- PSO 5 Develop tools and software with the help of theoretical and practical concepts learnt.
- PSO 6 Adapt to professional requirements and to grow in the chosen profession.
- PSO 7 Pursue higher education and research.

Shrimathi Devkunvar Nanalal Bhatt Vaishnav College for women
Department of Computer Science
Course Framework

Part	Semester	Paper/Allied	Title of the paper	Lecture Hours		Max. Marks			Credits
				Th	Pr	CA	SE	Tot	
I	I Year I Semester	Language-I	Tamil / Hindi / Sanskrit	6		40	60	100	3
II		English-I		4		40	60	100	3
III		Paper-I	Digital Logic Fundamentals	5		40	60	100	4
III		Practical –I	Digital Logic Fundamentals		3	40	60	100	2
III		Practical-II	Web Designing tools		2	-	-	-	-
III		Allied-I	Mathematics-I	6		40	60	100	5
IV		EVS	Environmental Studies	2		50		100	2
IV		Soft Skill –I	Essentials of Language and Communication skills	2		50		100	3
Total(Major)									22
I	I Year II Semester	Language-II	Tamil / Hindi / Sanskrit	6		40	60	100	3
II		English-II		4		40	60	100	3
III		Paper-II	Object Oriented programming in C++	4		40	60	100	4
III		Practical –II	Web Designing tools		3	40	60	100	4
III		Practical-III	C++ Programming		3	40	60	100	2
III		Allied-I	Mathematics-II	5		40	60	100	5
IV		Soft Skill – II	Essentials of spoken and presentation skills	2		50		100	3

IV		Value Education	Yoga and Wellness			50			2
Total (Major)									26
I	II Year III Semester	Language-III	Tamil / Hindi / Sanskrit	6		40	60	100	3
II		English-III		6		40	60	100	3
III		Paper-III	Data structures and Algorithms	5		40	60	100	4
III		Practical –IV	Data structures using C++		3	40	60	100	2
III		Practical-V	Scripting Languages		3				
III		Allied-II	Statistical Methods and its Applications-I	4	2	15	60	75	4
IV		NME offered to other depts.	Introduction to Computing	2		50		100	2
Total (Major)									18
I	II Year IV Semester	Language-IV	Tamil / Hindi / Sanskrit	6		40	60	100	3
II		English-IV		6		40	60	100	3
III		Paper –IV	Microprocessors & its Applications	4		40	60	100	4
III		Practical –V	Scripting languages		3	40	60	100	4
III		Practical –VI	Microprocessor		3	40	60	100	2
III		Allied-II	Statistical Methods and its Applications-II	4		15	60	75	4
III		Allied-Practical	Statistical Methods and its Applications		2	20	30	50	2
IV		NME offered to other depts.	Introduction to Computing	2		50		100	2
Total (Major)									24
III	III Year V Semester	Paper-V	ASP.Net Programming	5		40	60	100	4
III		Paper-VI	Operating Systems	6		40	60	100	4
III		Paper-VII	Relational Database Management Systems	5		40	60	100	4
III		Practical –VII	ASP.NET		4	40	60	100	2

III		Practical – VIII	SQL & PL/SQL		4	40	60	100	2
III		Elective – I	Any one from list of electives	6		40	60	100	5
IV		Skill Enhancement Course	Any one from the list-Project by student in Open Source Software.	2		50		100	3
T o t a l									24
III	III Year VI Semester	Paper-VIII	Python for Scientific Computing	4		40	60	100	4
III		Paper-IX	Programming in Java	4		40	60	100	4
III		Practical – IX	Python for Scientific Computing		4	40	60	100	2
III		Practical – X	Programming in Java		4	40	60	100	2
III		Elective – II	Any one from list of electives	5		40	60	100	5
III		Project	Mini Project	3	3	40	60	100	5
IV		Skill Based Elective	Any MOOC Course			50		100	3
		**Extra-Disciplinary Internship Programme (EDIP)	Internship	-	-	-	-	-	2
V		Extension Activities	Sports/ NSS / NCC / Rotract						1
T o t a l									26
Grand Total									140

Detailed Syllabus

Title of the Course/ Paper	PAPER I: - Digital Logic Fundamentals				
Core Theory	Year	Semester	Sub code:	Credit: 4	Hours : 75
	I	I			

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
------------------	----------------------------------	-------------------------

CO1	Apply the principles of number system, binary codes and Boolean algebra to minimize logic expressions	K1,K2,K3,K5
CO2	Acquire knowledge about various logic gates and logic families and analyse basic circuits of these families.	K1,K2,K3,K4,K5
CO3	Develop K-maps to minimize and optimize logic functions up to 5 variables	K1,K2,K3,K5
CO4	Design various combinational and sequential circuits such as encoders , decoders and counters using multiplexers, and flip – flops	K1,K2,K3,K4
CO5	Acquire knowledge about RAM ROM – memories and types of addressing modes	K1,K2

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5- Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO5	PSO 6	PSO 7
CO1	3	3	1	3	0	1	2
CO2	3	3	1	3	0	0	2
CO3	3	2	0	3	0	0	2
CO4	2	2	0	3	0	1	2
CO5	1	1	0	3	0	1	2
Average	2.4	2.2	0.4	3	0	0.6	2

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average = 1.514

Detailed Syllabus : PAPER I: - Digital Logic Fundamentals

Unit- 1 Number Systems & Codes: Number System – Base Conversion – Binary Codes-Code Conversion. Binary addition and subtraction using 1's and 2's complement-Digital Logic: Logic Gates-Truth Tables-Universal Gates. (15 Hrs)

- Unit- 2 Boolean Algebra: Laws & Theorems –SOP, POS Methods – Simplification of Boolean Functions – Using Theorems, K-Map, Prime – implicant Method-Implementation using Universal gates. Binary Arithmetic: Binary Addition-Subtraction-Various Representations of Binary Numbers-Arithmetic Building Blocks-Adders-Subtractors. (15 Hrs)
- Unit- 3 Combinational Logic: Multiplexers-De-multiplexers-Decoders-Encoders-Code Converters – Parity Generators & Checkers-PAL-PLA (15 Hrs)
- Unit- 4 Sequential Logic: RS, JK, D and T Flip-Flops-Edge-Triggered-Master-Slave Flip Flops. Registers: Shift Registers-Types of Shift Registers. (15 Hrs)
- Unit- 5 Counters: Asynchronous Counters Ripple, Mod, Up-Down Counters-Decoding Gates- Synchronous Counters-Ring, Decade, Presettable, Shift Counters. Memory: Basic Terms & Ideas-Magnetic Memories-Memory Addressing- Types of ROMs-Types of RAMs. (15 Hrs)

Books for Study	1.	D.P.Leach&A.P.Malvino,“ <i>Digital Principles and Applications</i> ”,TMH-Fifth Edition -2002.
	2.	M.MorrisMano,“ <i>Digital Logic and Computer Design</i> ”, PHI, 2001.
Books for Reference	1.	T.C. Bartee, “ <i>Digital Computer Fundamentals</i> ”, 6 th Edition, Tata McGraw Hill, 1991.
	2.	R.J. Tocci, “ <i>Digital System Principles and Applications</i> ”, 8 th Edition.

	1.	https://www.javatpoint.com/digital-electronics
	2.	https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/

Web References	3	https://www.tutorialspoint.com/digital_circuits/digital_circuits_logic_gates.htm
	4	https://learn.sparkfun.com/tutorials/digital-logic/all
	5	https://www.circuitbasics.com/what-is-digital-logic/

PEDAGOGY (TEACHING METHODOLOGY):

1. Formal black board teaching with chalk and talk in classroom
2. Using Projector and power point presentation in the classroom teaching
3. Using Google classroom for online class, submitting assignments and CAT exams
4. Giving Multiple Choice Questions in each unit, once the unit teaching is completed.
5. Using Moodle and Google as platform for online classes.
6. Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.
7. Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.
8. Encouraging the students to use open source software in their project development as well as for internship.
9. NPTEL courses are identified for each semester and make it compulsory that the students must complete minimum 2 courses (not included in the syllabus) in their entire degree duration.
10. Students are encouraged to do self-learn by registering in Spoken Tutorial, Mumbai, by MHRD and learn courses like latex, python, blender etc.

Title of the Course/ Paper	PRACTICAL I: Digital Logic Fundamentals				
Core Practical	Year	Semester	Sub code:	Credit:	Hours
	I	I		2	: 45

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
------------------	----------------------------------	-------------------------

CO1	Use various techniques learnt to simplify Boolean functions and design gated circuits to realize the Boolean functions	K4,K5
CO2	Formulate the problem as a Boolean function and design combinational circuits from scratch to solve the problem.	K4,K5
CO3	Design of asynchronous and synchronous counters	K4,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5-Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	3	0	3	0	0	2
CO2	3	3	0	3	0	0	2
CO3	3	3	0	3	0	0	2
Average	3	3	0	3	0	0	2

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average = 1.5714

Detailed Lab Syllabus: Digital Logic Fundamentals

1. Verification of truth table for AND, OR, NOT, NAND, NOR and XOR gates.
2. Realization of NOT, AND, OR, EX-OR gates with only NAND gates.
3. Realization of NOT, AND, OR, EX-OR gates with only NOR gates.
4. Verification of Associate Law for AND, OR gates.
5. Karnaugh's Map reduction and logic circuit implementation.
6. Verification of De-Morgan's Law.
7. Implementation of Half-Adder and Half-Subtractor.
8. Implementation of Full-Adder and Full-Subtractor.
9. Four bit binary Adder.
10. Four bits binary subtractor using 1s and 2s complement.
11. Implementation of shift Registers, Serial Transfer.
12. Ring Counter.

13. 4-bit binary counters

14. BCD Counter

Web References	1.	https://cse.iitkgp.ac.in/~chitta/coldvl/
	2.	https://www.iitg.ac.in/cseweb/vlab/Digital-System-Lab/experiments.php
	3.	http://vlabs.iitkgp.ernet.in/coa/#
	4.	https://cse15-iiith.vlabs.ac.in/Introduction.html?domain=Computer%20Science
	5.	http://vlabs.iitkgp.ernet.in/be/#

PEDAGOGY (TEACHING METHODOLOGY):

1. Formal black board teaching with chalk and talk in classroom
2. Using Projector and power point presentation in the classroom teaching
3. Using Moodle and Google as platform for online classes.
4. Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.
5. Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.

Title of the Course/ Paper	PRACTICAL II: Web Designing Tools (HTML,CSS, XML)				
Core Practical	Year	Semester	Sub code:	Credit:	Hours
	I	I & II			
				4	: 30/sem

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Explore Mark-up languages features and create pages using them	K1,K2,K3
CO2	Able to design front-end web pages.	K1,K3
CO3	Demonstrate ability to write well-formed XML	K1,K2,K3,K4
CO4	Demonstrate the ability to use XSLT to transform XML documents into different formats	K2,K3,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5-Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	2	3	3	3	3	3
CO2	3	2	3	3	3	3	3
CO3	3	2	3	3	3	3	3
CO4	3	2	3	3	3	3	3
Average	3	2	3	3	3	3	3

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average = 2.8571

Detailed Lab Syllabus: Web Designing Tools (HTML,CSS, XML) – Practical II

I HTML

1. Create a Web Page for your Personal Information using text formatting tags.
2. Create a web page to display railway train timings using tables.
3. Create a sample web page to promote a product using frames and links, images.
4. Create a form for a questionnaire

II – XML & CSS

1. Create an XML Document to store information about books and create the DTD files
2. Create an XML with child content for invoice description.
3. Create an XML schema for Newspaper Article
4. Create a XML file with DTD for product catalogue
5. Create a DTD For the Resume Xml Document
6. Create an XML document, which contains 10 users information. Write a program, which takes User Id as an input and returns the user details by taking the user information from the XML document. Write a XML program to store 10 user's information
7. Design an XML document to store information about a student in our college. The information must include Rollno, Name, Name of the College, Branch, Year of Joining, and e-mail id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.

8. Create an XSLT style sheet for one student element of the above document (Ques. 7) and use it to create a display of that element.
9. Write an XML which will display the book information. Which includes the following?

Title of Book, Author Name, ISBN Number, Publisher, Edition, Pricea) Write a DTD to validate

XML File b) Display XML as follows

1. The contents should be displayed in a table. The header of table should be in Grey color
2. The author Names column should be displayed in one color & capitalized & should be in bold
3. Use your own colors for remaining columns.

Use XSL & CSS for above purpose.

10. Create an XML document whose root is "classlist". This CLASSLIST is created from a starting point of single entity, STUDENT. Any number of students contains elements: firstname, lastname, emailaddress.
11. Create an XML document, schema, and stylesheet to list restaurants, including the most popular, in a city.
 - a. Create a new stylesheet that uses a named template to output the name of the city. Then use two templates with different modes to print out the restaurants, using a larger font for the most popular restaurant.
 - b. Now create a stylesheet that will sort the restaurant names alphabetically, and number them using the number() function and a single level of numbering.
12. Help the tour guides by creating a valid and well-formed XML schema describing currency codes (e.g. EUR for Euros). The currency code element should consist of three characters. Along that the country's name (e.g. Germany) and the name of the currency (e.g. Euros) should be included. Create a XML document in which some currency codes are listed.
13. Write an XML document for storing conversion rates of various currencies. The program should have the following inputs i) currency to be converted ii) amount to be converted and using XSLT access the XML file and convert the given amount.

Books for study	1.	Ivan Bayross , “ <i>Web enabled commercial applications development using HTML, DHTML, Javascript, Perl, CGI</i> ” , 3rd revised Ed-BPB
	2.	Gugoiu, Teodoru , “ <i>HTML,XHTML,CSS and XML BY Example</i> ”, Firewall Media

	3.	Duckett,Jon , “ <i>Beginning HTML,XHTML,CSS,AND JAVASCRIPT</i> ”, WILEY Publication
	4.	Robson,Elisabeth&Freeman,Eric, “ <i>HEAD FIRST HTML AND CSS</i> ”, O’Reilly Publication

Web References	1.	https://www.javatpoint.com/html-tutorial
	2.	https://www.w3schools.com/html/
	3	https://www.tutorialspoint.com/internet_technologies/website_designing.htm
	4	http://www.howtocreate.co.uk/tutorials/html/basics
	5	https://learn.shayhowe.com/html-css/

PEDAGOGY (TEACHING METHODOLOGY):

1. Formal black board teaching with chalk and talk in classroom
2. Using Projector and power point presentation in the classroom teaching
3. Using Moodle and Google as platform for online classes.
4. Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don’t miss the lessons as they were able to watch the lesson recordings in YouTube anytime.
5. Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don’t have software in their system, they can directly run the respective coding in the identified website and learn.

Title of the Course/ Paper	PAPER II: - OBJECT ORIENTED PROGRAMMING IN C++				
Core Theory	Year	Semester	Sub code:	Credit:	Hours
	I	II			

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
------------------	----------------------------------	-------------------------

CO1	Analyse the given problem statements to create basic program designs.	K1,K2,K4
CO2	Apply the concept of object oriented programming for the given problem by creating classes and objects wherever necessary and solve the problem.	K2,K3,K4
CO3	Implement the advanced object oriented concept like encapsulation, polymorphism, abstraction etc. in C++ and know their practical application	K2,K3,K4,K5
CO4	Illustrate the code re-usability and extensibility by means of Inheritance and polymorphism.	K2,K3,K4,K5
CO5	Apply error exception for the real world problem and solve the problems	K2,K3,K4,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5-

Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	2	3	3	3	2	3
CO2	3	2	3	3	3	2	3
CO3	3	2	3	3	3	2	3
CO4	3	2	3	3	3	2	3
CO5	3	2	3	3	3	2	3
Average	3	2	3	3	3	2	3

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course Average = 2.857

Detailed Syllabus: OBJECT ORIENTED PROGRAMMING IN C++

Unit- 1 Introduction to C++: Principles Of Object Oriented Programming (OOP) – Software Evolution - OOP Paradigm – Basic Concepts Of OOP, Benefits Of OOP – Applications Of OOP. Tokens, Keywords, Identifiers, Variables, Operators, Manipulators, Expressions and Control Structures in C++ (15 Hrs)

- Unit- 2 Pointers-Functions in C++ - Main Function-Function Prototyping-Parameters Passing in Functions- Values Return by Functions-Inline Functions-Friend and Virtual Functions.(10 Hrs)
- Unit- 3 Classes and Objects - Constructors and Destructors - Operator Overloading - Type Conversions-Type of Constructors-function overloading. Inheritance: Single Inheritance-Multilevel Inheritance-Multiple Inheritance- Hierarchical Inheritance-Hybrid Inheritance. Pointers, Virtual Functions and Polymorphism; Managing Console I/O operations.(20 Hrs)
- Unit- 4 Exception handling, Templates and iterators: Introduction – Function templates – Class templates – Container classes – Subclass templates – Passing template classes to template –Iterator classes.(15 Hrs)
- Unit- 5 Working with Files: Classes for File Stream Operations-Opening and Closing a File -End-of-File Deduction- File Pointers-Updating a File-Error Handling during File Operations-Command line Arguments (15 Hrs)

Books For Study	1.	E.Balaguruswamy,” <i>Object Oriented Programming With C++</i> ”, TMH
	2.	Robert Lafore, “ <i>Object Oriented Programming In Microsoft C++</i> ”, Galgotia
Books for Reference	1.	Venugopal, K.R. , Rajkumar & Ravishankar ,T., “ <i>Mastering C++</i> ”, Tata McGraw-Hill Publishing Company Ltd
	2.	Yashwant, P. Kanitkar, “ <i>LET US C++</i> ”, BPB
	3.	Cohoon, James.P, “ <i>C++ Program Design An Introduction To Programming And Object Oriented Design</i> ” TMPH, first edition.
	4.	Hubbard, John R, “ <i>Schaum's Outline Of Theory And Problems Of Programming With C++</i> ”
	5.	Bell,Douglas, “ <i>The Essence Of Programming Using C++</i> ” , Galgotia publications

Web References	1.	https://www.w3schools.com/cpp/
	2.	https://www.cplusplus.com/doc/tutorial/
	3.	https://www.programiz.com/cpp-programming
	4.	https://www.javatpoint.com/cpp-programs

	5.	https://beginnersbook.com/2017/08/c-plus-plus-tutorial-for-beginners/
--	----	---

PEDAGOGY (TEACHING METHODOLOGY):

1. *Formal black board teaching with chalk and talk in classroom*
2. *Using Projector and power point presentation in the classroom teaching*
3. *Using Google classroom for online class, submitting assignments and CAT exams*
4. *Giving Multiple Choice Questions in each unit, once the unit teaching is completed.*
5. *Using Moodle and Google as platform for online classes.*
6. *Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.*
7. *Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.*
8. *Encouraging the students to use open source software in their project development as well as for internship.*
9. *NPTEL courses are identified for each semester and make it compulsory that the students must complete minimum 2 courses (not included in the syllabus) in their entire degree duration.*
10. *Students are encouraged to do self-learn by registering in Spoken Tutorial, Mumbai, by MHRD and learn courses like latex, python, blender etc.*

Title of the Course/ Paper	PRACTICAL III: C++ PROGRAMMING				
Core Practical	Year	Semester	Sub code:	Credit:	Hours
	I	II		2	: 60

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Analyze the given problem statements to create basic program designs.	K2,K3,K4,K5
CO2	Implement different functions for input and output, various data types, basic operators, files and functions.	K2,K3,K4,K5
CO3	Demonstrate basic object oriented and structured programming concepts.	K2,K3,K4,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5-Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

<div>PSOs</div> <div>COs</div>	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	2	3	3	3	2	3
CO2	3	2	3	3	3	2	3
CO3	3	2	3	3	3	2	3
Average	3	2	3	3	3	2	3

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average= 2.714

Detailed Lab Syllabus: C++ Programming

Simple Programs

1. Generate the pyramid of digit
2. Generate Armstrong numbers upto a specific limit.
3. Generate Fibonacci series upto n (n<50) number

Functions

4. Write a function for a^n (n is an integer)
5. Add the specific no. of distance values using inline function

Classes and objects

6. Construct a class for storage of dimensions of circle, triangle and rectangle and calculate their areas.
7. Perform arithmetic operation on complex data using class and object.
8. Enter a date and add or subtract an integer from it depending upon user's choice.

Recursion

9. Perform Binary search
10. Reversal of a String

Polymorphism

11. Overload Unary operator
12. Overload Binary operator
13. Overload arithmetic assignment operator
14. Overload operators using friend function
15. Add seconds and time to a specific time value using overloaded functions

Inheritance

16. Illustrate multilevel inheritance
17. Illustrate multiple inheritance
18. Illustrate multiple inheritance (use virtual base class)

Virtual and Friend Functions

19. Illustrate runtime polymorphism
20. Multiply two matrices using a friend function

File Handling in C++

21. Copy a text file to another
22. Create a file of objects and display the objects stored in the file

Web References	1.	https://www.w3schools.com/cpp/cpp_intro.asp
	2.	https://www.cplusplus.com/doc/tutorial/
	3.	https://www.programiz.com/cpp-programming/variables-literals
	4.	https://www.tutorialspoint.com/cplusplus/index.htm
	5.	https://www.javatpoint.com/cpp-tutorial

PEDAGOGY (TEACHING METHODOLOGY):

1. *Formal black board teaching with chalk and talk in classroom*
2. *Using Projector and power point presentation in the classroom teaching*

3. *Using Moodle and Google as platform for online classes.*
4. *Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.*
5. *Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.*

Title of the Course/ Paper	PAPER III: Data Structures and Algorithms				
Core Theory	Year	Semester	Sub code:	Credit: 4	Hours : 75
	II	III			

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Recognize the basic primitive and composite data structures and able to analyse the algorithms in terms of its complexities. Apply the standard template libraries in developing data structure related applications	K1,K2,K3
CO2	Implement the stacks , queues data structures effectively in their applications and understand the use of recursion in programming.	K1,K2,K3,K4,K5
CO3	Implement Singly and doubly linked list applications.	K2,K3,K4,K5
CO4	Implement binary search tree for information retrieval in short duration. Implement the Graph applications for storage and traversal of data efficiently. Understand the usage of Hash table in efficient storage and retrieval of data.	K2,K3,K4,K5
CO5	Explain and implement divide and conquer techniques in Merge sort, Quick sort, selection sort, Binary Search. Able to analyse and design the algorithm and able to know the implementation of it in a simple way.	K2,K3,K4,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5- Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
COs							

CO1	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3
Average	3	3	3	3	3	3	3

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average=3.0

Detailed Syllabus: Data Structures and Algorithms

- Unit- 1 Definition of a Data Structure-Primitive and composite Data Types, Standard Template Library, Performance Analysis and measurement, Arrays, Operations on Arrays, Order lists.(10 Hrs)
- Unit- 2 Stacks-Application of stacks-Infix to postfix conversion, Recursion, Queues-Operations on Queues, Queue Applications, Circular Queue.(15 Hrs)
- Unit- 3 Singly Linked List-Operations, Applications-Representation of a polynomial, Polynomial addition; Doubly Linked List-Operations. (20 Hrs)
- Unit- 4 Trees, Binary Trees, Operations-Recursive Tree Traversals. Graphs-Definition, Types of Graphs – Traversal - Hashing Tables and Hashing Functions. (15 Hrs)
- Unit- 5 Algorithm-Definition-examples-Complexity-divide and conquer-Binary search- Maximum and Minimum-Merge Sort-Quick Sort-Selection sort. (15 Hrs)

Books for Study:	1.	Yashvant Kanethakar, “ <i>Data Structures through C++</i> ”, BPB Publications., 2003.
-------------------------	-----------	---

	2.	P.Sudharsan, J.JohnManoj Kumar, “C++ & Data Structures”, RBA Publications .,2009
	3.	Ellis Horowitz, S. Sahni and S. Rajasekaran,“Computer Algorithms” - Galgotia Pub. Pvt. Ltd., 1998.
Books for Reference:	1.	LipschutzSeympur“Schaum's Outline Of Theory And Problems Of Data Structure”,
	2.	E.Horowitz and S. Sahni, “Fundamentals of Data Structures in C++”, Galgotia Pub. 1999.

Web References	1.	https://www.programiz.com/dsa
	2.	https://www.geeksforgeeks.org/data-structures/
	3	https://www.tutorialspoint.com/data_structures_algorithms/algorithms_basics.htm
	4	https://www.javatpoint.com/data-structure-algorithm
	5	https://www.studytonight.com/data-structures/introduction-to-data-structures

PEDAGOGY (TEACHING METHODOLOGY):

1. Formal black board teaching with chalk and talk in classroom
2. Using Projector and power point presentation in the classroom teaching
3. Using Google classroom for online class, submitting assignments and CAT exams
4. Giving Multiple Choice Questions in each unit, once the unit teaching is completed.
5. Using Moodle and Google as platform for online classes.
6. Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.
7. Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.
8. Encouraging the students to use open source software in their project development as well as for internship.
9. NPTEL courses are identified for each semester and make it compulsory that the students must complete minimum 2 courses (not included in the syllabus) in their entire degree duration.
10. Students are encouraged to do self-learn by registering in Spoken Tutorial, Mumbai, by MHRD and learn courses like latex, python, blender etc.

Title of the Course/ Paper	PRACTICAL IV: Data Structures and Algorithms				
Core Practical	Year	Semester	Sub code:	Credit:	Hours
	II	III		2	: 45

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Implement the basic operations of Stack, Queue data structures	K2,K3,K4,K5
CO2	Implement different types of linked structures, Hash table structures	K2,K3,K4,K5
CO3	Implement binary search tree and its operations	K2,K3,K4,K5
CO4	Implement the searching and sorting techniques in their programs and write efficient programs	K2,K3,K4,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5- Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3
Average	3	3	3	3	3	3	3

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated

3	3	3	3	3	3	3
3	3	3	3	3	3	3
3	3	3	3	3	3	3
3	3	3	3	3	3	3

-1 No Correlation-0

Course average=3.0

Detailed Lab Syllabus: Data Structures and Algorithms Lab using C++

1. Implement PUSH, POP operations of stack using Arrays.
2. Implement PUSH, POP operations of stack using Pointers.
3. Implement add, delete operations of a queue using Arrays.
4. Implement add, delete operations of a queue using Pointers.
5. Conversions of infix to postfix using stack operations.
6. Postfix Expression Evaluation.
7. Addition of two polynomials using Arrays
8. Addition of two polynomials using Pointers.
9. Creation, Insertion, and Deletion in doubly linked list.
10. Binary tree traversals (in-order,pre-order,and post-order) using recursion.

Web References	1.	http://www.uoitc.edu.iq/images/documents/informatics-institute/Competitive_exam/DataStructures.pdf
	2.	https://www.geeksforgeeks.org/data-structures/
	3	https://www.tutorialspoint.com/data_structures_algorithms/index.htm
	4	https://runestone.academy/runestone/books/published/cppds/index.html
	5	https://towardsdatascience.com/data-structures-in-c-part-1-b64613b0138d
	6	https://www.techiedelight.com/data-structures-and-algorithms-interview-questions-stl/

PEDAGOGY (TEACHING METHODOLOGY):

1. *Formal black board teaching with chalk and talk in classroom*
2. *Using Projector and power point presentation in the classroom teaching*
3. *Using Moodle and Google as platform for online classes.*
4. *Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.*
5. *Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.*

Title of the Course/ Paper	PRACTICAL V: Scripting Languages - JavaScript				
Core Practical	Year	Semester	Sub code:	Credit:	Hours
	II	III & IV		4	: 60

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Explore Mark-up languages features and create pages using them	K1,K2
CO2	Able to design front end web pages.	K3,K4,K5
CO3	Learn and design Client side validation using scripting languages.	K3,K4,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5- Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	1	3	3	3	3	3
CO2	3	1	3	3	3	3	3
CO3	3	1	3	3	3	3	3
Average	3	1	3	3	3	3	3

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average = 2.714

Detailed Lab Syllabus: Scripting Languages –JavaScript

1. Write a java script program to create HTML tags using document object.
2. Write a java script program to sort the given numbers in ascending and descending order
3. Write a java script program to find the Factorial of a number using functions.
4. Write a java script program to display largest and smallest numbers from the given list.
5. Write a java script program to display a digital clock.
6. Create a web page to display the text “WELCOME TO COMPUTER SCIENCE” as a heading and change its color from black to white and then to red at an interval of 1000 milliseconds.
7. Create a document and a link to it. When the user moves the mouse over the link, it should load the linked document on its own (user is not required to click on the link)
8. Create a document , which opens a new window without a toolbar, address bar.
9. Create a web page for getting personal details using form controls

10. Write a java script program to design a simple calculator using form fields. Have two fields for input and one field for the output. Allow user to be able to do plus, minus, multiply and divide.
11. Dynamically creating and animating frame using Javascript
12. An Animation Using the onLoad() Event Handler using Javascript
13. Implementing a Toggle Button with Image Replacement using Javascript
14. An HTML Form Containing all Form Elements using Javascript
15. Estimating Your Taxes with JavaScript.

Books for study	1.	Ivan Bayross ,” <i>Web enabled commercial applications development using Html, DHTML, Javascript, Perl, CGI</i> ”, 3 rd revised Ed-BPB
	2.	Moncur, Michael ,” <i>Sams Teach Yourself Javascript In 24-Hours</i> ”, Pearson

Web References	1.	https://www.ionos.com/digitalguide/websites/web-development/what-are-scripting-languages/
	2.	https://code.visualstudio.com/docs/languages/javascript
	3	https://www.jshero.net/en/success.html
	4	https://exercism.io/tracks/javascript/exercises
	5	https://www.asmarterwaytolearn.com/js/index-of-exercises.html

PEDAGOGY (TEACHING METHODOLOGY):

1. *Formal black board teaching with chalk and talk in classroom*
2. *Using Projector and power point presentation in the classroom teaching*
3. *Using Moodle and Google as platform for online classes.*
4. *Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.*
5. *Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.*

Title of the Course/ Paper	PAPER IV: Microprocessor and its Applications				
Core Theory	Year	Semester	Sub code:	Credit:	Hours
	II	IV		4	:

					75
--	--	--	--	--	----

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Will be able to recognize various memories and understand the architecture of Microprocessor 8085. Identify the type of instructions based on word size and functions and learn to identify the number of machine cycles and T-states of each instruction.	K1,K2,K3,K5
CO2	To write simple to complex assembly language programs.	K1,K2,K3,K4,K5
CO3	To know the applications of counters and time delay in real time applications and write programs for counters by introducing time delays. Understand the concept of memory stack and its usage while executing functions.	K1,K2,K3,K5
CO4	Understand and do coding for conversion between different number systems like BCD, Binary, ASCII etc. Understand the BCD arithmetic and implement in assembly language	K2,K3,K4,K5
CO5	Acquire knowledge about Interrupts, Interfacing of memory with various devices, and use of DMA in data communication. Identify the difference between direct I/O and Memory mapped I/O	K1,K2,K3

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5- Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	3	2	2	3	1	2
CO2	3	3	3	2	2	1	2
CO3	3	3	3	2	2	1	2
CO4	3	3	3	2	2	1	2
CO5	3	3	3	2	2	1	2
Average	3	3	2.8	2	2.2	1	2

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average= 2.2857

Detailed Syllabus: Microprocessor (8085) and its Applications

- Unit- 1 Introduction to Micro Computers, Microprocessors and assembly Languages- Microprocessor architecture and its operations-8085 MPU-8085 Instruction Set and classifications.(20 Hrs)
- Unit- 2 Writing assembly levels programs-Programming techniques such as looping, Counting and indexing addressing modes- Data transfer instructions-Arithmetic And logic operations-Dynamic debugging. (15 Hrs)
- Unit- 3 Counters and Time delays-Hexa decimal counter–Modulo10 counter-Pulse Timings for flashing lights-Debugging counter and time delay program- Stack-subroutine-conditional call and return instructions.(15 Hrs)
- Unit- 4 BCD to Binary and Binary to BCD conversions–BCD to HEX and HEX to BCD conversions-ASCII to BCD and BCD to ASCII conversions-BCD to Seven segment LED Code conversions-Binary to ASCII and ASCII to Binary conversions-Multibyte Addition-Multibyte subtraction-BCD Addition-BCD Subtraction-Multiplication and Division. (10 Hrs)
- Unit- 5 Interrupt-Implementing interrupts-Multiple interrupt-8085-trap-Problems On implementing 8085interrupt-DMA-Memory interfaces-Ram & Rom- I/O interface-Direct I/O-Memory mapped I /O. (15 Hrs)

Books for Study	1.	R.S.Gaonkar ,” <i>Microprocessor Architecture, Programming and Applications With 8085/8080</i> ”, Wiley Eastern Limited, 1990.
	2.	A.Mathur, ' <i>Introduction to Microprocessor</i> ', Third Edition, TataMcGraw-Hill PublishingCo.Ltd.,1993.
Books for Reference	1.	V.Vijayendran ,” <i>Fundamentals of Microprocessor(8085)</i> ” ,S. Viswanathan, Printers & Publishers
	2.	Nagoorkani.A,” <i>Microprocessor(8085) and its Applications</i> ”, TMH
	3.	N.K.Srinath, “ <i>8085 Microprocessor: Programming and Interfacing</i> ”, Prentice Hall India Learning Private Limited;

Web References	1.	https://gradeup.co/8085-microprocessor-i-98c6e670-c040-11e5-90e9-37a8af81db5e
	2.	https://www.elprocus.com/8085-microprocessor-architecture/

	3	http://www.darshan.ac.in/Upload/DIET/Documents/CE/2150707-MPI-Study-Material_04112017_033410AM.pdf
	4	https://www.geeksforgeeks.org/microprocessor-tutorials/
	5	http://ce.sharif.edu/courses/86-7/1/ce126/resources/root/8085%20Microprocessor.pdf

PEDAGOGY (TEACHING METHODOLOGY):

1. Formal black board teaching with chalk and talk in classroom
2. Using Projector and power point presentation in the classroom teaching
3. Using Google classroom for online class, submitting assignments and CAT exams
4. Giving Multiple Choice Questions in each unit, once the unit teaching is completed.
5. Using Moodle and Google as platform for online classes.
6. Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.
7. Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.
8. Encouraging the students to use open source software in their project development as well as for internship.
9. NPTEL courses are identified for each semester and make it compulsory that the students must complete minimum 2 courses (not included in the syllabus) in their entire degree duration.
10. Students are encouraged to do self-learn by registering in Spoken Tutorial, Mumbai, by MHRD and learn courses like latex, python, blender etc.

Title of the Course/ Paper	PRACTICAL VI: Microprocessor				
Core Practical	Year	Semester	Sub code:	Credit: 2	Hours : 45
	II	IV			

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Solve simple arithmetic operations like 8 and 16 bit addition, subtraction and multiplication etc. Solve BCD arithmetic operation	K2,K3,K4,K5

CO2	Able to write programs for manipulating array (dealing with memory location) like searching for an element, sorting, finding largest and smallest etc.	K2,K3,K4,K5
CO3	Write programs for conversion from one number system to another number system. Able to write applications like finding square and square root of BCD and HEX numbers	K2,K3,K4,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5-Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	3	3	2	2	2	2
CO2	3	3	3	2	2	2	2
CO3	3	3	3	2	2	2	2
Average	3	3	3	2	2	2	2

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average= 2.428

Detailed Lab Syllabus : Microprocessor (8085)

Addition & Subtraction

1. 8-bit addition
2. 16-bit addition
3. 8-bit subtraction
4. BCD subtraction

Multiplication & Division

5. 8-bit multiplication
6. BCD multiplication
7. 8-bit division

Sorting & Searching

8. Searching for an element in an array.
9. Finding largest and smallest elements from an array.
10. Reversing array elements.

11. Block move
12. Sorting in Ascending order
13. Sorting in descending order.

Code Conversion

14. BCD to Hex and Hex to BCD
15. Binary to ASCII and ASCII to binary
16. ASCII to BCD and BCD to ASCII

Applications

17. Square of a single byte Hex number
18. Square of a two digit BCD number
19. Square root of a single byte Hex number
20. Square root of a two digit BCD number

Web References	1.	https://www.tutorialspoint.com/microprocessor/index.htm
	2.	https://www.hobbyprojects.com/microprocessor_tutorials.html
	3	https://www.javatpoint.com/microprocessor-tutorial
	4	https://www.geeksforgeeks.org/microprocessor-tutorials/
	5	http://ce.sharif.edu/courses/86-7/1/ce126/resources/root/8085%20Microprocessor.pdf

PEDAGOGY (TEACHING METHODOLOGY):

1. *Formal black board teaching with chalk and talk in classroom*
2. *Using Projector and power point presentation in the classroom teaching*
3. *Using Moodle and Google as platform for online classes.*
4. *Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.*
5. *Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.*

Title of the Course/	PAPER – V: ASP .NET PROGRAMMING
-----------------------------	--

Paper					
Core Theory	Year	Semester	Sub code:	Credit:	Hours
	III	V		4	: 75

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Students will understand .NET Framework and describe some of the feature of visual basic.	K1,K2,K3
CO2	Students will be able to design web applications using XML, HTML, and CSS.	K1,K2,K3,K5
CO3	Students will be able to use ASP.NET controls in web applications. Students will understand various state management techniques and how to use view state, session state, application state and cookies	K1,K2,K3,K4, K5
CO4	Students will be able to create database driven Asp.NET web Applications and web services	K1,K2,K3,K4
CO5	Students will understand the concept of secure connection, authentication and authorization in login controls.	K1, K2, K3

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5-Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

<div>PSOs</div> <div>COs</div>	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	1	2	2	2	1	2
CO2	3	2	2	3	3	2	1
CO3	3	1	2	2	2	1	1
CO4	3	1	2	3	3	2	2
CO5	3	3	3	3	3	3	2
Average	3	1.6	2.2	2.6	2.6	1.8	1.6

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average = 2.2

Detailed Syllabus : ASP .NET PROGRAMMING

- Unit- 1 An introduction to ASP.NET web programming – An introduction to web applications, an introduction to ASP.NET application development, Quick preview of how an ASP.NET application works. Introduction to HTML, How to code HTML documents, Basic skills for using CSS, Visual studio features for working with CSS. (15 Hrs)
- Unit- 2 Introduction to server controls, How to work with button controls, text boxes, labels, check boxes, radio buttons, list controls and other web server controls like image, hyperlink, file upload, and calendar controls. Introduction to validation controls, basic validation controls, validation techniques and advanced validation controls. (15 Hrs)
- Unit- 3 How to manage state- how to use view state, session state and application state. How to use cookies. An introduction to database programming – introduction to relational databases, how to use SQL to work with the data in databases, introduction to ADO.NET 4,introduction to ADO.NET 4 classes. (15 Hrs)
- Unit- 4 How to use SQL data sources – how to create a data source, how to use custom statements and stored procedures, DataList control, Data binding, advanced features of a SQL data source. Customize the GridView control, update GridView data, DetailsView control, update DetailsView data, FormView control, ListView control and update ListView data. (15 Hrs)
- Unit- 5 Introduction to SSL, How to get and use a digital secure certificate, how to use a secure connection. Introduction to authentication, how to set up authentication and authorization, how to use login controls. (15 Hrs)

Books for Study	1.	Anne Boehm, Murach's. "ASP.NET 4 web programming with VB 2010", Shroff Publishers and Distributors Pvt. Ltd.
Books for Reference	1.	ImarSpaanjaars, "Beginning ASP.NET 4.0 in C# and VB", Wiley Publishers
	2.	Simon Smart, "Learn ASP.NET 4.0, C# and VB 2010", published by Smart Method
	3.	Buczek, Greg,"Asp.Net Developer's Guide", TMH
	4.	Evjen , Bill & Others, "Professional Asp.Net 4 In C# And Vb", Wiley-India
	5.	Nikhil Kothari, Vandana Datye, "Developing Microsoft Asp.Net Server Controls And Components", Tata McGraw Hill

PEDAGOGY (TEACHING METHODOLOGY):

1. *Formal black board teaching with chalk and talk in classroom*
2. *Using Projector and power point presentation in the classroom teaching*
3. *Using Google classroom for online class, submitting assignments and CAT exams*
4. *Giving Multiple Choice Questions in each unit, once the unit teaching is completed.*
5. *Using Moodle and Google as platform for online classes.*
6. *Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.*
7. *Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.*
8. *Encouraging the students to use open source software in their project development as well as for internship.*
9. *NPTEL courses are identified for each semester and make it compulsory that the students must complete minimum 2 courses (not included in the syllabus) in their entire degree duration.*
10. *Students are encouraged to do self-learn by registering in Spoken Tutorial, Mumbai, by MHRD and learn courses like latex, python, blender etc.*

Title of the Course/ Paper	PAPER – VI: OPERATING SYSTEMS				
Core Theory	Year	Semester	Sub code:	Credit:	Hours
	III	V		4	: 75

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Understand the concepts of Operating System, illustrate virtual machine, Acquire knowledge about process , thread and various CPU Scheduling algorithms	K1,K2,K3,K4, K5
CO2	To know about the problems related to process synchronization and various algorithm of deadlocks	K2,K4,K5
CO3	Describe the concept of paging and segmentation for memory management	K2,K5
CO4	Acquire knowledge on virtual memory concept and various page replacement algorithms	K1,K2,K5
CO5	Apply various file system implementation and storage management	K1,K2,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5-Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	2	3	3	3	2	2
CO2	3	3	3	3	3	3	3
CO3	3	2	2	3	2	2	3
CO4	3	3	2	3	3	3	3
CO5	3	2	2	3	2	3	3
Average	3	2.4	2.4	3	2.6	2.6	2.8

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average = 2.6857

Detailed Syllabus : OPERATING SYSTEMS

Unit- 1 Introduction - System structures-operating system services-user operating system interface -system programs-Operating system design and implementation--operating – system structure-Virtual Machines– Process Management- Process scheduling-operations on processes- Interprocess communication -Multithreaded programming-

overview-multithreading models- Process scheduling-Basic concepts-scheduling criteria-scheduling algorithms-Multiple-Processor scheduling. (20 Hrs)

- Unit- 2 Process Synchronization: Critical-Section Problem-Synchronization Hardware-Semaphores-Classical Problems of Synchronization-Critical Region- Deadlocks: Characterization- Methods for Handling Deadlocks-Deadlock Prevention-Avoidance-Detection-Recovery.(10 Hrs)
- Unit- 3 Memory Management: Address Binding- Dynamic Loading and Linking- Logical and Physical Address Space –swapping –Contiguous Allocation- Internal & External Fragmentation. Non-Contiguous Allocation:Paging-Implementation-Hardware-Protection-Sharing—structure of page table- Segmentation. (15 Hrs)
- Unit- 4 Virtual Memory: Demand Paging –Page Replacement-Page Replacement Algorithms-Thrashing. (10 Hrs)
- Unit- 5 File System: File Concepts-Access Methods- Directory Structures-Protection Consistency Semantics –File System Structures–Allocation Methods-Free Space Management. System Security: Security Problems – Program Threats –System and Network Threats – User Authentication. (20 Hrs)

Books for Study:	1.	A.SilberschatzP.B.Galvin,Gange.,“ <i>OperatingSystemPrinciples</i> ”, 7 th Edn., JohnWiley&Sons.,2002.
-------------------------	-----------	---

Books for Reference:	1.	A.Silberschatz P.B.Galvin,Gange.,“ <i>Operating System Concepts</i> ”, 6 th Edition., JohnWiley&Sons.,2002.
	2.	H.M.Deitel,An “ <i>Introduction to Operating System</i> ” , Second Edition, Addison Wesley,1990
	3.	Tanenbaum, Andrew S, “ <i>Modern Operating Systems</i> ”, Prentice-Hall of India pvt. Ltd., 2 nd edition
	4.	Godbole, Achyut S, “ <i>Operating Systems</i> ”, Tata McGraw Hill
	5.	Dhamdhare D M,“ <i>Operating Systems a Concept Based Approach</i> ”, TMH, 3 rd edition

Web References	1.	https://www.tutorialspoint.com/operating_system/index.htm
	2.	https://www.javatpoint.com/os-tutorial
	3.	https://www.studytonight.com/operating-system/
	4.	https://www.guru99.com/os-tutorial.html
	5.	https://www.geeksforgeeks.org/operating-systems/

PEDAGOGY (TEACHING METHODOLOGY):

1. *Formal black board teaching with chalk and talk in classroom*
2. *Using Projector and power point presentation in the classroom teaching*
3. *Using Google classroom for online class, submitting assignments and CAT exams*
4. *Giving Multiple Choice Questions in each unit, once the unit teaching is completed.*
5. *Using Moodle and Google as platform for online classes.*
6. *Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.*
7. *Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.*
8. *Encouraging the students to use open source software in their project development as well as for internship.*
9. *NPTEL courses are identified for each semester and make it compulsory that the students must complete minimum 2 courses (not included in the syllabus) in their entire degree duration.*

10. Students are encouraged to do self-learn by registering in Spoken Tutorial, Mumbai, by MHRD and learn courses like latex, python, blender etc.

Title of the Course/ Paper	PAPER – VII: Relational Database Management Systems				
Core Theory	Year	Semester	Sub code:	Credit:	Hours
	III	V		4	: 75

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Describe the concepts of database technologies and Model Entity Relationship with E-R diagrams and Be familiar with the relational database theory, and be able to write relational algebra expressions for queries.	K1,K2,K3,K4
CO2	Design database schema considering normalization and relationships within database	K2,K3,K4
CO3	Be able to write SQL commands to create tables and indexes, insert/update/delete data, and query data ,joins in a relational DBMS.	K1,K2,K3,K4
CO4	Learn to design and implement PL/SQL programs	K1,K2,K3,K5
CO5	Develop triggers, procedures, user defined functions, packages and design PLSQL programs in Oracle	K2,K3,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5-Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	3	3	2	3	3	3
CO2	3	3	3	3	3	3	3
CO3	3	3	2	2	3	3	3
CO4	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3
Average	3	3	2.8	2.6	3	3	3

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average= 2.914

Detailed Syllabus : Relational Database Management Systems

- Unit- 1 Database Concepts: A Relational approach: Database – Relationships – DBMS – Relational Data Model – Integrity Rules – Theoretical Relational Languages. Database Design: Data Modeling and Normalization: Data Modeling – Dependency – Database Design – Normal forms – Dependency Diagrams – De normalization – Examples of Normalization. (15 Hrs)
- Unit- 2 Oracle9i: Overview: Personal Databases – Client/Server Databases – Oracle9i an introduction – SQL *Plus Environment – SQL – Logging into SQL *Plus - SQL *Plus Commands – Errors & Help – Alternate Text Editors - SQL *Plus Worksheet - SQL *Plus. Oracle Tables: DDL: Naming Rules and conventions – Data Types – Constraints – Creating Oracle Table – Displaying Table Information – Altering an Existing Table – Dropping, Renaming, Truncating Table – Table Types – Spooling – Error codes. (15 Hrs)
- Unit- 3 Working with Table: Data Management and Retrieval: DML – adding a new Row/Record – Customized Prompts – Updating and Deleting an Existing Rows/Records – retrieving Data from Table – Arithmetic Operations – restricting Data with WHERE clause – Sorting – Revisiting Substitution Variables – DEFINE command – CASE structure. Functions and Grouping: Built-in functions –Grouping Data. Multiple Tables: Join – Set operations. (15 Hrs)
- Unit- 4 PL/SQL: A Programming Language: History – Fundamentals – Block Structure – Comments – Data Types – Other Data Types – Declaration – Assignment operation – Bind variables – Substitution Variables – Printing – Arithmetic Operators. Control Structures and Embedded SQL: Control Structures – Nested Blocks – SQ L in PL/SQL – Data Manipulation – Transaction Control statements. PL/SQL Cursors and Exceptions: Cursors – Implicit & Explicit Cursors and Attributes – Cursor FOR loops – SELECT...FOR UPDATE – WHERE CURRENT OF clause – Cursor with Parameters – Cursor Variables – Exceptions – Types of Exceptions. (15 Hrs)
- Unit- 5 PL/SQL Composite Data Types: Records – Tables – Varrays. Named Blocks: Procedures – Functions – Packages –Triggers –Data Dictionary Views. (15 Hrs)

Books for Study:	1.	Nilesh Shah,“ <i>Database Systems Using Oracle</i> ” , 2nd edition, PHI.
Books for Reference:	1.	ArunMajumdar&Pritimoy Bhattacharya,“ <i>Database Management Systems</i> ” –, 2007, TMH.

	2.	Gerald V. Post, “ <i>Database Management Systems</i> ”, 3rd edition, TMH.
	3.	Dr.Deshpande P S, “ <i>SQL & PL/SQL FOR ORACLE 10G</i> ”, Dreamtech, 2 nd edition
	4.	Das Gupta, Pranab Kumar & Krishna, Radha P, “ <i>Database Management System Oracle SQL and PL/SQL</i> ”, PHI, 2 nd edition
	5.	Dr.Ahmed, Rizwan P, “ <i>RDBMS & ORACLE</i> ”, MARGHAM Publication

Web References	1.	https://www.tutorialspoint.com/sql/sql-rdbms-concepts.htm
	2	https://docs.oracle.com/cd/E11882_01/server.112/e40540/intro.htm
	3	https://www.javatpoint.com/what-is-rdbms
	4.	https://www.guru99.com/dbms-tutorial.html
	5	https://www.guru99.com/sql.html
	6.	https://www.w3schools.com/sql/

PEDAGOGY (TEACHING METHODOLOGY):

1. *Formal black board teaching with chalk and talk in classroom*
2. *Using Projector and power point presentation in the classroom teaching*
3. *Using Google classroom for online class, submitting assignments and CAT exams*
4. *Giving Multiple Choice Questions in each unit, once the unit teaching is completed.*
5. *Using Moodle and Google as platform for online classes.*
6. *Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.*
7. *Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.*
8. *Encouraging the students to use open source software in their project development as well as for internship.*
9. *NPTEL courses are identified for each semester and make it compulsory that the students must complete minimum 2 courses (not included in the syllabus) in their entire degree duration.*
10. *Students are encouraged to do self-learn by registering in Spoken Tutorial, Mumbai, by MHRD and learn courses like latex, python, blender etc.*

Title of the Course/ Paper	PRACTICAL VII: ASP .NET				
Core Practical	Year	Semester	Sub code:	Credit:	Hours
	III	V		2	: 60

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Students will be able to design web applications using XML, HTML, and CSS.	K1,K2,K3
CO2	Students will be able to create user interactive web pages using ASP.Net.	K1, K2,K3,K4
CO3	Students will be able to create simple data binding applications using ADO.Net Connectivity.	K1,K2,K3,K4,K5
CO4	Students will be able to perform database operations for windows form and web applications.	K1,K2,K3,K4,K5
CO5	Students will be able to create a webform with server controls	K1,K2,K3

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5-Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	2	3	2	3	3	2	2
CO2	3	3	3	3	3	2	2
CO3	3	2	3	3	3	3	2
CO4	3	3	3	3	3	2	2
CO5	3	2	2	3	3	3	2
Average	2.8	2.6	2.6	3	3	2.4	2

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average = 2.628

Detailed Lab Syllabus : ASP .NET

1. Write a program to display the following feedback form. The different options for the list box must be ASP-XML, DotNET, JavaPro and Unix,C,C++. When the Submit Form button is clicked after entering the data, a message as seen in the last line of the below figure must be displayed

The screenshot shows a Microsoft Internet Explorer window titled 'Radiant Software Limited - Feedback Form - Microsoft Internet Explorer provided by ZDNetIndia.com'. The address bar shows 'http://asppx/aspp/lab9-1.aspx'. The form is titled 'Courseware Feedback Form' and contains the following fields and controls:

- Student name:
- Sex: ☐ Male ☒ Female
- Select course: (dropdown menu)
- Technical Coverage:
 - ☒ Excellent
 - ☐ Good
 - ☐ Average
 - ☐ Poor
- Suggestions:
-
- Feedback message: Thanks Miss. Niveditha for your feedback.

7. Write a program that displays a button in green color and it should change into yellow when the mouse moves over it.
8. Write a program containing the following controls:
 - A ListBox
 - A Button
 - An Image
 - A Label

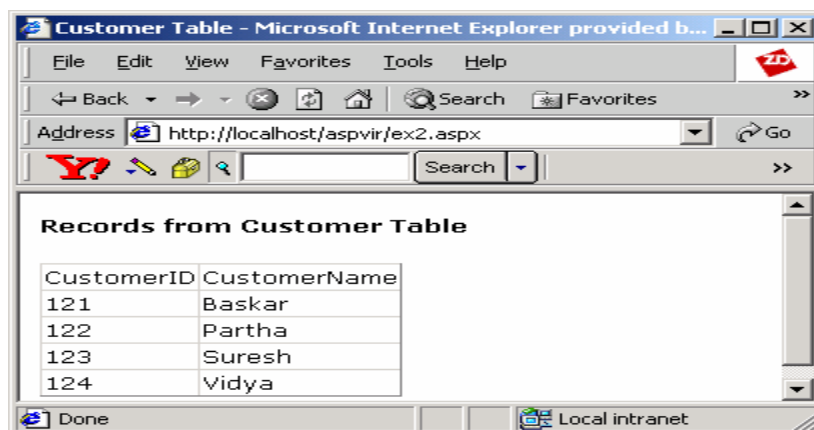
The listbox is used to list items available in a store. When the user clicks on an item in the listbox, its image is displayed in the image control. When the user clicks the button, the cost of the selected item is displayed in the control.

9. Extend the above program to add the following controls:
 - Two labels
 - A TextBox
 - A Button

One of the labels is displayed adjacent to the textbox , displaying the message “Enter the quantity:”. When the user enters the quantity in the textbox and clicks the button, the total cost is evaluated and displayed in another label.

10. Write a program to get a user input such as the boiling point of water and test it to the appropriate value using Compare Validator.

11. Write a program that gets user input such as the user name, mode of payment, appropriate credit card. After the user enters the appropriate values the Validation button validates the values entered.
12. Create a RadioButtonList that displays the names of some flowers in two columns. Bind a label to the RadioButtonList so that when the user selects an option from the list and clicks on a button, the label displays the flower selected by the user.
13. Create table Employee in master database with the following columns and datatypes.
 Dept Numeric
 Name Varchar(20)
 DojDatetime
 Sal Float
 DesginVarchar(20)
 Write a program to connect to the master database in SQL Server, in the Page_Load event. When the connection is established, the message "Connection has been established" should be displayed in a label in the form.
14. Select names from the employee table. Retrieve the result in a DataSet. Bind the DataSet to a
 RadioButtonList and display the result in three different forms as follows:
 The RepeatDirection property of the RadioButtonList is set to horizontal and its RepeatLayout property is set to Table.ii) The RepeatDirection property of the RadioButtonList is set to Vertical and its Repeat Layout property is set to Table.iii) The RepeatLayout property of the RadioButtonList is set to flow.
15. Write a program to display the records from the database as shown in the figure:



Records from Customer Table

CustomerID	CustomerName
121	Baskar
122	Partha
123	Suresh
124	Vidya

16. Write a program to implement the sorting feature in the customer table as shown in



the figure:

Web References	1.	https://www.guru99.com/asp-net-first-program.html
	2.	https://www.tutorialspoint.com/asp.net/asp.net_first_example.htm
	3.	https://www.w3schools.com/asp/default.ASP
	4.	https://www.tutorialride.com/asp-net-basic-programs/create-a-class-library-with-function-factorial-asp-net-program.htm
	5.	http://asp.net-informations.com/
	6.	https://www.oreilly.com/library/view/programming-aspnet-second/0596004877/ch01s03.html

PEDAGOGY (TEACHING METHODOLOGY):

1. Formal black board teaching with chalk and talk in classroom
2. Using Projector and power point presentation in the classroom teaching
3. Using Moodle and Google as platform for online classes.
4. Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.
5. Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.

Title of the Course/ Paper	PRACTICAL VIII: SQL & PL/SQL				
Core Practical	Year	Semester	Sub code:	Credit:	Hours
	III	V		2	: 60

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Applying create/ insert/update/delete data, and, joins in database.	K1,K2,K3,K4
CO2	Developing the procedural constructs with PL/SQL Statements.	K2,K3,K4,K5
CO3	Develop triggers, procedures, user defined functions, packages in Oracle	K2,K3,K4,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5-Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	3	3	2	3	3	3
CO2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3
Average	3	3	3	2.666667	3	3	3

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average= 2.95

Detailed Lab Syllabus : SQL & PL/SQL

SQL

- Write queries to create the following tables
 - EMPLOYEE(employee-name, street, city)
 - WORKS (employee-name, company-name,salary)
 - COMPANY(company-name,city)
 - MANAGERS (employee-name, manager-name) Use insert command to add data according to the need of queries.
- Find the names of all employees who work for a particular company from the following tables.
 - EMPLOYEE(employee-name, street, city)
 - COMPANY(company-name,city)
- Find the names and city of residence of all employee who work for a particular company from the following tables.
 - EMPLOYEE(employee-name, street, city)
 - COMPANY(company-name,city)

4. Find the names, street address and city of residence of all employees who work for a particular company and earn more than Rs. 2,00,000 per annum. (Nested subquery) from the following tables.
 - i) EMPLOYEE(employee-name, street, city)
 - ii) WORKS (employee-name, company-name,salary)
 - iii) COMPANY(company-name,city)
5. Find the names of employees who are living in a particular city for a particular company (use group by)
 - i) EMPLOYEE(employee-name, street, city)
 - ii) WORKS (employee-name, company-name,salary)
 - iii) COMPANY(company-name,city)
6. Find the names of the employees whose salary is greater than the average salary of the particular company (subquery)
 - i) EMPLOYEE(employee-name, street, city)
 - ii) WORKS (employee-name, company-name,salary)
7. Find the total and average salary of each company employees
 - i) EMPLOYEE(employee-name, street, city)
 - ii) WORKS (employee-name, company-name,salary)
8. Find the names of all the employees whose pay is greater than the average pay of their respective company
 - i) EMPLOYEE(employee-name, street, city)
 - ii) WORKS (employee-name, company-name,salary)
9. Find the names of the employee and the city they work under a particular manager.
 - i) EMPLOYEE(employee-name, street, city)
 - ii) WORKS (employee-name, company-name,salary)
 - iii) MANAGERS (employee-name, manager-name)
10. Update the name of an employee who has changed his company. Make proper changes in the following tables.
 - i) EMPLOYEE(employee-name, street, city)
 - ii) WORKS (employee-name, company-name,salary)
 - iii) COMPANY(company-name,city)
 - iv) MANAGERS (employee-name, manager-name)

1. Write a PL/SQL program to insert ten values in a table, check each value is odd or even and insert the output into the table
2. Use a cursor to select the five highest paid employees from the emp table.
3. Create a master and a transaction table. Write a PL/SQL code to update the master using transaction table.
4. Create a package, which consists of two procedures named hire_employee which will insert new employee details into emp table and another procedure named fire_employee which will delete an employee details from the database.
5. Write a PL/SQL block that will select all rows from a employee table. The block displays empno, empname, doj, dept, and experience column. Experience column should be calculated using current date and doj column.
6. Write a PL/SQL block to select only those rows where the ordered is 2000 from the item table and update the price to be three times the quantity and set the actual price column of the table to the value in price.

PROCEDURES

1. Create a procedure to calculate simple interest. Principal, rate of interest and no. of years are given as input.
2. Create a procedure to satisfy the following conditions accepting the route id as user input. Create suitable table(s).
 - a. If the distance is less than 500 then update the fare to be 190.98
 - b. If the distance is between 501-1000 then update fare to be 876.98
 - c. If the distance is greater than 1000 then update fare to be 1200.98

FUNCTIONS

1. Create a function that returns the empno of employees working in admin dept.
2. Create a function that finds out the result of a given student rollno

TRIGGERS

1. Write a database trigger before insert/update/delete for each row and allowing any of the transactions on Mondays, Wednesdays and Fridays. Create suitable table(s)
2. The price of a product changes constantly. It is important to maintain the history of the prices of the products. Create a trigger to update the "Product_price_history" table when the price of the product is updated in the "Product" table. Create the "Product" table and "Product_price_history" table with the following fields respectively
 - a. Product_price_history (product_id number(5), product_name varchar2(32), supplier_name varchar2(32), unit_price number(7,2))
 - b. Product (product_id number(5), product_name varchar2(32), supplier_name varchar2(32), unit_price number(7,2))
3. Create the Price_history_trigger and execute it.

4. Update the price of a product. Once the update query is executed, the trigger fires and should update the 'Product_price_history' table.
5. Generate a report for railway seat reservations. Check the validity of each field and generate reports for reservation and cancellation details.

Web References	1.	https://www.tutorialspoint.com/sql/sql-rdbms-concepts.htm
	2	https://www.codecademy.com/articles/what-is-rdbms-sql
	3.	https://www.javatpoint.com/what-is-rdbms
	4.	https://beginnersbook.com/2015/04/rdbms-concepts/
	5.	https://dbmslabnmit.wordpress.com/
	6.	https://helpmevishal.wordpress.com/rdbms-lab/

PEDAGOGY (TEACHING METHODOLOGY):

1. Formal black board teaching with chalk and talk in classroom
2. Using Projector and power point presentation in the classroom teaching
3. Using Moodle and Google as platform for online classes.
4. Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.
5. Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.

Title of the Course/ Paper	PAPER VIII: PYTHON FOR SCIENTIFIC COMPUTING				
Core Theory	Year	Semester	Sub code:	Credit: 4	Hours : 75
	III	VI			

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	To write simple python programs.	K1,K2,K3

CO2	To write efficient functions in Python and able to handle core data structures like Lists, Dictionaries, Tuples in Python.	K1,K2,K3,K4
CO3	To Interpret and Evaluate the concepts of Object-Oriented Programming using Python. Will be able to write programs interacting with MySQL data base and build applications	K1,K2,K3,K4,K5
CO4	To understand and use python exclusive packages like Numpy/ Scipy and Matplotlib.	K2,K3,K4,K5
CO5	Know to use Python package pandas and create data frames, grouping, and aggregate any data and visualize them.	K2,K3,K4,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5-Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3
Average	3	3	3	3	3	3	3

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average=3

Detailed Syllabus : PYTHON FOR SCIENTIFIC COMPUTING

Unit- 1 Introduction to Python - Installing in various Operating Systems - Executing Python Programs -Basic Programming concepts - Variables, expressions and statements - Input/Output –Operators. (15 Hrs)

- Unit- 2 Conditions - Functions - Arguments - Return values - Iteration - Loops - Strings - Data Structures: Lists - Dictionaries - Tuples - Sequences – Exception Handling. (15 Hrs)
- Unit- 3 File Handling - Modules - Regular Expressions - Text handling - Object Oriented Programming Classes - Objects - Inheritance - Overloading - Polymorphism Interacting with Databases - Introduction to MySQL - interacting with MySQL - Building a address book with add/edit/delete/search features (15 Hrs)
- Unit- 4 Scientific Programming using NumPy/SciPy and Matplotlib – Array operations, 2D Numpy arrays, Numpy basic Statistics , ScipyLinalg, scipy Optimize. Matplotlib – Introduction, Simple plots, Figures and Subplots. (15 Hrs)
- Unit- 5 Working with pandas – Selections, Indexing and Filtering methods, Series operations, Data frames, reading files , grouping, Aggregate Functions and Visualization. (15 Hrs)

Books for Study:	1.	Allen B. Downey O'Reilly , “ <i>Think Python: How to Think Like a Computer Scientist</i> ”, SPD
Books for Reference:	1.	JeffMcNeil , “ <i>Python2.6 Text Processing: Beginners Guide</i> “, Packet Pub Publications
	2.	Mark Pilgrim ,” <i>Dive Into Python</i> ” , APress
	3	Chun,Wesley.J, “ <i>Core Python Applications Programming</i> ”, PEARSON PUBLICATIONS, 3 rd edition
	4	Barry, Paul, “ <i>Head First Python</i> ”, SPD, 2 nd edition
	5	Mcgrath, Mike, “ <i>Python in easy steps</i> ”, Tata Mcgraw Hill, 1 st edition

Web References	1.	https://www.tutorialspoint.com/python/index.htm
	2	https://docs.python.org/3/tutorial/
	3.	https://www.programiz.com/python-programming
	4.	https://www.javatpoint.com/python-tutorial
	5.	https://www.w3schools.com/python/

PEDAGOGY (TEACHING METHODOLOGY):

1. *Formal black board teaching with chalk and talk in classroom*
2. *Using Projector and power point presentation in the classroom teaching*
3. *Using Google classroom for online class, submitting assignments and CAT exams*
4. *Giving Multiple Choice Questions in each unit, once the unit teaching is completed.*
5. *Using Moodle and Google as platform for online classes.*
6. *Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.*
7. *Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.*
8. *Encouraging the students to use open source software in their project development as well as for internship.*
9. *NPTEL courses are identified for each semester and make it compulsory that the students must complete minimum 2 courses (not included in the syllabus) in their entire degree duration.*
10. *Students are encouraged to do self-learn by registering in Spoken Tutorial, Mumbai, by MHRD and learn courses like latex, python, blender etc.*

Title of the Course/ Paper	PAPER IX: PROGRAMMING IN JAVA				
Core Theory	Year	Semester	Sub code:	Credit: 4	Hours : 75
	III	VI			

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	To understand basic data types , simple I/O, conditional and control structures, string handling methods	K1,K2,K3
CO2	Gain Knowledge about the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and inheritance	K2,K3,K4
CO3	Understand the principles of abstract class, packages, and interfaces.	K1,K2,K3,K4
CO4	To understand the importance of multi-threading and exception handling mechanisms.	K1,K2,K3,K5

CO5	Demonstrate the working features of file handling and graphics programming	K2,K3,K5
------------	--	----------

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5-Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	2	2	2	2	2	2
CO2	3	2	3	3	3	3	2
CO3	3	3	2	3	3	3	3
CO4	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3
Average	3	2.6	2.6	2.8	2.8	2.8	2.6

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average= 2.7428

Detailed Syllabus : PROGRAMMING IN JAVA

- Unit- 1 Introduction to Java – Features of Java- Object Oriented Concepts- Lexical Issues- data Types- Variables-Arrays-Operators-control Statements. (10 Hrs)
- Unit- 2 Classes–Objects – Constructors – Overloading method-Access Control- Static and final methods-Inner Classes –String Class-Inheritance- Overriding methods- using super Abstract class. (15 Hrs)
- Unit- 3 Packages – Access Protection – Importing Packages – Interfaces – Exception Handling Throw and Throws –Thread –Synchronization -Messaging- Runnable Interface-Inter thread Communication-Deadlock- Suspending, Resuming and stopping threads- Multithreading. (20 Hrs)
- Unit- 4 I/OStreams –File Streams – Applets – String Objects –StringBuffer –CharArray - Java Utilities–Code Documentation. (15 Hrs)
- Unit- 5 Working with windows using AWT Classes-AWT Controls –Labels –Button – CheckBox –RadioButton- Choice-List- Scrollbars- Layout Managers –Flow Layout-

Border Layout-Grid Layout -Card Layout - Grid bag Layout – panels – Frames - Menus- Dialogs -Mouse Events and their Listeners. (15 Hrs)

Books for Study:	1.	Cay S.Horstmann, Gary Cornell, “ <i>Java2 Volume I -Fundamentals</i> ”, 5 th Edition,PHI,2000.
	2.	P.Naughtonand H.Schildt , “ <i>Java2 (The Complete Reference)</i> ”,Third Edition TMH 1999.
	3.	K.Arnoldand J.Gosling, “ <i>The Java Programming Language</i> ”, Second Edition Addison Wesley,1996.
Books for Reference:	1.	E.Baluguruswamy , “ <i>Programming With Java, A Primer</i> ”, TMH
	2.	C.Muthu , “ <i>Programming in Java</i> “ , Vijay Nicole publication
	3.	Sachin Malhotra & Saurabh Choudhary, “ <i>Programming in JAVA</i> ”, 2nd Ed, Oxford Press
	4.	Robert Sedgewick& Kevin Wayne, “ <i>Introduction to Programming in Java</i> ”, Addison Wesley 2017

Web References	1.	https://beginnersbook.com/java-tutorial-for-beginners-with-examples/
	2.	https://www.javatpoint.com/java-tutorial
	3.	https://www.tutorialspoint.com/java/index.htm
	4.	https://www.guru99.com/java-tutorial.html
	5.	https://www.w3schools.com/java/default.asp

PEDAGOGY (TEACHING METHODOLOGY):

1. Formal black board teaching with chalk and talk in classroom
2. Using Projector and power point presentation in the classroom teaching
3. Using Google classroom for online class, submitting assignments and CAT exams
4. Giving Multiple Choice Questions in each unit, once the unit teaching is completed.
5. Using Moodle and Google as platform for online classes.
6. Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.
7. Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.

8. Encouraging the students to use open source software in their project development as well as for internship.
9. NPTEL courses are identified for each semester and make it compulsory that the students must complete minimum 2 courses (not included in the syllabus) in their entire degree duration.
10. Students are encouraged to do self-learn by registering in Spoken Tutorial, Mumbai, by MHRD and learn courses like latex, python, blender etc.

Title of the Course/ Paper	PRACTICAL IX: PYTHON FOR SCIENTIFIC COMPUTING				
Core Practical	Year	Semester	Sub code:	Credit:	Hours
	III	VI		2	: 60

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Write simple to complex object oriented programs in python.	K1,K2,K3,K4,K5
CO2	Write programs in python exclusive features like list, tuple, dictionaries etc.	K1,K2,K3,K4,K5
CO3	Write programs for extracting and manipulating data from MySQL database. Know to use python efficient packages and do visualization with data.	K2,K3,K4,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5-Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

<div>PSOs</div> <div>COs</div>	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3

CO3	3	3	3	3	3	3	3
Average	3	3	3	3	3	3	3

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average=3

Detailed Lab Syllabus : PYTHON FOR SCIENTIFIC COMPUTING

Exercises

1. Write a program that takes the radius of a sphere (a floating point number) as input and outputs the sphere's diameter, circumference, surface area and volume
2. Write a program to calculate the BMI of a person given the following specifications. The class BMI is defined as follows

BMI
-name : str -age : int -weight : float -height : float getName() getAge() getWeight() getHeight()
BMI(name: str, age: int, weight: float, height: float) getBMI():float getStatus(): str

3. Design a class named Quadratic Equation for a quadratic equation $ax^2 + bx + c = 0$. The class contains:
 - The private data fields a,b and c the three co-efficients
 - A constructor with arguments
 - Three get methods
 - A method named getDiscriminant() that returns the discriminant
 - The methods named getRoot1() and getRoot2() returning the two roots of the equation. Note:- These methods are valid only if discriminant is nonnegative
4. Write a program to implement the above class and test it with different inputs.
5. Write a function to check whether a string is a valid password where the following are the rules of valid password.
 - a. A password must have at least eight characters
 - b. A password must consist of only letters and digits
 - c. A password must contain at least two digits
6. Design a class **Polygon** with the following:-
 - Number of sides
 - Magnitude of the sides as a list
 - inputSides()
 - dispSides()

Define another class **Triangle** which will inherit **Polygon** and has one extra function **indArea()** to

- calculate the area of a triangle.(Any extra methods can be defined if required)
7. Write a program to illustrate ZeroDivisionError, KeyError, ValueError using exception handling
8. Write a program to do List and dictionary Operations in Python
9. Write a program using string handling and regular expressions in python
10. Create new module for mathematical operations and use in your program
11. Write a program to Connect with MySQL and create address book
12. Write a program to read and write files, create and delete directories
13. Write a program for plotting two graphs using matplotlib and subplot
14. Write a program for plotting bar chart graph using matplotlib
15. Write a program for plotting pie chart graph using matplotlib

Web References	1.	https://realpython.com/
	2.	https://www.learnpython.org/
	3.	https://www.guru99.com/python-tutorials.html
	4.	https://www.tutorialsteacher.com/python
	5.	https://www.codecademy.com/learn/learn-python

PEDAGOGY (TEACHING METHODOLOGY):

1. Formal black board teaching with chalk and talk in classroom
2. Using Projector and power point presentation in the classroom teaching
3. Using Moodle and Google as platform for online classes.
4. Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.
5. Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.

Title of the Course/ Paper	PRACTICAL X: PROGRAMMING IN JAVA				
Core Practical	Year	Semester	Sub code:	Credit:	Hours
	III	VI		2	: 60

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	To understand how to design, implement, test, debug, and document programs that use basic data types and computation, simple I/O, conditional and control structures, string handling and functions	K1,K2,K3,K4
CO2	To understand and implement Classes & objects along with constructors, Arrays and Vectors.	K2,K3,K4,K5
CO3	Apply the principles of inheritance, interface and packages and demonstrate through problem analysis assignments how they relate to the design of methods, abstract classes and interfaces and packages	K2,K3,K4,K5
CO4	To implement Multi-threading & different exception handling mechanisms	K2,K3,K4,K5
CO5	To learn experience of designing, implementing graphical user interfaces in Java using applet	K2,K3,K4,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5-Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

<div>PSOs</div> <div>COs</div>	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	3	3	2	2	2	2
CO2	3	3	3	2	2	2	2
CO3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3
Average	3	3	3	2.6	2.4	2.6	2.6

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average= 2.74

Detailed Lab Syllabus : JAVA PROGRAMMING

Applications

1. Area and perimeter of the circle
2. Substring removal
3. Program for overloading functions in java
4. Hierarchical inheritance in java
5. Program for overriding
6. Program for abstract class

7. Program for interface.
8. Program for pre-defined exception handling
9. Program for user-defined exception handling
10. Thread and exceptional handling
11. Thread synchronization
12. Program for Inter Thread Communication
13. Program for java utility (calendar class)
14. Program for string manipulation.
15. File streams

Applets

16. Program for applet with mouse listener
17. Frames and controls
18. Menus and dialog box
19. Panel and layout
20. Incorporating graphics

Web References	1.	https://www.geeksforgeeks.org/java/?ref=shm
	2.	https://www.javatpoint.com/java-tutorial
	3.	https://www.learnjavaonline.org/
	4.	https://www.tutorialspoint.com/java/index.htm
	5.	https://www.guru99.com/java-tutorial.html

PEDAGOGY (TEACHING METHODOLOGY):

1. Formal black board teaching with chalk and talk in classroom
2. Using Projector and power point presentation in the classroom teaching
3. Using Moodle and Google as platform for online classes.
4. Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.
5. Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.

Title of the Course/ Paper	MINI PROJECT				
Elective - III	Year	Semester	Sub code:	Credit: 5	Hours : 75
	III	VI			

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	To identify the specific problems for their project and start analysis part of it	K2,K3,K4,K5
CO2	Identify the respective software and implement the analysis part in it	K3,K4,K5
CO3	Deliver the final project output to the staff in the department.	K3,K4,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5-Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3
Average	3	3	3	3	3	3	3

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course Average= 3

Group Projects
<u>Project Evaluation:</u> Power point presentation of the project and individual viva

Detailed Elective Syllabus

Title of the Course/ Paper	COMPUTER GRAPHICS				
Elective - I	Year	Semester	Sub code:	Credit: 5	Hours : 75
	III	V			

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Understand the basics of computer graphics, different graphics systems and applications of computer graphics.	K1,K2,K3
CO2	Discuss various graphics drawing algorithms, filling of basic objects	K2,K4,K5
CO3	Provide an understanding of mapping from a world coordinates to device coordinates, clipping, and application in composite form.	K2,K3,K4K5
CO4	To understand the concept of geometrical transformations and 3D viewing.	K2,K3,K4,K5
CO5	Explore projections and visible surface detection techniques for display	K2,K3,K4,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5-Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	2	2	2	2	2	1
CO2	3	3	3	2	2	2	2
CO3	3	3	3	3	3	2	2

CO4	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3
Average	3	2.8	2.8	2.6	2.6	2.4	2.2

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average = 2.628

Detailed Syllabus : COMPUTER GRAPHICS

- Unit- 1 Introduction to computer graphics: Brief Survey of Computer Graphics – Graphics Systems: Video Display Devices – Types – Raster-Scan Systems and Random-Scan Systems – Input Devices – Hard-Copy Devices – Graphics Software.
- Unit- 2 Output primitives and their attributes Line-Drawing (DDA and Bresenham's) Algorithms – Circle-Generating (Midpoint) Algorithm – Ellipse-Generating (Midpoint) Algorithms- Area-Filling (Boundary-Fill and Flood-Fill) Algorithms - Line Attributes - Color and Grayscale Levels – Character Attributes.
- Unit- 3 Two-dimensional transformations and viewing : Basic Transformations - Matrix Representations and Homogeneous Coordinates – Composite Transformations - Other Transformations – Window-to- Viewport Coordinate Transformation.
- Unit- 4 Three-dimensional concepts: Three-Dimensional Display Methods: Parallel and Perspective Projections – Depth Cueing - Visible Line and Surface Identification – Three-Dimensional Transformations: Translation- Rotation- Scaling - Other Transformations.
- Unit- 5 Three-dimensional viewing: Viewing Pipeline and Coordinates – Transformation from World to Viewing Coordinates – Projections – Parallel Projection- Perspective Projection.

Books for Study:	1.	D. Hearn and M.P. Baker,2005, “ <i>Computer Graphics</i> ”, 2ndEdition, Pearson Education, Prentice Hall, 19th Reprint.
-------------------------	-----------	---

Books for Reference:	1.	S. Harrington, 1987, " <i>Computer Graphics</i> ", 2nd Edition, Tata McGraw-Hill Book Co.
	2.	W.M. Newman and R.F. Sproull, 1997, " <i>Principles of Interactive Computer Graphics</i> ", 2nd Edition, Tata McGraw-Hill Publishing Co. Ltd.
	3.	D.P. Mukherjee, 1999, " <i>Fundamentals of Computer Graphics and Multimedia</i> ", 1 st Edition, Prentice-Hall of India Pvt. Ltd.

Web References	1.	https://www.javatpoint.com/computer-graphics-tutorial
	2.	https://www.tutorialspoint.com/computer_graphics/index.htm
	3.	https://www.geeksforgeeks.org/computer-graphics-2/
	4.	https://www.tutorialandexample.com/computer-graphics-tutorial/
	5.	https://tutorialspoint.dev/computer-science/computer-graphics

PEDAGOGY (TEACHING METHODOLOGY):

1. *Formal black board teaching with chalk and talk in classroom*
2. *Using Projector and power point presentation in the classroom teaching*
3. *Using Google classroom for online class, submitting assignments and CAT exams*
4. *Giving Multiple Choice Questions in each unit, once the unit teaching is completed.*
5. *Using Moodle and Google as platform for online classes.*
6. *Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.*
7. *Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.*
8. *Encouraging the students to use open source software in their project development as well as for internship.*
9. *NPTEL courses are identified for each semester and make it compulsory that the students must complete minimum 2 courses (not included in the syllabus) in their entire degree duration.*
10. *Students are encouraged to do self-learn by registering in Spoken Tutorial, Mumbai, by MHRD and learn courses like latex, python, blender etc.*

Title of the Course/ Paper	RESOURCE MANAGEMENT TECHNIQUES				
Elective - I	Year	Semester	Sub code:	Credit:	Hours
	III	V		5	: 75

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Ability to solve optimization problems using Linear Programming Techniques	K1,K2,K3,K4,K5
CO2	Interpret and apply various transportation methods to solve the issues regarding transfer of goods to obtain the maximum profit	K1,K2,K3,K4,K5
CO3	Determine the effectiveness of solving sequencing problem to synchronize with the latest trends and demands from the industry.	K1,K2,K3,K4,K5
CO4	Ability to analyse win or loss in a business strategy.	K1,K2,K3,K4,K5
CO5	Construct network diagrams and implement PERT and CPM methods to plan, schedule and control project activities to meet the needs of corporate sector.	K1,K2,K3,K4,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5-Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	3	1	3	1	1	2
CO2	3	3	1	3	1	1	2
CO3	3	3	1	3	1	1	2
CO4	3	3	1	3	1	1	2
CO5	3	3	1	3	1	1	2
Average	3	3	1	3	1	1	2

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0
Course average =2

Detailed Syllabus : RESOURCE MANAGEMENT TECHNIQUES

- Unit- 1 Basic of Operations Research (OR): Characteristics of OR-Necessity of OR in industry-OR and Decision making-Role of computers in OR. Linear programming: Formulation and Graphical solution (of 2 variables) canonical and standard terms of Linear programming problem. Algebraic solution and Graphical solution: Simplex method (20 Hrs)
- Unit- 2 Transportation model: Definition-formulation and solution of transportation models – the row- minima, column-minima, matrix minima and Vogel’s Approximation methods. Assignment model: Definition of assignment model-comparison with transportation model-formulation and solution of Assignment model-variation of Assignment problem. (20 Hrs)
- Unit- 3 Sequencing problem: Processing each of n jobs through m machines-processing n jobs through 2 machines-processing n jobs through 3 machines – processing 2 jobs through m machines-processing n jobs through m machines – traveling salesman problem. (15 Hrs)
- Unit- 4 Game Theory: Characteristic of games – maximin,minimax criteria of optimality – Dominance property – algebraic and graphical method of solution of solving 2*2 games. (10 Hrs)
- Unit- 5 Pert-CPM: Networks-PERT computation-CPM computation – resource scheduling. (10 Hrs)

Books for Study:	1.	P.R.Vittal,V.Malini , “ <i>Operations Research -Resource Management Technique</i> ”, ,Margham Publication.
	2.	HamdyA.Taha, “ <i>Operation Research – An Introduction</i> ” , 5 th ed. Prentice Hall of India, Private Limited.,New Delhi,1996.

Books for Reference:	1.	KantiSwarup, p.k. Gupta and Man Mohan, “ <i>Operations Research</i> ”, Sultan Chand & Sons, 2020
-----------------------------	-----------	--

	2.	Srinath L.S., “PERT and CPM principles and applications”, Affiliated East Press Pvt. Ltd., New York, 1973.
--	----	--

Web References	1	https://nptel.ac.in/courses/112/106/112106134/
	2	https://www.tutorialspoint.com/management_concepts/critical_path_method.htm
	3	https://www.geeksforgeeks.org/transportation-problem-set-6-modi-method-uv-method/
	4	http://www.universalteacherpublications.com/univ/ebooks/or/Ch14/example.htm
	5	https://nptel.ac.in/courses/110/106/110106062/
	6	https://www.ncss.com/software/ncss/operations-research-in-ncss/
	7	http://people.brunel.ac.uk/~mastjjb/jeb/or/tutorial.html
	8	http://www.brainkart.com/subject/Resource-Management-Techniques_176/

PEDAGOGY (TEACHING METHODOLOGY):

1. Formal black board teaching with chalk and talk in classroom
2. Using Projector and power point presentation in the classroom teaching
3. Using Google classroom for online class, submitting assignments and CAT exams
4. Giving Multiple Choice Questions in each unit, once the unit teaching is completed.
5. Using Moodle and Google as platform for online classes.
6. Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.
7. Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.
8. Encouraging the students to use open source software in their project development as well as for internship.
9. NPTEL courses are identified for each semester and make it compulsory that the students must complete minimum 2 courses (not included in the syllabus) in their entire degree duration.
10. Students are encouraged to do self-learn by registering in Spoken Tutorial, Mumbai, by MHRD and learn courses like latex, python, blender etc.

Title of the Course/ Paper	PAPER : - E-Commerce
---------------------------------------	-----------------------------

Elective Theory	Year	Semester	Sub code:	Credit: 5	Hours : 75
	III	V/VI			

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Provide basic knowledge on E-commerce technologies. To understand the nature and current trends of e-Commerce. Recognize the business impact and potential of e-Commerce. Explain the technologies required to make e-Commerce viable.	K1,K2
CO2	Understand the business, web technology and network concepts of electronic market in the fast changing business environment. Discuss the current drivers and inhibitors facing the business world in adopting and using E-Commerce and explain the economic consequences of e-Commerce. Discuss the trends in e-Commerce and the use of the Internet.	K1,K2
CO3	Provide knowledge on internet security and transactions. Incorporate the solutions for legal, ethical and security issues in E-Commerce and M-Commerce.	K1,K2
CO4	Understand the business, web technology and network concepts of electronic market in the fast changing business environment. Acquire knowledge about the required mechanisms for conducting business transactions through electronic means. Describe the key features of Internet, Intranets and Extranets and explain how they relate to each other.	K1,K2,K4
CO5	Design and Analyze the different models for the various E-Commerce companies based on the different business standards and payment methods. understand the concepts of different electronic payment system, understand the concepts of information based marketing and the functioning of an e-market.	K1,K2,K4,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5- Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	0	1	0	0	1	2
CO2	3	0	1	0	0	1	2
CO3	3	0	1	0	1	1	2

CO4	3	0	1	0	1	1	2
CO5	3	0	1	0	1	1	2
Average	3	0	1	0	0.6	1	2

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average = 1.0857

Detailed Syllabus : E-COMMERCE

- Unit- 1 Electronic Commerce and Opportunities: Background The Electronic Commerce Environment – Electronic Marketplace Technologies – Modes of Electronic Commerce: Overview: Electronic Data Interchange.
- Unit- 2 Approaches to Safe Electronic Commerce. Overview – Secure Transport Protocols – Secure Transaction – Secure Electronic Payment Protocol (SEPP) – Secure Electronic Transaction (SET)
- Unit- 3 Certificates for Authentication – Security on Web Servers – Payment Schemes: Internet Monetary Payment and Security Requirements- Payment and purchase order process – Online electronic cash.
- Unit- 4 Internet / Intranet Security Issues and Solutions : The Need for Computer Security – Specific Intruder Approaches – Security Strategies-Security Tools – Encryption – Enterprise Networking and Access to the Internet Antivirus Programs.- Security Teams.
- Unit- 5 MasterCard/Visa Secure Electronic Transaction: Introduction –Business Requirements – Concepts – payment Processing.

Books for Study:	1.	Daniel Minoli & Emma Minoli, “ <i>Web Commerce Technology Handbook</i> ”, Tata McGraw Hill – 1999.
Books for Reference:	1.	K.Bajaj & D Nag , “ <i>E-Commerce</i> ”, Tata McGraw Hill – 1999.
	2.	Mamta Bhusry , “ <i>E-Commerce</i> ”, Firewall Media, 2005
	3.	Dr,Abirami Devi,K.& Dr,Alagammai,M.,” <i>E-Commerce</i> ”, Margham Publications

Web References	1.	https://opentextbc.ca/electroniccommerce/chapter/electronic-commerce-technology/
	2.	https://irp-cdn.multiscreensite.com/1c74f035/files/uploaded/introduction-to-e-commerce.pdf
	3.	http://www.aagasc.edu.in/cs/msccs/ECommerce%20Unit%201.pdf

PEDAGOGY (TEACHING METHODOLOGY):

1. Formal black board teaching with chalk and talk in classroom
2. Using Projector and power point presentation in the classroom teaching
3. Using Google classroom for online class, submitting assignments and CAT exams
4. Giving Multiple Choice Questions in each unit, once the unit teaching is completed.
5. Using Moodle and Google as platform for online classes.
6. Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.
7. Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.
8. Encouraging the students to use open source software in their project development as well as for internship.
9. NPTEL courses are identified for each semester and make it compulsory that the students must complete minimum 2 courses (not included in the syllabus) in their entire degree duration.
10. Students are encouraged to do self-learn by registering in Spoken Tutorial, Mumbai, by MHRD and learn courses like latex, python, blender etc.

Title of the Course/ Paper	PAPER : - Cloud Computing				
Elective Theory	Year	Semester	Sub code:	Credit:	Hours :
	III	V/VI			

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Understand the basic of Cloud and basic cloud models. Can differentiate between public and private clouds.	K1,K2
CO2	Understand the basics of Virtualization and its management	K1,K2,K3,K4
CO3	Understand the basic infrastructure of cloud, its challenges in designing and inter cloud management	K2,K3,K4
CO4	Understand the security features , security monitoring , security architecture design and governance of security in Cloud.	K3,K4,K5
CO5	Understand the way to collaborate with other community through respective clouds and collaboration via blogs and wikis	K1,K2,K3,K4,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5- Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	2	2	2	2	2	3
CO2	3	2	2	2	2	2	3
CO3	3	2	2	2	2	2	3
CO4	3	2	2	2	2	2	3
CO5	3	3	3	3	3	3	3
Average	3	2.2	2.2	2.2	2.2	2.2	3

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average= 2.428

Detailed Syllabus : CLOUD COMPUTING

Unit- 1 Understanding Cloud Computing: An Introduction to Cloud Computing –Cloud Models:- Characteristics – Cloud Services – Cloud models (IaaS, PaaS, SaaS) –

Public vs Private Cloud –Cloud Solutions - Cloud ecosystem – Service management – Computing on demand.

- Unit- 2 VIRTUALIZATION : Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization -Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices -Virtual Clusters and Resource management – Virtualization for Data-center Automation.
- Unit- 3 CLOUD INFRASTRUCTURE :Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.
- Unit- 4 SECURITY IN THE CLOUD :Security Overview – Cloud Security Challenges and Risks – Software-as-a-Service Security –Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security - Identity Management and Access Control– Autonomic Security.
- Unit- 5 Outside the Cloud: Other Ways to Collaborate Online: Collaborating via Web-Based Communication Tools - Collaborating via Social Networks and Groupware - Collaborating via Blogs and Wikis.

Books for Study:	1.	George Reese, “ <i>Cloud Application Architectures: Building Applications and Infrastructure in the Cloud</i> ” O'Reilly
	2.	Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, ‘ <i>Mastering Cloud Computing</i> ’,TMGH,2013.
	3.	Michael Miller, “Cloud Computing”, Pearson publication, 2013
Books for Reference:	1.	Toby Velte, Anthony Velte, Robert Elsenpeter, “ <i>Cloud Computing, A Practical Approach</i> ”, TMH, 2009.
	2.	Kumar Saurabh, “ <i>Cloud Computing – insights into New-Era Infrastructure</i> ”,Wiley India,2011.

Web References	1.	https://www.javatpoint.com/cloud-computing-tutorial
	2.	https://www.tutorialspoint.com/cloud_computing/index.htm
	3.	https://www.guru99.com/cloud-computing-for-beginners.html

	4.	https://data-flair.training/blogs/cloud-computing-tutorial/
	5.	https://www.simplilearn.com/cloud-computing-tutorial-video
	6.	https://www.w3schools.in/cloud-computing/cloud-computing/

PEDAGOGY (TEACHING METHODOLOGY):

1. Formal black board teaching with chalk and talk in classroom
2. Using Projector and power point presentation in the classroom teaching
3. Using Google classroom for online class, submitting assignments and CAT exams
4. Giving Multiple Choice Questions in each unit, once the unit teaching is completed.
5. Using Moodle and Google as platform for online classes.
6. Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.
7. Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.
8. Encouraging the students to use open source software in their project development as well as for internship.
9. NPTEL courses are identified for each semester and make it compulsory that the students must complete minimum 2 courses (not included in the syllabus) in their entire degree duration.
10. Students are encouraged to do self-learn by registering in Spoken Tutorial, Mumbai, by MHRD and learn courses like latex, python, blender etc.

Title of the Course/ Paper	PAPER : - SECURITY IN INFORMATION TECHNOLOGY				
Elective Theory	Year	Semester	Sub code:	Credit:	Hours :
	III	V/VI			
				5	75

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Identify the security issues in the network and resolve it.	K1,K2,K3
CO2	Learn the concept of Risk Management and Security Policies	K1,K2,K3

CO3	Understand network security basics, analyze different attacks on networks and evaluate the performance of firewalls and Intrusion Detection, Access control and other tools.	K1,K2,K3
CO4	To explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms	K1,K2,K3,K4
CO5	Learn the application of security techniques and technologies in solving real life security problems in practical systems.	K1,K2,K3

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5- Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	2	1	2	3	1	2
CO2	3	3	1	2	2	1	2
CO3	3	3	1	2	2	1	2
CO4	3	3	1	3	3	2	3
CO5	3	3	1	2	2	1	2
Average	3	2.8	1	2.2	2.4	1.2	2.2

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average= 2.1142

Detailed Syllabus : SECURITY IN INFORMATION TECHNOLOGY

- Unit- 1 **Information Security** – Introduction of information security – History, critical characteristic of Information, NSTISSC Security model, Components of an information system, securing components. **The need for security** – Introduction, Business needs, Treats, Attacks, Malicious code, Hoaxes, Back doors, Password crack, Brute force, Dictionary, DoS, Spoofing, Man-in-the-middle, Spam, Mail Bombing, Sniffers, Social Engineering, Buffer Overflow, Timing Attack
- Unit- 2 **Risk Management** – Introduction, overview of risk management, risk identification, risk assessment, risk control strategies, selecting a risk control strategy. **Security Policies** – Introduction, information security policy, standards

and practices, information security blueprint, continuity strategies, introduction to ISO27000 series.

Unit- 3 **Firewall and VPNs** - Introduction, Physical design, Firewalls, protecting remote connections. **Intrusion Detection, Access control and other tools** – Introduction, IDSs, Honey nets and Padded cell systems, Scanning and Analysis tools, Access control devices.

Unit- 4 **Cryptography** – Introduction, Principles of Cryptography, Cryptography tools, Public key infrastructure, Digital certificates, Hybrid cryptography systems, Steganography, protocols for secure communication.

Unit- 5 **Information Security Maintenance** – Introduction, security management models, maintenance model.

Books for Study:	1.	Michael E. Whitman and Herbert J. Mattord , “ <i>Principles of Information Security</i> ”, 4 th Edition, Thomson Course Technology, Boston.
	2.	Richard E. Smith, “ <i>Elementary Information Security</i> ”, Jones & Bartlett Learning; 3rd edition (October 28, 2019)
	3.	David Kim, Michel G. Solomon, “ <i>Fundamentals of Information Systems Security</i> ”, Jones & Bartlett Learning; 3rd edition (October 26, 2016)
Books for Reference:	1.	Daswani Neil, Christopher Kern and Anita Kesavan , (2007), “ <i>Foundations of Security – What every programmer needs to know</i> ”, Apress, Berkeley CA.
	2.	Kumar Saurabh, “ <i>Cloud Computing – insights into New-Era Infrastructure</i> ”, Wiley India, 2011.
	3	Jason Andress, “ <i>Foundations of Information Security: A straightforward Introduction</i> ”, No Starch Press (October 7, 2019)

Web References	1.	https://blog.eccu.edu/all-about-network-security-firewalls-and-vpns/
	2.	https://www.geeksforgeeks.org/risk-management-for-information-security-set-1/?ref=rp
	3.	https://www.geeksforgeeks.org/risk-management-for-information-security-set-2/?ref=rp
	4.	https://www.geeksforgeeks.org/what-is-information-security/
	5.	https://www.exabeam.com/information-security/information-security/
	6.	https://www.upguard.com/blog/information-security
	7.	https://www.kaspersky.co.in/resource-center/definitions/what-is-cyber-security

PEDAGOGY (TEACHING METHODOLOGY):

1. *Formal black board teaching with chalk and talk in classroom*
2. *Using Projector and power point presentation in the classroom teaching*
3. *Using Google classroom for online class, submitting assignments and CAT exams*
4. *Giving Multiple Choice Questions in each unit, once the unit teaching is completed.*
5. *Using Moodle and Google as platform for online classes.*
6. *Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.*
7. *Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.*
8. *Encouraging the students to use open source software in their project development as well as for internship.*
9. *NPTEL courses are identified for each semester and make it compulsory that the students must complete minimum 2 courses (not included in the syllabus) in their entire degree duration.*
10. *Students are encouraged to do self-learn by registering in Spoken Tutorial, Mumbai, by MHRD and learn courses like latex, python, blender etc.*

Title of the Course/ Paper	PAPER : - COMPUTER NETWORKS				
	Year	Semester	Sub code:	Credit:	Hours :
Elective Theory	III	V/VI		5	75

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Understand the basics of networking and different types of reference model of transmission media	K1,K2,K3

CO2	Understand the concept of Data link layer Design issues.	K1,K2,K3
CO3	Understand the functions of Medium Access Layer to ensure that the data has been transmitted across the layers error free	K1,K2,K3,K4,K5
CO4	Analyse various routing and Congestion control algorithms to determine optimal network data transfer paths between network nodes with good quality of service	K1,K2,K3,k4,k5
CO5	Understand the functions of transport layer and the concept on how information is transmitted fast and secure across various systems.	K1,K2,K3,K4,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5- Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	1	1	2	2	1	2
CO2	3	1	2	2	2	2	2
CO3	3	2	1	2	2	2	2
CO4	3	2	2	3	2	2	2
CO5	3	2	1	3	2	2	2
Average	3	1.6	1.4	2.4	2	1.8	2

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average= 2.0285

Detailed Syllabus : COMPUTER NETWORKS

Unit- 1 Introduction - Network Hardware – Software - Reference Models – Internet – ATM
- Physical layer - Transmission media - wireless transmission – switching (circuit

switching, packet switching, hybrid switching) methods – Communication Satellites.

- Unit- 2 Data link layer Design issues – error detection and correction – elementary data link protocols – Sliding window protocols – Data link Layer in the Internet
- Unit- 3 Medium Access Layer – Channel Allocation Problem – Multiple Access Protocols – Ethernet – Ethernet Cabling- Manchester Encoding-Ethernet MAC Sublayer Protocol - Wireless LANs.
- Unit- 4 Network layer – design issues – Routing algorithms – Congestion control algorithms – Internet Working – IP protocol – IP Address – Internet Control Protocol.
- Unit- 5 Transport layer – Elements of Transport Protocols – Addressing, Establishing & Releasing A connection – Internet Transport Protocol (TCP) – The application layer- DNS-The domain name system-Electronic mail-the– Cryptography.

Books for Study:	1.	Andrew S.Tannenbaum , “ <i>Computer Networks</i> ” , Fourth Edition , - Pearson Education , Inc,(Prentice hall of India Ltd) 2003.
Books for Reference:	1.	Behrouz Forouzan, “ <i>Introduction to Data Communications in Networking</i> ” , TMH – 1999.
	2.	Fred Halsall , “ <i>Data Communications , Computer Networks and Open Systems</i> ” , Addison Wessley.
	3.	D.Bertsekas and R.Gallager , “ <i>Data Networks</i> ” , Prentice hall, 1992.
	4.	Peterson, Larry, L, “ <i>Computer Networks – A System Approach</i> ”, Morgan, 3 rd edition
	5.	Pahuja, Sanjay, “ <i>Data Communications & Computer Networks</i> ”, Standard Publishers & Distributors, 1 st edition

Web References	1.	https://www.javatpoint.com/computer-network-introduction
	2.	https://www.cse.iitk.ac.in/users/dheeraj/cs425/lec01.html#physical
	3.	https://www.tutorialspoint.com/data_communication_computer_network/physical_layer_introduction.htm
	4.	https://www.geeksforgeeks.org/basics-computer-networking/
	5.	https://www.studytonight.com/computer-networks/

PEDAGOGY (TEACHING METHODOLOGY):

1. Formal black board teaching with chalk and talk in classroom
2. Using Projector and power point presentation in the classroom teaching
3. Using Google classroom for online class, submitting assignments and CAT exams
4. Giving Multiple Choice Questions in each unit, once the unit teaching is completed.
5. Using Moodle and Google as platform for online classes.
6. Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.
7. Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.
8. Encouraging the students to use open source software in their project development as well as for internship.
9. NPTEL courses are identified for each semester and make it compulsory that the students must complete minimum 2 courses (not included in the syllabus) in their entire degree duration.
10. Students are encouraged to do self-learn by registering in Spoken Tutorial, Mumbai, by MHRD and learn courses like latex, python, blender etc.

Title of the Course/ Paper	PAPER : - SOFTWARE ENGINEERING & TESTING				
Elective Theory	Year	Semester	Sub code:	Credit: 5	Hours : 75
	III	V/VI			

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Understand about process model for developing a software project	K1,K2,K3
CO2	Understand about Requirements Engineering	K1, K2,K3
CO3	To Know to build and analyze model	K1,K2,K3
CO4	Apply Component level design	K3,K4
CO5	Study and Apply various Software Testing Strategies	K3,K4,K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5- Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	2	1	3	3	3	1
CO2	3	3	3	1	1	2	1
CO3	3	3	3	3	3	2	2
CO4	3	2	1	1	2	1	1
CO5	3	3	3	3	3	1	3
Average	3	2.5	2	2	2.25	2	1.25

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average= 2.1428

Detailed Syllabus : SOFTWARE ENGINEERING & TESTING

- Unit- 1 Introduction to Software Engineering: The Software process: A generic view of process-Software Engineering –Layered technology,Processframework,CMMI ,Process patterns , Process assessment , Personal and Team process models ,Process technology and Product&Process. Process models: Waterfall model,Incremental process models,Evolutionarymodels,Specialised Process models,Unified process.-UML.
- Unit- 2 Software Engineering: System engineering –computer based systems,System Engineering hierarchy, business process engineering, Product engineering ,system modeling.Requirements Engineering- Bridge to design and construction,Requirements Engineering tasks,Initiating the requirements engineering process,Eliciting Requirements ,Developing Usecases,Building the analysis model ,Negotiating Requirements and Validating Requirements.
- Unit- 3 Software Engineering: Building the analysis model – Requirement analysis ,Analysis modeling approaches , Data Modeling concepts, Object oriented analysis , Scenario based modeling , Flow oriented modeling ,class based modeling ,Creating Behavioral model. Design Engineering: Design within the context of software Engineering, Design process and design quality,Design concepts , Design model , Pattern Based Software design.
- Unit- 4 Modeling component level design: What is a component, Defining class based components, conducting component level design ,object constraint

language, Designing Conventional components. Performing user interface design: Golden rules, user interface analysis and design, interface analysis, interface design steps and design evaluation

Unit- 5 Testing strategies: A strategic approach to software testing, strategic issues Test strategy for conventional software, testing strategies for object oriented software, validation testing, system testing and art of debugging. Testing tactics: software testing fundamentals, black box testing, White box testing, Basis path testing, Control structure testing.

Books for Study:	1.	Roger .S. Pressman, Software Engineering – “A Practitioner’s Approach”, McGraw – Hill International Edition, Sixth Edition.
	2.	K.K. Aggarwal & Yogesh Singh, “Software Engineering”, New Age International publishers.
Books for Reference:	1.	Ian Sommerville, “ Software Engineering”, Pearson Education, Asia -3rd Edition
	2.	Srinivasan Desikan & Ramesh Gopalswamy, ”Software Testing Principles and Practices”, Pearson Education
	3.	K.K. Aggarwal & Yogesh Singh, “Software Engineering”, New Age International publishers.
	4.	Richard Fairely, “Software Engineering Concepts”, TMH publishers.
	5.	Beizer Boris, “Software Testing Technique”, Dreamtech Press

Web References	1.	https://www.tutorialspoint.com/software_engineering/index.htm
	2.	https://www.javatpoint.com/software-engineering-tutorial
	3.	https://www.guru99.com/what-is-software-engineering.html
	4.	https://nptel.ac.in/courses/106/105/106105182/
	5.	https://www.tutorialandexample.com/software-engineering-tutorial/
	6.	https://www.ece.rutgers.edu/~marsic/books/SE/links/
	7	https://www.tutorialspoint.com/software_engineering/software_testing_overview.htm
	8	https://www.tutorialspoint.com/software_engineering/index.htm
	9	https://www.javatpoint.com/software-engineering-tutorial

PEDAGOGY (TEACHING METHODOLOGY):

1. *Formal black board teaching with chalk and talk in classroom*
2. *Using Projector and power point presentation in the classroom teaching*
3. *Using Google classroom for online class, submitting assignments and CAT exams*
4. *Giving Multiple Choice Questions in each unit, once the unit teaching is completed.*
5. *Using Moodle and Google as platform for online classes.*
6. *Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.*
7. *Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.*
8. *Encouraging the students to use open source software in their project development as well as for internship.*
9. *NPTEL courses are identified for each semester and make it compulsory that the students must complete minimum 2 courses (not included in the syllabus) in their entire degree duration.*
10. *Students are encouraged to do self-learn by registering in Spoken Tutorial, Mumbai, by MHRD and learn courses like latex, python, blender etc.*

Title of the	PAPER : - DATA MINING
---------------------	------------------------------

Course/ Paper					
Elective Theory	Year	Semester	Sub code:	Credit:	Hours :
	III	V/VI			

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	To introduce students to the basic concepts and techniques of Data Mining. and to possess some knowledge of the concepts and terminology associated with database systems, statistics, and machine learning	K1, K2, K3
CO2	To understand data pre processing steps and implement them	K1, K2
CO3	To study about Data mining techniques and implement them using different data sets	K1, K2
CO4	To understand about Classification and Prediction and finding the accuracy of different classifiers	K1, K2
CO5	Understand the various clustering techniques and apply them for appropriate data.	K1, K2, K3

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5- Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

PSOs COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO1	3	2	3	3	3	3	3
CO2	3	2	2	2	1	3	3
CO3	2	2	3	2	2	2	3
CO4	3	1	3	2	3	3	3
CO5	3	2	3	3	3	3	3
Average	2.8	1.8	2.8	2.4	2.4	2.8	3

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course Average=2.5714

Detailed Syllabus : DATA MINING

Unit- 1 Introduction: Data Mining tasks – Data Mining versus Knowledge Discovery in Data bases - Mining Issues – Metrics – Social implications of Data mining. Data

Mining Techniques – Introduction – A statistical perspective on Data Mining – similarity measures – Decision Trees – Neural Networks – Genetic Algorithms.

Unit- 2 Data Preprocessing: Why Preprocess the data – Data cleaning – Data Integration – Data Transformation – Data Reduction – Data Discretization.

Unit- 3 Data Mining Techniques: Association Rule Mining – The Apriori Algorithm – Multilevel Association Rules – Multidimensional Association Rules – Constraint Based Association Mining

Unit- 4 Classification and Prediction: Issues regarding Classification and Prediction – Decision Tree induction – Bayesian Classification – Back Propagation – Classification Methods – Prediction – Classifiers accuracy.

Unit- 5 Clustering Techniques: cluster Analysis – Clustering Methods – Similarity and Distance Measures – Hierarchical Methods - Partitional Methods – Outlier Analysis

Books for Study:	1.	Han and M. Kamber , 2001, “ <i>Data Mining: Concepts and Techniques</i> ”, Morgan Kaufmann, .New Delhi.
Books for Reference:	1.	M. H.Dunham, 2003, “ <i>Data Mining : Introductory and Advanced Topics</i> ” , Pearson Education, Delhi.
	2	PaulrajPonnaiah, 2001,” <i>Data Warehousing Fundamentals</i> “, Wiley Publishers.S.N. Sivananda and S. Sumathi, 2006, Data Mining, Thomsan Learning, Chennai
	3	http://nptel.iitm.ac.in/video.php?subjectId=106106093 http://cecs.louisville.edu/datamining/PDF/0471228524.pdf

Web References	1.	https://www.tutorialspoint.com/data_mining/index.htm
	2.	https://www.javatpoint.com/data-mining
	3.	https://www.guru99.com/data-mining-tutorial.html
	4.	https://www.tutorialspoint.com/dm/dm_quick_guide.htm
	5.	https://tutorialspoint.dev/computer-science/dbms/data-mining-kdd-process
	6.	Thedacs.com, Dwreview.com, Pcai.com, Eruditionhome.com

PEDAGOGY (TEACHING METHODOLOGY):

1. *Formal black board teaching with chalk and talk in classroom*
2. *Using Projector and power point presentation in the classroom teaching*
3. *Using Google classroom for online class, submitting assignments and CAT exams*
4. *Giving Multiple Choice Questions in each unit, once the unit teaching is completed.*
5. *Using Moodle and Google as platform for online classes.*
6. *Submitting video recording of classes in YouTube, so that students can view repeatedly and learn the concept with clarity. This ensures the students who are absent for a particular class, don't miss the lessons as they were able to watch the lesson recordings in YouTube anytime.*
7. *Helping the students to identify various website where free programming code (virtual labs) can be executed. So even if they don't have software in their system, they can directly run the respective coding in the identified website and learn.*
8. *Encouraging the students to use open source software in their project development as well as for internship.*
9. *NPTEL courses are identified for each semester and make it compulsory that the students must complete minimum 2 courses (not included in the syllabus) in their entire degree duration.*
10. *Students are encouraged to do self-learn by registering in Spoken Tutorial, Mumbai, by MHRD and learn courses like latex, python, blender etc.*

Title of the Course/ Paper	NON MAJOR ELECTIVE FOR OTHER DEPARTMENTS				
NME	Year	Semester	Sub code:	Credit:	Hours
	II	3 & 4			

COURSE OUTCOMES : on completion of the course the students will be able to ..

CO Levels	Course Outcome Statements	Knowledge Levels
CO1	Apply the principles of Analytical reasoning to train the students in attending various competitive exams	K1,K2,K3,K4,K5
CO2	Acquire knowledge about various verbal and non verbal analysis to improve the mental and reasoning ability	K1,K2,K3,K4,K5
CO3	Apply the concept of reasoning to enhance logical thinking of the students	K1,K2,K3,K4, K5

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5- Evaluate

Mapping of Course Outcomes to Programme Specific Outcomes

<div>PSOs</div> <div>COs</div>	PSO 1	PSO 2	PSO 3	PSO 4	PSO5	PSO 6	PSO 7
CO1	3	3	1	3	0	1	3
CO2	3	3	1	3	1	1	3
CO3	3	2	1	3	1	1	3
Average	3	3	0.3	3	0.2	0.3	3

Strongly Correlated-3 Moderately Correlated-2 Weekly Correlated-1 No Correlation-0

Course average = 1.828

Title of the Course/ Paper	Tests of Analytical Reasoning (Verbal & Non Verbal) [From 2019 Batch onwards]	
Non major Elective	II Year	Credit: 2
Course outline	Unit-1:	Questions relating to analogy test, classification, Logic based Venn diagrams
	Unit-2:	Logical arrangement of words, Letter series
	Unit-3:	Questions relating to Analytical Reasoning, Counting of figures
Books for Study:	1.	B.S.Sijwali, InduSijwali – A new approach to reasoning, verbal and non-verbal, Arihant Publications Pvt. Ltd.