Syllabi for

- **Other UG/ PG/ Diploma Courses (Allied/NME Courses)**

SYLLABUS FOR OTHER PROGRAMMES

Computer Courses for Undergraduate Programmes

Programme	Sem.	Course Code	Course	Credits	CFA		ESE		Total
					Theory	Practical	Theory	Practical	
B.Sc. (Physics)	III	21CSAU03T1	Python Programming and its Applications in Physics	2+1	20	30	30	20	100
B.Sc. (Chemistry)	III	21CSAU03T2	Python Programming and its Applications in Chemistry	2+1	20	30	30	20	100
B.Sc. (Micro Biology)	III	21CSAU03T3	Python Programming and its Applications in Microbiology	2+1	20	30	30	20	100
B.Sc. (Geology)	III	21CSAU03T4	Python Programming and its Applications in Geology	2+1	20	30	30	20	100
B.Sc. (Home Science)	III	21CSAU03T5	Web Designing	2+1	20	30	30	20	100
B.Sc. (Textile and Fashion Designing)	III	21CSAU03T5	Web Designing	2+1	20	30	30	20	100
B.Sc. (Agriculture – Honors.)	II	21CSAU02T6	Agri Data Ananlysis using R Programming	2+1	20	30	30	20	100
B.Com. (Co-Operation)	IV	21CSAU04T7	MIS and Computer Applications in Business	2+1	20	30	30	20	100
B.B.A.	IV	21CSAU04T8	Digital Marketing	2+1	20	30	30	20	100
B.Voc. (Dairy Production Technology)	III	21CSAV03T2	Web Designing	0+3	-	60	-	40	100
B.Voc. (Organic Agriculture and Enterprise Development)	II	21CSAV02T1	Digital Marketing	0+3	-	60	-	40	100
	IV	21CSAV04T2	Web Designing	0+3	-	60	-	40	100

Programme	Semester	Course Code	Course	Credits	CFA Theory	CFA Practical	ESE Theory	ESE Practical	Total
B.Voc. (Renewable Energy)	II	21CSAV02T1	Digital Marketing	0+3	-	60	-	40	100
	IV	21CSAV04T2	Web Designing	0+3	-	60	-	40	100
B.Voc. (Food Testing and Quality Evaluation)	II	21CSAV02T1	Digital Marketing	0+3	-	60	-	40	100
	IV	21CSAV04T2	Web Designing	0+3	-	60	-	40	100
B.Voc. (Food Processing)	II	21CSAV02T1	Digital Marketing	0+3	-	60	-	40	100
	IV	21CSAV04T2	Web Designing	0+3	-	60	-	40	100
Diploma in Textile Technology	II	21CSAD02T1	Web Designing	2+1	20	30	30	20	100
PG-Dip(Yoga Edu.)	II	21CSAD02T1	Web Designing	2+1	20	30	30	20	100

Computer Courses for Postgraduate Programmes

Programme	Semester	Course Code	Course	Credits	CFA		ESE		Total
					Theory	Practical	Theory	Practical	
M.A. (Development Administration)	IV	21CSAI04T1	Web Designing	2+1	20	30	30	20	100
	VI	21CSAI06T2	Digital Marketing	2+1	20	30	30	20	100
	VII	21CSAI07T3	R Programming for Data Analysis	2+1	20	30	30	20	100
M.A. (Sociology)	IV	21CSAI04T1	Web Designing	2+1	20	30	30	20	100
	VI	21CSAI06T2	Digital Marketing	2+1	20	30	30	20	100
	VII	21CSAI07T3	R Programming for Data Analysis	2+1	20	30	30	20	100

UG –Generic Electives

Course Code	Subject	Department	Sem	Credits	Theory		Total
					CFA	ESE	
21CSAU03G1	Internet & Web Technology	UG-NME- All Social Science	III	3	40	60	100
21CSAU03G2	Computer Animation						
21CSAU04G3	R Programming	UG-NME- All Science	IV	3	40	60	100
21CSAU04G4	Computer Essentials for Data Science						
21CSAU05G5	Industry 4.0	UG-NME- All Social Science	V	3	40	60	100
21CSAU05G6	Big Data Analytics using R	UG-NME- All Science		3	40	60	100
21CSAU05G7	Mobile Application Development	UG-NME- All Science & Social Sciences		3	40	60	100

PG– Generic Electives

Course Code	Subject	Credits	Theory		Total
			CFA	ESE	
21CSAP02G1	Multimedia Technologies	3	40	60	100
21CSAP02G2	Web Designing	3	40	60	100
21CSAP02G3	Computer Graphics	3	40	60	100
21CSAP02G4	Java Programming	3	40	60	100
21CSAP02G5	Elements of Industry 4.0	3	40	60	100
21CSAP02G6	Big Data Analysis using R	3	40	60	100
21CSAP02G7	Python Programming	3	40	60	100
21CSAP02G8	Internet of Things (IoT)	3	40	60	100
21CSAP02G9	R Programming	3	40	60	100
21CSAP02G310	Essentials of Virtual Reality	3	40	60	100
21CSAP02G11	Introduction to Machine Learning	3	40	60	100

Under Graduation

PYTHON PROGRAMMING AND ITS APPLICATIONS IN PHYSICS

Course Code	Department	Semester	Credits	Hours		Theory		Practical		Total
				T	P	CFA	ESE	CFA	ESE	
21CSAU04 T1	B.Sc. (Physics)	IV	2+1	3	2	20	30	30	20	100

Cognitive Level	**K-1** Recall the basic definitions and terminologies of computer. **K-2** Summarize the knowledge in programming **K-3** Prepare programs related to their field using Python language
Course Objectives	**The Course aims to** • Introduce the concepts of computer basics and terminologies. • Enlarge the programming concepts • Provide an in-depth training with Python programming

UNIT	CONTENT
	Introduction to Computer and Python Programming
I	• Introduction to Computer, Types of computer • Programming languages • History of Python Programming Language • Applications of Python • Parts of Python Programming Language : Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Comments, Type conversions
	Statements in Python
II	• Decision control statements: if, else, if..elif. • Looping Statements: for, while • Continue and break statements • Exception handling statements
	Functions and Strings
III	• Built-in functions • Commonly used modules • Function definition and calling - return statement and void function - command line arguments • Strings: Basic String Operations, Accessing Characters in String, String slicing and joining, String Methods, Formatting Strings
	Lists, Dictionaries and Tuples
IV	• Lists: Creating Lists, Basic List Operations, Indexing and Slicing Lists, Built-In Functions used on Lists, List Methods. • Dictionaries: Creating Dictionary, Dictionary methods. • Tuples and sets: Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Tuple Methods. Sets, Set Methods

	Python Programs for Physics
V	- Work, Power, Energy calculations - Viscosity, surface tension calculations - Gravitational force, Potential energy, Gravitational Energy calculation - Focal length calculation in Plane and Spherical mirror - Heat conversion: Fahrenheit to Centigrade, Centigrade to Fahrenheit - Photons Energy and Momentum computation
Text and Reference Books	Introduction to Python Programming, Gowrishankar S, Veena A, CRC Press, Taylor & Francis Group, 2019. Learn Python in 7 Days, MohitBhaskar N. Das, Packt Publishing, 2017 Learn Programming in Python with Cody Jackson, Cody Jackson, Packt Publishing, 2018
Course Outcomes	**On completion of the course, students should be able to** **CO1:** Recall the fundamental concept of computer and programming languages **CO2:** Be familiar with the programming concepts **CO3:** Employ the built-in functions, dictionaries and tuples in programs **CO4:** Understand the application areas of programming in Physics **CO5:** Apply the Python programming in Physics

List of Programs

- Simple programs to get input and display output
- Programs to know arithmetic operations
- Programs to know the control statements
- Programs to know the looping statements
- Programs to know the branching statements
- Programs using function
- Programs using String functions
- Programs using List
- Programs using Dictionaries
- Programs to understand the Tuples
- Programs to understand the set
- Implement Python to compute measures used in Physics

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	3	3	3	3	2
CO2.	3	3	3	3	2
CO3.	3	3	3	3	2
CO4.	3	3	3	3	2
CO5.	3	3	3	3	2

PYTHON PROGRAMMING AND ITS APPLICATIONS IN CHEMISTRY

Course Code	Department	Semester	Credits	Hours		Theory		Practical		Total
				T	P	CFA	ESE	CFA	ESE	
21CSA04T2	B.Sc. (Chemistry)	IV	2+1	3	2	20	30	30	20	100

Cognitive Level	**K-1** Recall the basic definitions and terminologies of computer. **K-2** Summarize the knowledge in programming **K-3** Prepare programs related to their field using Python language
Course Objectives	**The Course aims to** • Introduce the concepts of computer basics and terminologies. • Enlarge the programming concepts • Provide an in-depth training with Python programming

UNIT	CONTENT
	Introduction to Computer and Python Programming
I	• Introduction to Computer, Types of computer • Programming languages • History of Python Programming Language • Applications of Python • Parts of Python Programming Language : Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Comments, Type conversions
	Statements in Python
II	• Decision control statements: if, if..elif.. else. • Looping Statements: for, while • Continue and break statements • Exception handling statements
	Functions and Strings
III	• Built-in functions • Commonly used modules • Function definition and calling - return statement and void function - command line arguments • Strings: Basic String Operations, Accessing Characters in String, String slicing and joining, String Methods, Formatting Strings
	Lists, Dictionaries and Tuples
IV	• Lists: Creating Lists, Basic List Operations, Indexing and Slicing Lists, Built-In Functions used on Lists, List Methods. • Dictionaries: Creating Dictionary, Dictionary methods. • Tuples and sets: Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Tuple Methods. Sets, Set Methods

	Python Programs for Chemists
V	• Normality, molarity and molality values calculation • Compute n_i value of Boltzmann statistics • value of magnetic moment of a substance • value of Lattice Energy • slope and intercept of a straight line • Computation of K_a for weak acid • Computation of value of Bohr magneton • Computation of Lattice energy on the basis of Born Lande's Equation • Computation of iso-electric point in amino acids
Text and Reference Books	Introduction to Python Programming, Gowrishankar S, Veena A, CRC Press, Taylor & Francis Group, 2019. Learn Python in 7 Days, MohitBhaskar N. Das, Packt Publishing, 2017 Learn Programming in Python with Cody Jackson, Cody Jackson, Packt Publishing, 2018 Computers for Chemists by K. V. Raman, Tata McGraw Hill Publication. Computer Applications in Chemistry by KishorArora, Anmol Publications New Delhi's Publication. Tim J. Stevens, Wayne Boucher, Python Programming for Biology, Cambridge University Press, 2020
Course Outcomes	**On completion of the course, students should be able to** **CO1:** Recall the fundamental concept of computer and programming languages **CO2:** Be familiar with the programming concepts **CO3:** Employ the built-in functions, dictionaries and tuples in programs **CO4:** Understand the application areas of programming in Chemistry **CO5:** Apply the Python programming in Chemistry

List of Programs

- Simple programs to get input and display output
- Programs to know arithmetic operations
- Programs to know the control statements
- Programs to know the looping statements
- Programs to know the branching statements
- Programs using function
- Programs using String functions
- Programs using List
- Programs using Dictionaries
- Programs to understand the Tuples
- Programs to understand the set
- Implement Python to compute measures used in Chemistry

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	3	3	3	3	2
CO2.	3	3	3	3	2
CO3.	3	3	3	3	2
CO4.	3	3	3	3	2
CO5.	3	3	3	3	2

PYTHON PROGRAMMING AND ITS APPLICATIONS IN MICRO-BIOLOGY

Course Code	Department	Semester	Credits	Hours		Theory		Practical		Total
				T	P	CFA	ESE	CFA	ESE	
21CSA04T3	B.Sc. (Micro-Biology)	IV	2+1	3	2	20	30	30	20	100

Cognitive Level	**K-1** Recall the basic definitions and terminologies of computer. **K-2** Summarize the knowledge in programming **K-3** Prepare programs related to their field using Python language
Course Objectives	**The Course aims to** • Introduce the concepts of computer basics and terminologies. • Enlarge the programming concepts • Provide an in-depth training with Python programming

UNIT	CONTENT
	Introduction to Computer and Python Programming
I	• Introduction to Computer, Types of computer • Programming languages • History of Python Programming Language • Applications of Python • Parts of Python Programming Language : Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Comments, Type conversions
	Statements in Python
II	• Decision control statements: if, if..elif.. else. • Looping Statements: for, while • Continue and break statements • Exception handling statements
	Functions and Strings
III	• Built-in functions • Commonly used modules • Function definition and calling - return statement and void function - command line arguments • Strings: Basic String Operations, Accessing Characters in String, String slicing and joining, String Methods, Formatting Strings
	Lists, Dictionaries and Tuples
IV	• Lists: Creating Lists, Basic List Operations, Indexing and Slicing Lists, Built-In Functions used on Lists, List Methods. • Dictionaries: Creating Dictionary, Dictionary methods. • Tuples and sets: Creating Tuples, Basic Tuple Operations, Indexing and

	Slicing in Tuples, Tuple Methods. Sets, Set Methods	
V	**Applications in Biology**	
	- Convert masses between units of pounds and kilograms - Airway resistance calculation - Hill equation - Earth similarity calculation - Reaction rate calculation using the model of Michaelis – Menten enzyme kinetics - Reverse a DNA sequence	
Text and Reference Books	Introduction to Python Programming, Gowrishankar S, Veena A, CRC Press, Taylor & Francis Group, 2019. Learn Python in 7 Days, MohitBhaskar N. Das, Packt Publishing, 2017 Learn Programming in Python with Cody Jackson, Cody Jackson, Packt Publishing, 2018 Ref.: https://www.fxsolver.com/blog/2016/05/04/top-8-biology-formulas/	
Course Outcomes	**On completion of the course, students should be able to** **CO1:** Recall the fundamental concept of computer and programming languages **CO2:** Be familiar with the programming concepts **CO3:** Employ the built-in functions, dictionaries and tuples in programs **CO4:** Understand the application areas of programming in Micro-Biology **CO5:** Apply the Python programming in Micro-Biology	

List of Programs

- Simple programs to get input and display output
- Programs to know arithmetic operations
- Programs to know the control statements
- Programs to know the looping statements
- Programs to know the branching statements
- Programs using function
- Programs using String functions
- Programs using List
- Programs using Dictionaries
- Programs to understand the Tuples
- Programs to understand the set
- Implement Python to compute measures used in Micro Biology

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	3	3	3	3	2
CO2.	3	3	3	3	2
CO3.	3	3	3	3	2
CO4.	3	3	3	3	2
CO5.	3	3	3	3	2

PYTHON PROGRAMMING AND ITS APPLICATIONS IN GEOLOGY

Course Code	Department	Semester	Credits	Hours		Theory		Practical		Total
				T	P	CFA	ESE	CFA	ESE	
21CSAU04 T4	B.Sc. (Geology)	IV	2+1	3	2	20	30	30	20	100

Cognitive Level	**K-1** Recall the basic definitions and terminologies of computer. **K-2** Summarize the knowledge in programming **K-3** Prepare programs related to their field using Python language
Course Objectives	**The Course aims to** • Introduce the concepts of computer basics and terminologies. • Enlarge the programming concepts • Provide an in-depth training with Python programming

UNIT	CONTENT
	Introduction to Computer and Python Programming
I	• Introduction to Computer, Types of computer • Programming languages • History of Python Programming Language • Applications of Python • Parts of Python Programming Language : Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Comments, Type conversions
	Statements in Python
II	• Decision control statements: if, if..elif.. else. • Looping Statements: for, while • Continue and break statements • Exception handling statements
	Functions and Strings
III	• Built-in functions • Commonly used modules • Function definition and calling - return statement and void function - command line arguments • Strings: Basic String Operations, Accessing Characters in String, String slicing and joining, String Methods, Formatting Strings
	Lists, Dictionaries and Tuples
IV	• Lists: Creating Lists, Basic List Operations, Indexing and Slicing Lists, Built-In Functions used on Lists, List Methods. • Dictionaries: Creating Dictionary, Dictionary methods.

	• Tuples and sets: Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Tuple Methods. Sets, Set Methods
V	**Applications inGeology**
	• Earth quack prediction • Computing permeability using Darcy's law • Attractive force calculation using Newton's law of universal gravitation • Escape velocity calculation • Latent Heat calculation to detect the evaporation rate • Free-fall time calculation • Natural draught flow rate calculation
Text and Referenc e Books	Introduction to Python Programming, Gowrishankar S, Veena A, CRC Press, Taylor & Francis Group, 2019. Learn Python in 7 Days, MohitBhaskar N. Das, Packt Publishing, 2017 Learn Programming in Python with Cody Jackson, Cody Jackson, Packt Publishing, 2018 Ref.: www.fxsolver.com/blog
Course Outcom es	**On completion of the course, students should be able to** **CO1:** Recall the fundamental concept of computer and programming languages **CO2:** Be familiar with the programming concepts **CO3:** Employ the built-in functions, dictionaries and tuples in programs **CO4:** Understand the application areas of programming in Geology **CO5:** Apply the Python programming in Geology

List of Programs

- Simple programs to get input and display output
- Programs to know arithmetic operations
- Programs to know the control statements
- Programs to know the looping statements
- Programs to know the branching statements
- Programs using function
- Programs using String functions
- Programs using List
- Programs using Dictionaries
- Programs to understand the Tuples
- Programs to understand the set
- Implement Python to compute measures used in Geology

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	3	3	3	3	2
CO2.	3	3	3	3	2
CO3.	3	3	3	3	2
CO4.	3	3	3	3	2
CO5.	3	3	3	3	2

WEB DESIGNING

Course Code	Department	Semester	Credits	Hours		Theory		Practical		Total
				T	P	CFA	ESE	CFA	ESE	
21CSAU03T5	B.Sc. (Home Science)	III	2+1	3	2	20	30	30	20	100
21CSAU03T5	B.Sc. (Textile & Fashion Designing)	III	2+1	3	2	20	30	30	20	100
21CSAD02T1	Diploma in Textile Technology	II	2+1	3	2	20	30	30	20	100

Cognitive Level	**K-1** Recall the basic definitions and terminologies of computer. **K-2** Summarize the knowledge in web programming **K-3** Prepare web pages related to their field using HTML
Course Objectives	**The Course aims to** • Introduce the concepts of internet and terminologies. • Enlarge the web designing concepts • Provide an in-depth training with HTML and JavaScript

UNIT	CONTENT
	Introduction to Computer and HTML
I	• Introduction to Internet and Website, Web development tools • HTML : Introduction - Head and Body Sections • Designing Title - Designing Headings • Designing Body Section – Alignment and Formatting Tags • Paragraph Tags
	Ordered List, Tables and Forms
II	• Ordered and Unordered List • Tables - Using Colors • Embedding Images and Videos • Hyperlink • Forms and Frames: Form Elements • Buttons - Frame Layouts • Floating Frames.
	Cascade Style Sheet
III	• Introducing Cascading style sheet • Formatting colors and background • Formatting Heading, Paragraph text

	• Formatting Table • Formatting images • More CSS Techniques
	JavaScript
IV	• Introduction to Java Script • Anatomy of a Script • Variables, Operators and Events • Polyfills • JavaScript Libraries • Database connection with JavaScript
	XML
V	• XML: Introduction - Syntax • XML Document Structure • Document Type Definitions • Some Simple DTD Examples.
Referenc e Books	Learning Web Design, Jennifer Niederst Robbins, O'Reilly Publication, 2018 JavaScript and JQuery, Jon Duckett, Wiley, 2014 Web coding Bible, Chong Lip Phang, Chong Lip Phang, 2020
Course Outcom es	**On completion of the course, students should be able to** **CO1:**Recall the fundamental concept of computer, Internet and Websites **CO2:** Be familiar with the web programming concepts **CO3:**Able to write web programs **CO4:** Understand the data manipulation using Scripting language **CO5:**Build a simple web site

Lab Exercises

- Create a simple web site using HTML
- HTML code to apply the formatting tags in a Web page
- HTML code to apply the List tags in a Web page
- HTML code to apply the Table and Table formatting tags
- HTML code to apply the Form and Form elements
- HTML code to apply the Frames
- CSS code to design background
- CSS code to design text and paragraphs
- CSS code to design table
- Simple JavaScript code to understand the variables and operators utilization
- JavaScript code to use control statements
- JavaScript code to validate the content of the website using functions
- JavaScript code to connect a database with the website
- JavaScript code to get and store the registration form
- XML code define the structure of the document

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	3	3	3	3	2
CO2.	3	3	3	3	2
CO3.	3	3	3	3	2
CO4.	3	3	3	3	2
CO5.	3	3	3	3	2

MIS AND COMPUTER APPLICATIONS IN BUSINESS

Course Code	Department	Semester	Credits	Hours		Theory		Practical		Total
				T	P	CFA	ESE	CFA	ESE	
21CSAU04T7	B.Com	IV	2+1	3	2	24	36	24	16	100

Cognitive Level	**K-1** Recall the basic working principles of computer **K-2** Discuss business applications which integrates with MS-office. **K-3** Prepare applications using MS-Word, MS-Excel and MS-PowerPoint **K-4** Illustrate the database concepts using MS-Access.
Course Objectives	**The Course aims** • To understand the basic concepts of computer operations in Business • To provide an in-depth training with Office Automation packages • To provide Database knowledge using Access. • To learn the basics of Internet basics and Internet terminologies

UNIT	Content	No. of Hours
I	**MANAGEMENT INFORMATION SYSTEM** • Management Information System(MIS) : Concept and Definition of MIS • Structure of MIS • MIS support for Planning, Organizing and Controlling • Information for Decision Making • MIS and Decision Support Systems • Concept of System - Characteristics of System • Systems classification • Information System Definition (IS) • Types of Information System • Managerial View of IS • Uses of Information System	9
II	**E-COMMERCE** Introduction to E-Commerce Features, Importance, Objectives of E-commerce E-Commerce industry framework Types of E-Commerce Reasons for growth of E-commerce Applications of E-Commerce	7
III	**MS-WORD**	8

	- MS-Word: Introduction - Features - Document Creation - Document Editing: Cursor Movements - Selecting Text - Copying Text - Moving Text - Finding and Replacing Text - Spelling and Grammar - Page Setup - Table Creation. - Mail Merge - Test on MS-Word Shortcut Keys		
	Exercises: Preparation of Bio Data , Agenda, Minutes, Circular Letters, Letters to Various Sectors, Mail Merge, Designing a News Paper		
IV	**MS-Excel**		
	- MS-Excel : Introduction - Advantages & Applications - Organization of Workbook - Editing a Worksheet - Range - Formatting Worksheet - Chart: Creation - Changing Type - Print Options - Built-in Functions. - Test on Excel Functions	8	
	Exercises: Preparation of Payrolls, Invoice, Stock Maintenance, Charts for Business Analysis, Use of Financial Functions.		
V	**MS-Access**		
	- Purpose of Database System , Definition of Database Management System (DBMS) - Advantages and Disadvantages of DBMS - Instances and Schema, Data Independence 3 Level architecture - Database Administrator and Database Users. - MS-Access : Introduction – Advantages & Applications - Store Data in a Table - Retrieve Data From a Table - Sorting, Searching in a Table - Viewing Data Using Forms - Using SQL Commands - Preparation of Business Reports	30	
	Exercise: Preparation of Business Databases & Reports		
	Total Contact Hours	**42**	
Reference	**Reference Books:** 1. Management Information System: CVS. Murthy, HPH. 2. Management Information System: O Brian, TMH. 3. Management Information System: Gordon B.Davis & Margrethe H.Olson, TMH. 4. Information System for Modern Management: Murdick, PHI. 5. Management Information System: Jawadekar, TMH. 2. 2007 Microsoft Office System Step by Step, Joyce Cox, Joan Preppernau, Steve Lambert and Curtis Frye, 2007.		

Course Outcomes	On completion of the course, students should be able to
	CO1: Create documents with different formatting in MS-Word.
	CO2: Work with built in functions and Draw Charts using MS-Excel.
	CO3: Store and Retrieve data in database using MS-Access.
	CO4: To prepare Presentations using MS-Power Point.
	CO5: Effective use of other internet techniques.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	3	3	3	3	2
CO2.	3	3	3	3	2
CO3.	3	3	3	3	2
CO4.	3	3	3	3	2
CO5.	3	3	3	3	2

Digital Marketing										
Course Code	**Department**	**Semester**	**Credits**	**Hours**		**Theory**		**Practical**		**Total**
				T	**P**	**CFA**	**ESE**	**CFA**	**ESE**	
21CSAU04 T8	B.B.A.	IV	2+1	3	2	20	30	30	20	100
Cognitive Level	**K-1** Recall the basic definitions and terminologies of computer. **K-2** Summarize the knowledge in digital marketing **K-3** Ready to deal with online business									
Course Objectives	**The Course aims to** • Introduce the concepts of digital marketing • Provide the knowledge in Digital marketing sites • Give experience to the students to sale their products in Digital medias									
UNIT	**CONTENT**									
	Introduction to Digital Marketing									
I	• Evolution of Digital Marketing from traditional to modern era • Role of Internet; Current trends, Info-graphics, • Inference for business & society • Emergence of digital marketing • Drivers of the new marketing environment • Digital marketing strategy • P.O.E.M. framework, Digital landscape, Digital marketing plan, Digital marketing models.									
	Internet Marketing and Digital Marketing									
II	• Internet Marketing, opportunities and challenges • Digital marketing framework • Digital Marketing mix, Impact of digital channels on IMC • Search Engine Advertising: - Pay for Search Advertisements, Ad Placement, Ad Ranks, Creating Ad Campaigns, Campaign Report Generation Display marketing • Buying Models • Programmable Digital Marketing • Analytical Tools • YouTube marketing									
III	**Social Media Marketing – Role of Influencer Marketing, Tools & Plan**									

	• Facebook Marketing • Linkedin Marketing • Twitter Marketing • Instagram and Snapchat Marketing • Mobile Marketing • Social media metrics
	Marketing and Trends in Digital Advertising
IV	• Need for SEO • Use of Search engines and its working patterns • On-page and off-page optimization • SEO tactics • Introduction to SEM • Web Analytics – Google analytics • Data collection for web analytics • Universal analytics • Tracking code
	Trends in Digital Advertising and Case Study
V	• Trends in digital advertising • Impact of digital advertising • Case study: Students generate advertisement and sale it in Mobile marketing, twitter Marketting, Facebook Marketing, LinkedIn Marketing, Instagram or Snapchat Marketing. • Ask them to report
Reference Books	Seema Gupta Digital Marketing Mc-Graw Hill 1 st Edition - 2017 Ian Dodson The Art of Digital Marketing Wiley Latest Edition Puneet Singh Bhatia Fundamentals of Digital Marketing Pearson 1 st Edition - 2017 VandanaAhuja Digital Marketing Oxford University Press Latest Edition Philip Kotler Marketing 4.0: – Moving from Traditional to Digital Wiley 2017
Course Outcomes	**On completion of the course, students should be able to** CO1: Students gain an overall understanding of Digital Marketing and insight on Current Trends – Digital and Social Statistics (Infographics) CO2 : Provide an introduction to Digital Marketing Platforms like Facebook, Twitter, YouTube CO3: Pinterest, etc. Introduction to the basics of Search Engine Optimization (SEO) and Mobile Marketing CO4: Introduction to various strategies involved in Marketing products and Services Digitally.

Lab Exercises

- Creating Facebook page Uploading contacts for invitation
- Exercise on fan page wall posting Increasing fans on fan page
- How to do marketing on fan page (with examples)
- Fan engagement important apps fan page marketing
- Facebook advertising
- Types of Facebook advertising
- Best practices for Facebook advertising
- Understanding edgerank and art of engagement
- Creating Facebook advertising campaign targeting in ad campaign
- Payment module- CPC vs CPM vs CPA
- LinkedIn Marketing
- Understanding LinkedIn Company profile vs Individual profiles
- Understanding LinkedIn groups
- LinkedIn publishing
- Twitter Marketing
- Twitter advertising
- Uploading videos on video marketing websites
- YouTube for business
- YouTube video marketing Strategies
- Bringing visitors from YouTube videos to your website

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	3	3	3	3	2
CO2.	3	3	3	3	2
CO3.	3	3	3	3	2
CO4.	3	3	3	3	2

Digital Marketing										
Course Code	Department	Semester	Credits	Hours		Theory		Practical		Total
				T	P	CFA	ESE	CFA	ESE	
21CSAV02 T1	B.Voc. (FP)	II	0+3	0	3	0	0	60	40	100
21CSAV02 T1	B.Voc. (FTQE)	II	0+3	0	3	0	0	60	40	100
21CSAV02 T1	B.Voc. (Renewable Energy)	II	0+3	0	3	0	0	60	40	100
21CSAV02 T1	B.Voc. (Organic Agriculture & ED)	II	0+3	0	3	0	0	60	40	100
21CSAV02 T1	B.Voc. (FAD)	II	0+3	0	3	0	0	60	40	100
Cognitive Level	**K-1** Recall the basic definitions and terminologies of computer. **K-2** Summarize the knowledge in digital marketing **K-3** Ready to deal with online business									
Course Objectives	**The Course aims to** • Introduce the concepts of digital marketing • Provide the knowledge in Digital marketing sites • Give experience to the students to sale their products in Digital medias									

Lab Exercises

- Creating Facebook page Uploading contacts for invitation
- Exercise on fan page wall posting Increasing fans on fan page
- How to do marketing on fan page (with examples)
- Fan engagement important apps fan page marketing
- Facebook advertising
- Types of Facebook advertising
- Best practices for Facebook advertising
- Understanding edgerank and art of engagement
- Creating Facebook advertising campaign targeting in ad campaign
- Payment module- CPC vs CPM vs CPA
- LinkedIn Marketing
- Understanding LinkedIn Company profile vs Individual profiles
- Understanding LinkedIn groups
- LinkedIn publishing

	• Twitter Marketing • Twitter advertising • Uploading videos on video marketing websites • YouTube for business • YouTube video marketing Strategies • Bringing visitors from YouTube videos to your website • Google Analytic account • Setting up Google Ad words account • Working with online advertisement platforms • Setting up email marketing account • Creating a broadcast email • Setting up auto responders • Sending bulk emails • Make money with adsense
Reference Books	Seema Gupta Digital Marketing Mc-Graw Hill 1 st Edition - 2017 Ian Dodson The Art of Digital Marketing Wiley Latest Edition Puneet Singh Bhatia Fundamentals of Digital Marketing Pearson 1 st Edition - 2017 VandanaAhuja Digital Marketing Oxford University Press Latest Edition Philip Kotler Marketing 4.0: – Moving from Traditional to Digital Wiley 2017
Course Outcomes	**On completion of the course, students should be able to** CO1: Students gain an overall understanding of Digital Marketing and insight on Current Trends – Digital and Social Statistics (Infographics) CO2 : Provide an introduction to Digital Marketing Platforms like Facebook, Twitter, YouTube CO3: Pinterest, etc. Introduction to the basics of Search Engine Optimization (SEO) and Mobile Marketing CO4: Introduction to various strategies involved in Marketing products and Services Digitally.

Web Designing										
Course Code	Depart ment	Semes ter	Credi ts	Hours		Theory		Practical		Total
				T	P	CFA	ESE	CFA	ESE	
21CSAV04 T1	B.Voc. (FP)	IV	0+3	0	3	0	0	60	40	100
21CSAV04 T1	B.Voc. (FTQE)	IV	0+3	0	3	0	0	60	40	100
21CSAV04 T1	B.Voc. (Renewa ble Energy)	IV	0+3	0	3	0	0	60	40	100
21CSAV04 T1	B.Voc. (Organic Agricult ure & ED)	IV	0+3	0	3	0	0	60	40	100
21CSAV04 T1	B.Voc. (FAD)	IV	0+3	0	3	0	0	60	40	100
21CSAV03 T1	B.Voc. (DPT)	III	0+3	0	3	0	0	60	40	100
Cognitive Level	**K-1** Recall the basic definitions and terminologies of computer. **K-2** Summarize the knowledge in web programming **K-3** Prepare web pages related to their field using HTML									
Course Objectives	**The Course aims to** • Introduce the concepts of internet and terminologies. • Enlarge the web designing concepts • Provide an in-depth training with HTML and JavaScript									
	Lab Exercises									
	• Create a simple web site using HTML • HTML code to apply the formatting tags in a Web page • HTML code to apply the List tags in a Web page • HTML code to apply the Table and Table formatting tags • HTML code to apply the Form and Form elements • HTML code to apply the Frames • CSS code to design background • CSS code to design text and paragraphs • CSS code to design table • Simple JavaScript code to understand the variables and operators utilization • JavaScript code to use control statements • JavaScript code to validate the content of the website using functions • JavaScript code to connect a database with the website									

	• JavaScript code to get and store the registration form • XML code define the structure of the document
Reference Books	Learning Web Design, Jennifer Niederst Robbins, O'Reilly Publication, 2018 JavaScript and JQuery, Jon Duckett, Wiley, 2014 Web coding Bible, Chong Lip Phang, Chong Lip Phang, 2020
Course Outcomes	**On completion of the course, students should be able to** **CO1:**Recall the fundamental concept of computer, Internet and Websites **CO2:** Be familiar with the web programming concepts **CO3:**Able to write web programs **CO4:** Understand the data manipulation using Scripting language **CO5:**Build a simple web site

Post Graduation

WEB DESIGNING										
Course Code	Department	Semester	Credits	Hours		Theory		Practical		Total
				T	P	CFA	ESE	CFA	ESE	
21CSAI04T1	M.A. (Development and Administration	IV	2+1	3	2	20	30	30	20	100
21CSAI04T1	M.A. (Sociology)	IV	2+1	3	2	20	30	30	20	100
Cognitive Level	**K-1** Recall the basic definitions and terminologies of computer. **K-2** Summarize the knowledge in web programming **K-3** Prepare web pages related to their field using HTML									
Course Objectives	**The Course aims to** • Introduce the concepts of internet and terminologies. • Enlarge the web designing concepts • Provide an in-depth training with HTML and JavaScript									

UNIT	CONTENT
	Introduction to Computer and HTML
I	• Introduction to Internet and Website, Web development tools • HTML : Introduction - Head and Body Sections • Designing Title - Designing Headings • Designing Body Section – Alignment Tags
	Ordered List, Tables and Forms
II	• Ordered and Unordered List • Tables - Using Colors • Paragraph Tags – Hyperlink • Embedding Images and Videos • Forms and Frames: Form Elements • Buttons - Frame Layouts • Floating Frames.
	Cascade Style Sheet
III	• Introducing Cascading style sheet • Formatting text • Formatting colors and background • More CSS Techniques
	JavaScript
IV	• Introduction to Java Script • Anatomy of a Script • Variables, Operators and Events

	- Polyfills - JavaScript Libraries - Database connection with JavaScript	
V	**XML**	
	- XML: Introduction - Syntax - XML Document Structure - Document Type Definitions - Some Simple DTD Examples.	
Reference Books	Learning Web Design, Jennifer Niederst Robbins, O'Reilly Publication, 2018 JavaScript and JQuery, Jon Duckett, Wiley, 2014 Web coding Bible, Chong Lip Phang, Chong Lip Phang, 2020	
Course Outcomes	**On completion of the course, students should be able to** **CO1:** Recall the fundamental concept of computer, Internet and Websites **CO2:** Be familiar with the web programming concepts **CO3:** Able to write web programs **CO4:** Understand the data manipulation using Scripting language **CO5:** Build a simple web site	

Lab Exercises

- Create a simple web site using HTML
- HTML code to apply the formatting tags in a Web page
- HTML code to apply the List tags in a Web page
- HTML code to apply the Table and Table formatting tags
- HTML code to apply the Form and Form elements
- HTML code to apply the Frames
- CSS code to design background
- CSS code to design text and paragraphs
- CSS code to design table
- Simple JavaScript code to understand the variables and operators utilization
- JavaScript code to use control statements
- JavaScript code to validate the content of the website using functions
- JavaScript code to connect a database with the website
- JavaScript code to get and store the registration form
- XML code define the structure of the document

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	3	3	3	3	2
CO2.	3	3	3	3	2
CO3.	3	3	3	3	2
CO4.	3	3	3	3	2
CO5.	3	3	3	3	2

Digital Marketing									
Course Code	**Depart ment**	**Semes ter**	**Credi ts**	**Hours**		**Theory**		**Practical**		**Total**
				T	**P**	**CF A**	**ESE**	**CFA**	**ESE**	
21CSAI06 T2	M.A. (D.A.)	VI	2+1	3	2	20	30	30	20	100
21CSAI06 T2	M.A. (Sociolo gy)	VI	2+1	3	2	20	30	30	20	100
Cognitive Level	**K-1** Recall the basic definitions and terminologies of computer. **K-2** Summarize the knowledge in digital marketing **K-3** Ready to deal with online business									
Course Objectives	**The Course aims to** • Introduce the concepts of digital marketing • Provide the knowledge in Digital marketing sites • Give experience to the students to sale their products in Digital medias									

UNIT	CONTENT
	Introduction to Digital Marketing
I	• Evolution of Digital Marketing from traditional to modern era • Role of Internet; Current trends, Info-graphics, • Inference for business & society • Emergence of digital marketing • Drivers of the new marketing environment • Digital marketing strategy • P.O.E.M. framework, Digital landscape, Digital marketing plan, Digital marketing models.
	Internet Marketing and Digital Marketing
II	• Internet Marketing, opportunities and challenges • Digital marketing framework • Digital Marketing mix, Impact of digital channels on IMC • Search Engine Advertising: - Pay for Search Advertisements, Ad Placement, Ad Ranks, Creating Ad Campaigns, Campaign Report Generation Display marketing • Buying Models • Programmable Digital Marketing • Analytical Tools • YouTube marketing
	Social Media Marketing – Role of Influencer Marketing, Tools & Plan
III	• Facebook Marketing • Linkedin Marketing • Twitter Marketing • Instagram and Snapchat Marketing

	• Mobile Marketing • Social media metrics
IV	**Marketing and Trends in Digital Advertising**
	• Need for SEO • Use of Search engines and its working patterns • On-page and off-page optimization • SEO tactics • Introduction to SEM • Web Analytics – Google analytics • Data collection for web analytics • Universal analytics • Tracking code
V	**Trends in Digital Advertising and Case Study**
	• Trends in digital advertising • Impact of digital advertising • Case study: Students generate advertisement and sale it in Mobile marketing, twitter Marketting, Facebook Marketing, LinkedIn Marketing, Instagram or Snapchat Marketing. • Ask them to report
Reference Books	Seema Gupta Digital Marketing Mc-Graw Hill 1 st Edition - 2017 Ian Dodson The Art of Digital Marketing Wiley Latest Edition Puneet Singh Bhatia Fundamentals of Digital Marketing Pearson 1 st Edition - 2017 VandanaAhuja Digital Marketing Oxford University Press Latest Edition Philip Kotler Marketing 4.0: – Moving from Traditional to Digital Wiley 2017
Course Outcomes	**On completion of the course, students should be able to** CO1: Students gain an overall understanding of Digital Marketing and insight on Current Trends – Digital and Social Statistics (Infographics) CO2 : Provide an introduction to Digital Marketing Platforms like Facebook, Twitter, YouTube CO3: Pinterest, etc. Introduction to the basics of Search Engine Optimization (SEO) and Mobile Marketing CO4: Introduction to various strategies involved in Marketing products and Services Digitally.

Lab Exercises

• Creating Facebook page Uploading contacts for invitation
• Exercise on fan page wall posting Increasing fans on fan page

- How to do marketing on fan page (with examples)
- Fan engagement important apps fan page marketing
- Facebook advertising
- Types of Facebook advertising
- Best practices for Facebook advertising
- Understanding edgerank and art of engagement
- Creating Facebook advertising campaign targeting in ad campaign
- Payment module- CPC vs CPM vs CPA
- LinkedIn Marketing
- Understanding LinkedIn Company profile vs Individual profiles
- Understanding LinkedIn groups
- LinkedIn publishing
- Twitter Marketing
- Twitter advertising
- Uploading videos on video marketing websites
- YouTube for business
- YouTube video marketing Strategies
- Bringing visitors from YouTube videos to your website
- Google Analytic account
- Setting up Google Ad words account
- Working with online advertisement platforms
- Setting up email marketing account
- Creating a broadcast email
- Setting up auto responders
- Sending bulk emails
- Make money with adsense

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO6.	3	3	3	3	2
CO7.	3	3	3	3	2
CO8.	3	3	3	3	2
CO9.	3	3	3	3	2
CO10.	3	3	3	3	2

R Programming for Data Analysis

Course Code	Department	Semester	Credits	Hours		Theory		Practical		Total
				T	P	CFA	ESE	CFA	ESE	
21CSAI07 T3	M.A. (DA)	VII	2+1	3	2	20	30	30	20	100
21CSAI07 T3	M.A. (Sociology)	VII	2+1	3	2	20	30	30	20	100

Cognitive Level	**K-1** Recall the basic definitions and terminologies of computer. **K-2** Summarize the knowledge in data analysis **K-3** Prepare data analysis tools using R Programming
Course Objectives	**The Course aims to** • Introduce the concepts of Data analysis • Enlighten the knowledge in Programming using R • Provide an in-depth knowledge in programming for data analysis

UNIT	CONTENT
	Introduction to R Programming
I	• Introduction to Computer and data analysis • Introduction to data analysis methods • Introduction to R-Programming • Working with Directory • Data types in R • Commands for Data Exploration
	Loading and Handling Data in R
II	• Challenges of Analytical Data Processing • Expression Variables and Functions • Missing values Treatment in R • Vectors • Matrices, Factors and List • Common Analytical Tasks • Aggregating and Group Processing of a Variable • Simple analysis using R • Methods for Reading data
	Exploring Data in R
III	• Data frames • R functions for understanding data in data frames • Loading data frames • Exploring data • Finding the missing values • Invalid values and outliers • Descriptive statistics

	• Spotting problems in data with visualisation
	Elementary Statistics
IV	• Probability Distributions • Z-Test • F-Test • T-Test
	Basic Multivariate Analysis
V	• Correlation Analysis • Regression • Analysis of Co-Variance • Forecasting • Time Series Analysis • Advanced Graphs
Reference Books	Data Analytics using R, SeemaAcharya, McGraw Hill Education, 2018 Data Analysis using R Programming, Jeeva Jose, Khanna Book Publishing, 2019 Big Data Analytics with R, Simon Walkowiak, Packt Publishing, 2016
Course Outcomes	**On completion of the course, students should be able to** CO1: Discover how to use RStudio to apply R to your analysis CO2: Explore the fundamental concepts associated with programming in R. CO3: Explore the contents and components of R packages including the Tidyverse package. CO4: Gain an understanding of dataframes and their use in R. CO5: Discover the options for generating visualizations in R.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	3	3	3	3	2
CO2.	3	3	3	3	2
CO3.	3	3	3	3	2
CO4.	3	3	3	3	2
CO5.	3	3	3	3	2

Introduction to R Programming							
Course Code	**Department**	**Semester**	**Credits**	**Hours**	**Theory**		**Total**
					CFA	**ESE**	
21CSAU04G3	UG-NME-All Science	IV	3	3	40	60	100

Cognitive Level

K-1 Define data structures of R Programming K-2
Describe matrix operations.
K-3   Practice graphics commands
K-4   Outline models in R programming

Course Objectives The

Course aims

- To introduce the concept of R programming
- To make the students familiar data modelling using R.
- To gain knowledge on programming practices using R.

Learning Outcomes

On completion of the course, students should be able to
    CO1: Understand the basics of R programming
    CO2: Practice with syntax of R programs
    CO3: Gain familiarity with OOP concepts
    CO4: Employ mathematical perations
    CO5: Know customized graphs

UNIT	**Content**	**No. of Hours**
I	**Introduction:** Introducing to R – R Data Structures – Help functions in R – Vectors – Scalars – Declarations – recycling – Common Vector operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Vectorised if-then else – Vector Equality – Vector Element names	**8**

II	**Matrices, Arrays And Lists:** Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists	9
III	**Data Frames:** Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with factors – Working with tables - Other factors and table related functions - Control statements .	9
IV	Arithmetic and Boolean operators and values – Default values for arguments - Returning Boolean values – functions are objects – Environment and Scope issues – Writing Upstairs - Recursion – Replacement functions – Tools for composing function code – Math and Simulations in R.	8
V	**OOP**: S3 Classes – S4 Classes – Managing your objects – Input/Output – accessing keyboard and monitor – reading and writing files – accessing the internet – String Manipulation – Graphics – Creating Graphs – Customizing Graphs – Saving graphs to files – Creating three-dimensional plots	9
	Total Contact Hours	**43**

Text Books

1. R Programming A Step-By-Step Guide for Absolute Beginners , Daniel Bell, 2019. ISBN:9781696769648, 1696769647
2. R Programming and Its Applications in Financial Mathematics, Shuichi Ohsaki, Jori Ruppert-Felsot, Daisuke Yoshikawa, CRC Press, 2018. ISBN:9781498766304, 1498766302

Reference Books

1. Learn R Programming in 1 Day Complete Guide for Beginners, Krishna Rungta, 2019.
2. Statistical Predictive Modelling through R Programming, Laxmi Lydia E, Shankar K, S.Sheeba Rani, Lakshmanaprabu S.K,Evincepub Publishing,2019.ISBN:9789389125603, 938912560X

E- References
1. https://www.youtube.com/watch?v=rGfuLF0QJ2M
2. https://www.youtube.com/watch?v=NVyOEwOJgNQ
3. https://www.youtube.com/watch?v=NGGxJ754Q1c

R Programming Lab

Implement the following in R

1. Read Structured Data into R from various sources
2. Understand the different data types in R
3. Understand the different data structures in R
4. Apply Date and Time methods in R
5. Mathematical operations
6. Control statements
7. User-defined R functions
8. Loop constructs in R

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	3	3	3	3	2
CO2.	3	3	3	3	2
CO3.	3	3	3	3	2
CO4.	3	3	3	3	2
CO5.	3	3	3	3	2

Generic Elective Courses - UG

		COMPUTER ESSENTIALS FOR DATA SCIENCE					

Course Code	Departm ent	Semeste r	Credi ts	Hour s	Theory		Tot al
					CF A	ES E	
21CSAU04G4	UG-NME-All Science	IV	3	3	40	60	100

Cognitive Level

K-1 Define digital fundamentals.
K-2 Describe file system and database.
K-3 Practice queries.
K-4 Outline data science concept.

Course objectives The Course aims

- To introduce the concept of numbering systems in Computers
- To make the students familiar with Word, Excel and PowerPoint.
- To gain knowledge on database operations using SQL

Learning Outcomes

On completion of the course, students should be able to
     CO1: Know the concepts of numbering systems in computer

    CO2 : Understand the concept of basics in Word,Excel and
Powerpoint CO3: Practice SQL commands
CO4: Apply DBMS concepts for suitable applications
   CO5: Know data representations and data sciences

UNIT	Content	No. of Hours
I	**Introduction:** Digital Fundamentals: Number Systems-Binary, Hexadecimal, Octal, Conversion, Dataencoding, Operations on Binary number system, representation of positive and negative integer,compliment operations, real number system.	**9**

II	MS-Word: Introduction - features - Document creation - Document editing-Table creation. Mail Merge. MS-Excel : Introduction - Advantages & applications - Workbook creation - Editing a worksheet - Chart: creation - changing type - Built- in functions. MS-Power Point :features –Creating presentation - Changing Layout - Slide transition-Adding animation effects - Inserting table, charts, pictures, clipart in presentation.	9
III	Introduction to Database Management Systems-Database, DBMS, Why Database -File system vsDBMS, Database applications, Database users, Introduction to SQL, Data types, Classification of SQL-DDL with constraints.	8
IV	Data representation, Types of Data, structured, unstructured, semi structured, examples of real world data, data collection techniques, data interpretation mechanisms. Data storage mechanisms, Hierarchy of storage, Characteristics of storage, Storage media, storage related technologies, online and offline storage mechanisms.	9
V	Introduction to Data Science - Steps – Skills – Data – Datasets – Existing data sources – datamodels, Applications.	8
	Total Contact Hours	**43**

Reference Books:

1. Multiple-Base Number System Theory and Applications, Vassil Dimitrov, Graham Jullien, Roberto Muscedere, CRC Press, 2017.ISBN:9781439820475, 1439820479.
2. DATABASE MANAGEMENT SYSTEMS, PANNEERSELVAM R,PHI Learning Pvt. Ltd.,2018. ISBN:9789387472305, 9387472308.
3. Fundamentals of Office 2019,The Illustrated Guide to Using Microsoft Office, Kevin Wilson, 2018.ISBN:9781728949178, 1728949173
4. Data Science, John D. Kelleher, Brendan Tierney, MIT Press, 2018.ISBN:9780262347037, 0262347032

E-References :
1. https://www.youtube.com/watch?v=LljXPO3wtWA
2. https://www.youtube.com/watch?v=kAnBaQoJkpo
3. https://www.youtube.com/watch?v=shaXOcxm8Wk
4. https://www.youtube.com/watch?v=gynwZx0Rdjk
5. https://intellipaat.com/blog/learn-data-science/
6. https://www.youtube.com/watch?v=jNeUBWrrRsQ
7. https://www.youtube.com/watch?v=kh3a--gzIPg
8. https://www.youtube.com/watch?v=HXV3zeQKqGY
   https://www.youtube.com/watch?v=k5WZ9MJTA_Y

COMPUTER ESSENTIALS FOR DATA SCIENCE LAB

- Usage of Word, Excel and PowerPoint
- SQL-Create: Table and column level constraints- Primary key, Foreign key, Null/ Not null.Unique, Default.
- Check, Alter, Drop, Insert, Update, Delete, Truncate
- Select: using WHERE,AND, OR, IN, NOT IN

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	3	3	3	3	2
CO2.	3	3	3	3	2
CO3.	3	3	3	3	2
CO4.	3	3	3	3	2
CO5.	3	3	3	3	2

					Theory			
Course Code	**Department**	**Semester**	**Credits**	**Hours**	**CFA**	**ESE**	**Total**	
21CSAU05G5	UG-NME-All Social Science	V	3	3	40	60	100	

Industry 4.0

Cognitive Level

K-1 Define background and overview of Industry 4.0
K-2 Describe basic principles and architecture of Industry 4.0.
K-3 Practice to understand Augmented Reality and Machine Learning. K-4 Outline the security risk using Industry 4.0 and AI

Course Objectives
The Course aims
- To introduce the concept Industry 4.0 and its Applications
- To make the students familiar with Augmented Reality.
- To gain knowledge on Artificial Intelligence, and Machine Learning.

Learning Outcome

On completion of the course, students should be able to
    CO1: Understand thecurrent state of Industry 4.0
    CO2: Gain familiarity with augmented reality.
    CO3: Identify robot process
    CO4: Employ Machine learning practices
    CO5: Know the security risk using Industry 4.0 and AI

UNIT	Content	No. of Hours
	Industry 4.0 Concepts	
I	Background and Overview - Origin of Industry 4.0 concept - Industry 4.0 production system (Smart Factory) - Basic principles and technologies of Smart Factory - Reference Architecture model RAM14.0 - Current state of Industry 4.0 - Key challenges for the Indian manufacturing industry	9
	Main use case for Augumented Reality (AR) in Manufacturing	
II	AR – devices an overview - Integrating design & manufacturing - Training shop floor workers - Supporting complex assembly operations - Service and maintenance - Supporting complex sales solution - Executing oversight and data visualisation - Applications with AR	30

III	**Human – Robot collaboration**	**30**
	Human – Robot collaboration in industry - Collaborative Robots, tasks - Collaborative robots, examples - Types of Human – Robot collaboration - Application with collaborative robot.	
IV	**Open Platform Communications United Architecture (OPC UA)**	**9**
	Introduction into OPC UA - Information modelling - System architecture OPC UA and cloud - Applications with OPC UA	
V	**Artificial Intelligence (AI) & Machine learning (ML)**	**5**
	Basics of ML- Machine learning process - Preparing data - Machine learning practices - Security and security risk using Industry 4.0 and AI	
	Total Contact Hours	**43**

Reference Books:
1. Understanding Industry 4.0: AI, the Internet of Things, and the Future of Work,Bruno S. Sergi, Elena G. Popkova, Aleksei V. Bogoviz, Tatiana N. Litvinova, Emerald Group Publishing,2019.
2. Industry 4.0 for SMEs Challenges, Opportunities and Requirements , Dominik T. Matt, Vladimír Modrák, Helmut Zsifkovits,Springer International Publishing, 2020. ISBN:9782020254254, 2020254259
3. Industry 4.0: Industrial Revolution of the 21st Century, Elena G. Popkova, Yulia V. Ragulina,Springer, 2019.

E- References
1. https://www.youtube.com/watch?v=wgWRLu8p90M
2. https://www.youtube.com/watch?v=b9mJrzdlfR8
3. https://www.youtube.com/watch?v=2njYS9D6IPs
4. https://www.youtube.com/watch?v=UrwbeOIlc68&t=2s
5. https://www.youtube.com/watch?v=RN9iskWeNfE

Big Data Analytics using R							
Course Code	**Department**	**Semester**	**Credits**	**Hours**	**Theory**		**Total**
					CFA	**ESE**	
21CSAU05G 6	UG-NME-All Science	V	3	3	40	60	100

Cognitive Level

K-1 Define background and overview Big data analytics
K-2 Describe data modelling.
K-3 Practice data visualization.
K-4 Outline practices on R programming

Course Objectives

The Course aims
- To introduce the concept of big data analytics
- To make the students familiar data modelling and data visualization.
- To gain knowledge on R programming.

Learning Outcomes:
On completion of the course, students should be able to CO1: Understand the concept of Big data
CO2: Acquire knowledge on data analytics methods
CO3: Practice programs using R

CO4: Employ data visualization

CO5: Apply data analytics for real time applications

UNIT	Content	No. of Hours
I	Introduction to Big Data, Types of Digital Data, Characteristics of Big Data, Evolution of BigData, Definition of Big Data, Data Appliance, Challenges with Big Data, Big data sources, Bestpractices in Big Data Analytics, Introduction to Data Modelling.	**8**
II	Introduction to elementary data analysis: Measures of center: Mean, Median, Mode, Variance,Standard deviation, Range, Normal Distribution : Center, Spread, Skewed Left, Skewed Right,Outlier, Correlation Patterns, Magnitude and Direction in relationship, Introduction to BayesianModel	**9**
III	History of Visualization, Goals of Visualization, Types of Data Visualization: ScientificVisualization, Information Visualization, Visual Analytics, Impact of visualization, Big DataVisualization Tools: Tableau, Google Chart.	**8**

IV	What is R? - RStudio Overview -Working in the Console - Arithmetic Operators - Logical Operations - Using Functions - Data structures, variables, and data types - Creating Variables Numeric, Character and Logical Data - Vectors - Data Frames - Factors - Sorting Numeric, character, and Factor Vectors - Special Values - Descriptive statistics in R - Measures of central tendency - Measures of variability - Skewness and kurtosis	9
V	Summary functions, describe functions, and descriptive statistics by group - Correlations . Statistical graphs - Working with messy data - Messy Data - Renaming Columns (Variable Names) - Attaching / Detaching - Tabulating Data: Constructing Simple Frequency Tables - Ordering Factor Variables Iteration - while loops - for loops - Conditional statements - If / else.	9
	Total Contact Hours	**43**

Text Books
1. Data Analytics and Big Data, Soraya Sedkaoui, Wiley,2018.ISBN:9781786203264,1786203264
2. Big Data Analytics Methods - Analytics Techniques in Data Mining, Deep Learning and Natural Language Processing By Peter Ghavami, De Gruyter, 2019. ISBN:9782047402081, 2047402083

3. R Programming A Step-By-Step Guide for Absolute Beginners , Daniel Bell, 2019. ISBN:9781696769648, 1696769647
4. R Programming and Its Applications in Financial Mathematics, Shuichi Ohsaki, Jori Ruppert-Felsot, Daisuke Yoshikawa, CRC Press, 2018. ISBN:9781498766304, 1498766302

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1. Learn R Programming in 1 Day Complete Guide for Beginners, Krishna Rungta, 2019.
2. Statistical Predictive Modelling through R Programming, Laxmi Lydia E, Shankar K, S.Sheeba Rani, Lakshmanaprabu S.K,Evincepub Publishing,2019.ISBN:9789389125603, 938912560X

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2. http://www.columbia.edu/~sjm2186/EPIC_R/EPIC_R_BigData.pdf
3. https://rstudio.com/resources/webinars/working-with-big-data-in-r/
4. https://tell.colvee.org/course/view.php?id=17
5. https://www.youtube.com/watch?v=VyhLRJVoIrI

					Theory		
Course Code	**Department**	**Semester**	**Credits**	**Hours**	**CFA**	**ESE**	**Total**
21CSAU05G7	UG-NME-All Science& All Social Science	V	3	3	40	60	100

MOBILE APPLICATION DEVELOPMENT

Cognitive Level

K-1 Define the process of Android Mobile application development
K-2 Describe architecture of Android.
K-3 Developmobile applications.

Course Objectives
The Course aims

- To enable the students practice the concepts of Mobile application and develop solutions for real world problems.
- Understand how to work with various mobile application development frameworks
- Comprehend the capabilities and limitations of mobile devices.

Learning Outcomes

On completion of the course, students should be able to
CO1 :ApplyPractical knowledge of mobile application development using Android
CO 2 : Design real life situational problems and think creatively about developing automated solutions
CO 3: Appraise the best features programs for creating dynamic and interactive mobile applications.

UNIT	Content	No. of Hours
I	Android application development - Overview of Android - Devices running android - Why Develop for Android - Features of android - Architecture of Android, Libraries - Software development kit. Designing the user interface - Introducing views , List of views and view groups - Introducing layouts, Creating new views, - Creating and using Menus	**9**
II	Starting with Application Coding - Introducing Intents - Introducing Adapters Using Internet Resources - Introducing Dialogs - Capturing Date and Time - Validating and Handling Input data	**9**
III	Accessing Location Based Services Application - Selecting Location Provider Finding your location - Creating map based activities - Data Storage, retrieval and Sharing - File system in android - Internal and external storage - Saving and loading files - File Management tools	**9**

IV	Introduction to SQLite - Creating SQLite database - Editing Tasks with SQLite Cursors and content values - Working with Android database .	9
V	Peer to peer to communication - Accessing Telephony Hardware Introducing Android Instant Messaging - GTalk Service : Using, binding & Making Connection - Managing chat Sessions - Sending and receiving Data messages Introducing SMS - Using, sending & receiving SMS Messages - Accessing Android Hardware - Audio, Video and Using the camera - Introducing Sensor Manager - Android Telephony - Using Bluetooth - Manage network and Wi-Fi connections - Publishing Android Application to Market	7
	Total Contact Hours	**43**

Generic Elective Courses - PG

MULTIMEDIA TECHNOLOGIES							
Course Code	**Department**	**Semester**	**Credits**	**Theory Hours**	**Theory**		**Total**
					CFA	**ESE**	
21CSAP02G1	PG (NME)	II	3	3	40	60	100

Cognitive Level

K-1   Define the elements and principles of design in multimedia.
K-2   Recognize the operation of equipment and/or procedures associated with multiple facets of multimedia.
K-3   Apply the knowledge of designing and editing with multimedia tool
K-4   Identify the real world applications related to each area of multimedia.

Course Objectives

The Course aims
- To understand the basic concepts of multimmedia elements
- To develop webpage using multimedia elements.
- To practice shoot and edit videos

Learning Outcomes

On completion of the course, students should be able to

CO1: Explore the basic understanding of various Multimedia Concepts.

CO2: Utilization of Multimedia tools

CO3: Familiarize the concepts of text and image editing.

CO4: Practice sound and video editors.

CO5: Develop a webpage using multimedia design techniques.

UNIT	Content	No. of Hours
	Introduction	
I	• Introduction: Definition of Multimedia • Uses of Multimedia – Multimedia Hardware Connections • Memory and Storage Devices • Input Devices - Output Hardware • Communication Devices • Test on Multimedia Terms	**14**

	Multimedia Tools	
II	• Multimedia Tools: • Basic Multimedia Software Tools • Multimedia Authoring Tools. • Video Clips/ Software Demo / Usage of Tools	**13**
	Text And Images	
II I	• Text and Images: Text: Fonts and Faces - • Using Text in Multimedia - Font Editing and Design Tools • Hypermedia and Hypertext. Images: Making Still Images • Coloring Images - Image File Formats • Video Clips/ Software Demo / Usage Of Tools	**13**
	Sound and Animation	
I V	• Sound and Animation: Sound: Digital Audio - MIDI Audio • Multimedia System Sounds - Audio File Formats • Adding Sound to Multimedia Project. Animation: Principles of Animation • Animation Techniques - Animation File Formats • Making Animations That Work. • Video Clips/ Software Demo / usage of tools	**13**
	Video and Internet	
V	• Video and Internet: Video: How Video Works and is Displayed • Digital Video Containers - Shooting and Editing Video. • Internet: Designing for the World Wide Web. • Video Clips/ Software Demo / usage of tools	**11**
	Total Contact Hours	**64**

Reference Books
1. Multimedia and Web Technology,   Reeta Sahoo, Gagan Sahoo,Random Publications, 2018. ISBN: 9789352690206.
2. Multimedia Technology and Applications, Olive Marsh, Larsen and Keller Education, 2017. ISBN:9781635491913, 1635491916

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1. https://www.youtube.com/watch?v=Syeu_l3sAJE
2. https://www.youtube.com/watch?v=Fg06vz1Krcc
3. https://www.youtube.com/watch?v=NPQW-UwR6vQ
4. https://www.youtube.com/watch?v=4ZM6pojgHOg

					Theory		
Course Code	**Department**	**Semester**	**Credits**	**Theory Hours**	**CFA**	**ESE**	**Total**
21CSAP02G2	PG (NME)	II	3	3	40	60	100

WEB DESIGNING (NME)

Cognitive Level

K-1 Recall the basic definitions and terminologies of computer.

K-2 Describe the basic HTML tags.

K-3 Demonstrate the designing of web pages using HTML.

K-4 Outline the experience of working with XML.

Course Objectives

The Course aims
- To provide insight into the basics of web programming.
- To design and implement complete applications over the web.
- To gain knowledge to create and develop websites.

Learning Outcomes

On completion of the course, students should be able to

CO1: Understand the Fundamental generations, types and peripheral devices of Computer.
CO2: Apply the basic tags in HTML.
CO3: Design webpage using HTML.
CO4: Creating webpage with forms and frames.
CO5: Possess Practical experience with XML.

UNIT	Content	No. Of Hours
	Computer	
I	• Computer: Definition – Anatomy of A Computer • Generations of Computers – Types of Computers • Storage Devices – Input and Output Devices • Computer Terminologies	**12**
	HTML	
II	• HTML : Introduction – Head and Body Sections • Designing Title – Designing Headings • Designing Body Section – Alignment Tags	**12**

	Ordered and Unordered List	
III	• Ordered and Unordered List • Tables – Using Colors • Paragraph Tags – Hyperlink • Embedding Images and Videos	12
	Forms and Frames	
IV	• Forms and Frames: Form Elements • Buttons – Frame Layouts • Floating Frames.	14
	XML	
V	• XML: Introduction – Syntax • XML Document Structure • Document Type Definitions • Some Simple DTD Examples.	14
	Total Contact Hours	64

Reference Books:
1. Learning Web Design A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics Jennifer Robbins, O'Reilly Media, 2018. ISBN:9781491960208, 1491960209
2. Practical Web Design Learn the Fundamentals of Web Design with HTML5, CSS3, Bootstrap, Jquery, and Vue.js, Philippe Hong, Packt Publishing, 2018. ISBN:9781788396305, 1788396306.
3. Mega Book of Website Designing, Mahinroop PM,CreateSpace Independent Publishing Platform,2017. ISBN:9781978093539, 1978093535

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2. https://www.youtube.com/watch?v=pQN-pnXPaVg
3. https://www.youtube.com/watch?v=KeLiQXqVgMI
4. https://www.youtube.com/watch?v=Q0k5yS
5. https://www.youtube.com/watch?v=n-y-YHVZSwkZGPBc

COMPUTER GRAPHICS						
Course Code	**Department**	**Semester**	**Credits**	**Theory Hours**	**Theory**		**Total**
					CFA	**ESE**	
21CSAP02G3	PG (NME)	II	3	3	40	60	100

Cognitive Level

K-1 Define the elements and principles of designing with multimedia.

K-2 Recognize the operation of equipment and/or procedures associated with multiple facets of multimedia.

K-3 Apply the knowledge of designing and editing with multimedia tool

K-4 Identify the real world applications related to each area of multimedia.

Course Objectives

The Course aims

- To understand the basic concepts of multimedia elements
- To develop web page using the multimedia elements.
- To practise shoot and edit videos

Learning Outcomes

On completion of the course, students should be able to

  CO1: Explore the basic understanding of various Multimedia Concepts.

  CO2: Utilize Multimedia tools

  CO3: Familiar with text and image editing.

  CO4: Apply sound and video editors.

  CO5: Develop a webpage using multimedia design techniques.

UNIT	Content	No. of Hours
	Overview of Graphics Systems	
I	- Overview of Graphics Systems - Video Display Devices - Raster Scan And Random Scan Systems - Input Devices - GUI and Interactive Input Methods: Logical Classification of Input Devices - Input Functions	**13**
II	**Output Primitives** Output Primitives : Points and Lines – Line Drawing Algorithms – DDA and Bresenham's Loading the Frame Buffer – Line Function – Circle Generating Algorithms Filled Area Primitives – Fill Area Functions –	**13**

	Cell Array - Character Generation.	
	Attributes of Output Primitives	
	• Attributes of Output Primitives : Line Attributes • Curve Attributes- Colour and Gray Scale • Area Fill Attributes – Character Attributes • Bundled Attributes – Inquiry Functions • Anti-aliasing	
IV	**Two Dimensional Geometric Transformations**	13
	• Two Dimensional Geometric Transformations: Basic Transformations – Matrix Representation • Composite Transformations – General Fixed Point – Scaling – Other Transformations • Two Dimensional Viewing : The Viewing Pipeline – Window– to– Viewport Coordinate Transformation — • Clipping Operations – Point Clipping – Line Clipping – Cohen – Sutherland Line Clipping • Sutherland – Hodgeman Polygon Clipping – Curve Clipping – Text Clipping	
V	**Three Dimensional Concepts**	13
	• Three Dimensional Concepts: Three Dimensional Methods – Three Dimensional Geometric and Modeling Transformations • Translation – Rotation – Scaling – Other Transformations. • Visible – Surface Detection Methods – Classification – Depth Buffer Method • Scan Line Method – Depth Sorting Method • BSP Tree Method – Area Subdivision Method.	
	Total Contact Hours	**64**

References Books
1. Computer Graphics with An Introduction to Multimedia, 4th Edition, Chopra Rajiv, S CHAND & Company Limited, 2017. ISBN:9789385676338, 9385676334
2. COMPUTER GRAPHICS, K.Sonisharmila, K.Rameshchandra, Notion Press, 2019. ISBN:9781684669305, 1684669306
3. Introduction to Computer Graphics with OpenGL ES, JungHyun Han, CRC Press, 2018. ISBN:9780429811197, 0429811195

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2. https://www.youtube.com/watch?v=U9NrXOBXA1I&list=PLWPirh4EWFpHukXICQrDcmjZU a2W lLMAb
3. https://www.youtube.com/watch?v=Kp8Za-JkRuc&list=PLBW4he7ty4QAThPNwtvZc1Q4PjlwOIptututU

JAVA PROGARAMMING							
Course Code	**Department**	**Semester**	**Credits**	**Theory Hours**	**Theory**		**Total**
					CFA	**ESE**	
21CSAP02G4	PG (NME)	II	3	3	40	60	100

Cognitive Level

K-1: Recall the object oriented programming concepts
K-2: Practice Java programming
K-3: Designing applications using Java

Course Objectives

The Course aims
- To provide the foundation to the object oriented programming concepts
- To discuss the implementation of OOP's concepts in Java language
- To make learners as a good Java programmers
- To import skills and knowledge to create and run Java programs for solving real time problems

Learning outcomes

On completion of the course, students should be able to
CO1: Outline the concepts of OOP and basics of Java language features, types, control
     statements and array.
CO2: Grasped the idea of inheritance, package and identify classes, objects, member
     of a class and the relationship among them.
CO3: Discuss the implementation of exception handling and Input Output stream classes.
CO4: Describe the methods in String. Identify the use of threads to perform subtask and inter-thread
     communication.
CO5: Develop client side programming with AWT.

UNIT	Content	No. of Hours
	Basics	
I	- Introduction: Object Oriented Programming Concepts - Encapsulation, Inheritance, Polymorphism, Features of Java Language, Types of Java Programs, Java Architecture. - Literals, Data Types and Variables: Literals - Integer, Floating Point, Character, String and Boolean Literals, Data Types - Integer, Floating Point, Character and Boolean. Variables, - The Structure of A Java Program – Comments, Expressions and	13

		Statements, Type Conversion, Block Statements and Scope, Operators –Arithmetic, Bitwise, Relational, Boolean Logical and Ternary. Operator Precedence, Control Statements – If...Else, Switch, While, Do...While, For..., Break, Continue and Comma Statement, Arrays - One-Dimensional and Multi-Dimensional Arrays.	
II	**Classes, Inheritance, Packages**		**12**
		• Classes: Defining A Class, The New Operator and Objects, The Dot Operator, Method Declaration and Calling, Constructors, Instance Variable Hiding, This in A Constructor, Method Overloading, Passing Objects as Parameters to Methods • Inheritance: Creating Subclasses, Method Overriding, Final Class, Final Method, Final Variables, Object Destruction and Garbage Collection, Recursion, Static Method, Static Variables and Static Block, Abstract Classes, Mathematical Methods • Packages and Interfaces: Package, The Import Statement, Access Modifier, Interfaces - Defining Interfaces, Implementing an Interface • Wrapper Classes – The Number Class, The Character Class, The Boolean Class	
III	**Exceptions & Input and Output Classes**		**13**
		• Exceptions: Types of Exceptions, Catching Exceptions - Nested Try Blocks, Hierarchy of Multiple Catch Blocks, Throw Statement, Creating your Own Exceptions, Throws Statement, The Finally Block, Checked and Unchecked Exceptions • Input and Output Classes - I/O Streams, The File Class, ByteStream - InputStream, OutputStream, DiskFileHandling - FileInputStream, FileOutputStream, FilteredByteStream – DataOutputStream, DataInputStream	
IV	**Strings & Threads** • Strings: String Class - Equality Operator(==) and Equals Method, String Concatenation with +, Stringbuffer Class, Threads - Multitasking, Creating a Thread, States of a Thread, Multithreaded Programming, Thread Priorities, Join Method, Controlling the Threads		**12**
	Applets & Graphics		

V	• Applets: Applet Basics, Methods of Building an Applet, Some General Methods of Applet, Displaying Text in Status Bar, Embedding Applet Information, The HTML Applet Tag, Reading Parameters into AppletsGraphics - Drawing Lines, Rectangles, Ovals and Circles, Arcs, Polygons and Polyline.	14
	Total Contact Hours	**64**

Text Book:

1. Introduction to JAVA Programming, K. Somasundaram, Jaico Publishing House, New Delhi, 2013.

References Books :

1. Do 'n' Learn JAVA – A Practical Approach, K.Somasundaram, Anuradha Publications, Chennai, 2013.
2. Basic Java Programming for Kids and Beginners, GreatKnowledgesharing, iUniverse, 2019. ISBN:9782032078767, 2032078765
3. Basic Java programming, Sau prakashani, sau prakashani, 2019.
4. Learn the Fundamentals of Programming with Java, Mark Lassoff, Packt Publishing, 2017. ISBN:9781788299046, 178829904

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2. https://www.youtube.com/watch?v=-HafzawNlUo
3. https://www.youtube.com/watch?v=eIrMbAQSU34

Elements of Industry 4.0							
Course Code	**Department**	**Semester**	**Credits**	**Theory Hours**	**Theory**		**Total**
					CFA	**ESE**	
21CSAP02G5	PG (NME)	II	3	3	40	60	100

Cognitive Level
K-1 Define background and overview of Industry 4.0
K-2 Describe basic principles and architecture of Industry 4.0.
K-3 Practice to understand Artificial Intelligence and machine learning.
K-4 Outline the concept of Big data analytics.

Course Objectives

The Course aims

- To introduce the concepts of Industry 4.0 and its Applications
- To make the students familiar with IoT and IIoT.
- To gain knowledge on artificial intelligence, and machine learning.

Learning Outcomes

On completion of the course, students should be able to
    CO1: Understand current state of Industry 4.0
    CO2: Comprehend the ideas of augmented reality.
    CO3: Identify robot process
    CO4: Employ Machine learning practices
    CO5: Know the security risk using Industry 4.0 and AI

UNIT	Content	No. of Hours
I	**Introduction to Industry 4.0**	8
	Introduction – Revolution of Industry 1.0 to Industry 4.0 – Smart Digital Technology – Basic Terminologies – Benefits of Industry 4.0 – Challenges in Smart Industries – Implications of Industry 4.0	
II	**IoT and IIoT**	9
	IoT concepts - Components of IoT System- Application Domains - IOT in Indian Scenario. Industrial IoT : Introduction- Business Model - IIoT Architecture - Application Domains: Oil, chemical and pharmaceutical industry , Healthcare, Power Plants, Inventory Management & Quality Control.	
III	**Artificial Intelligence and Machine Learning**	30
	Artificial Intelligence: Introduction to AI and different sub-areas of AI - supervised learning - unsupervised learning - reinforcement learning - Problem Solving by Search -Knowledge Representation and Reasoning - Planning and Decision Making. Machine Learning : Introduction - Support Vector Machines - Neural Networks - Decision Trees – Applications of AI and ML.	
IV	**Big Data Analytics**	7
	Introduction - Types of Digital Data - Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes - Big Data Platforms and its Use cases.	
V	**Automation and Robotics**	9
	Automation: Design of an automated system: Building blocks of an automated system, working principle and examples. **Robotics**: Introduction to Robots and Robotics – History – Growth - Laws of Robotics Robot Kinematics- Robot applications- Manufacturing industry, defense, rehabilitation, medicine.Chatbots	
	Total Contact Hours	**43**

TextBooks:

1. Understanding Industry 4.0: AI, the Internet of Things, and the Future of Work,Bruno S. Sergi, Elena G. Popkova, Aleksei V. Bogoviz, Tatiana N. Litvinova, Emerald Group Publishing,2019.
2. Industry 4.0: The Industrial Internet of Things ,AlasdairGilchrist,Apress , 2016.

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1. Industry 4.0: Industrial Revolution of the 21st Century, Elena G. Popkova, Yulia V. Ragulina,Springer, 2019.
2. Understanding Industry 4.0 AI, the Internet of Things, and the Future of Work, Elena G. Popkova, Aleksei V. Bogoviz, Tatiana N. Litvinova, Emerald Publishing Limited 2019. ISBN:9781789733136, 1789733138

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2. https://www.youtube.com/watch?v=wgWRLu8p90
   M 3. https://nptel.ac.in/courses/306/305/306305195/
4. https://www.youtube.com/watch?v=CYDcHQ_MKlE

BIG DATA ANALYTICS							
Course Code	**Department**	**Semester**	**Credits**	**Theory Hours**	**Theory**		**Total**
					CFA	**ESE**	
21CSAP02G6	PG (NME)	II	3	3	40	60	100

Cognitive Level
K-1 Define characteristics of Big data
K-2   Practice to understand clustering and classification
K-3 Describe the concept of association rules.
K-4 Outline the applications of Big data analytics.

Course Objectives
The Course aims
- To introduce the overview of the big data
- To make the students familiar with data analytics.
- To impart knowledge on various algorithms in clustering and classification.

Learning Outcomes

On completion of the course, students should be able to
   CO1: Understand the concept of big data analytics
   CO2: Apply decision trees for modelling real life
   problems CO3: Identify association rules.
   CO4: Employ the concepts of stream memory.
   CO5: Know data visualization

UNIT	Content	No. of Hours
	INTRODUCTION TO BIG DATA	
I	Evolution of Big data - Best Practices for Big data Analytics - Big data characteristics – Validating - Big Data Use Cases- Characteristics of Big Data Applications -Understanding Big Data Storage – A General Overview of High-Performance Architecture - HDFS – MapReduce and YARN – Map Reduce Programming Model	**8**
	CLUSTERING AND CLASSIFICATION	
II	Overview of Clustering - K-means - Use Cases -Overview of the Method - Determining the Number of Clusters - Diagnostics - Reasons to Choose and Cautions .- Classification: Decision Trees - Overview of a Decision Tree – The General Algorithm - Decision Tree Algorithms - Evaluating a Decision Tree - Decision Trees in R - Naïve Bayes - Bayes' Theorem - Naïve Bayes Classifier.	**9**

	ASSOCIATION AND RECOMMENDATION SYSTEM	
III	Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Finding Association& finding similarity - Recommendation System: Collaborative Recommendation- Content Based Recommendation - Knowledge Based Recommendation- Hybrid Recommendation Approaches.	**8**
	STREAM MEMORY	
IV	Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing, Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating moments – Counting oneness in a Window – Decaying Window – Real time Analytics Platform(RTAP) applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics	**9**
	NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION	
V	NoSQL Databases : Schema-less Models‖: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores - Tabular Stores - Object Data Stores - Graph Databases Hive - Sharding –- Hbase – Analyzing big data with twitter - Big data for E-Commerce Big data for blogs - Review of Basic Data Analytic Methods using R.	**9**
	Total Contact Hours	**43**

Text Books
1. Data Analytics and Big Data, Soraya Sedkaoui, Wiley,2018.ISBN:9781786203264, 1786203264
2. Big Data Analytics Methods - Analytics Techniques in Data Mining, Deep Learning and Natural Language Processing By Peter Ghavami, De Gruyter, 2019. ISBN:9782047402081, 2047402083
3. R Programming A Step-By-Step Guide for Absolute Beginners , Daniel Bell, 2019. ISBN:9781696769648, 1696769647
4. R Programming and Its Applications in Financial Mathematics, Shuichi Ohsaki, Jori Ruppert-Felsot, Daisuke Yoshikawa, CRC Press, 2018. ISBN:9781498766304, 1498766302

Reference Books

1. Learn R Programming in 1 Day Complete Guide for Beginners, Krishna Rungta, 2019.
2. Statistical Predictive Modelling through R Programming, Laxmi Lydia E, Shankar K, S.Sheeba Rani, Lakshmanaprabu S.K,Evincepub Publishing,2019.ISBN:9789389125603, 938912560X

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2. https://www.youtube.com/watch?v=3SK9iJNYehg
3. https://www.youtube.com/watch?v=Ixik7u5JJFc
4. https://www.youtube.com/watch?v=aRReF-lvyPQ
5. https://www.youtube.com/watch?v=zez2Tv-bcXY

Lab Exercises Using R Programming

- Create an R Markdown Document
- Produce Different Output
- Importing Data
- Using dplyr
- Using tidyr
- Fitting Polynomials
- Clustering techniques
- Evaluating Different Classification Measures
- Decision Trees
- Support Vector Machines
- Compare Classification Algorithms
- Dealing with Missing Data

Python Programming								
Course Code	**Department**	**Semester**	**Credits**	**Theory Hours**	**Theory**		**Total**	
					CFA	**ESE**		
21CSAP02G7	PG (NME)	II	3	3	40	60	100	

Cognitive Level

K-1 State the development and refinement of programming.
K-2 Give examples for modular programming using sequence, selection, and repetition control structures.
K-3 Solve programming problems using a procedural approach.
K-4 Apply the user defined functions, strings, dictionaries , modules and files.

Course Objectives

The Course aims

- To enable the students to gain knowledge in programming concepts of Python
- To utilize sound problem solving and program design techniques to solve a large and complex problem
- To implement different looping structures and conditional statements, following accepted principles of good style and program format.
- To use Functions, handling Exceptions , managing files

Learning Outcomes

On completion of the course, students should be able to
CO1: Apply fundamental programming concepts to solve simple problems.
CO2: Develop skills in Python programming language to implement various algorithms,
CO3: Evaluate Algorithm development and ability to refine to improve performancein problem solving.
CO4: Analyze programming problems to choose appropriate programming constructs to produce a better result.
CO5: Identify and eliminate errors in programs

UNIT	Content	No. of Hours
I	Introduction to Python and Computer Programming, Data Types, Variables, Basic Input-Output Operations, Basic Operators.	8
II	Boolean Values, Conditional Execution, Loops, Lists and List Processing, Logical and Bitwise Operations	**9**

III	Functions, Tuples, Dictionaries, and Data Processing	8
IV	Modules, Packages, String and List Methods, and Exceptions	9
V	The Object-Oriented Approach: Classes, Methods, Objects, and the Standard Objective Features; Exception Handling, and Working with Files	9
	Total Contact Hours	**43**

Reference Books:
1. Python Programming, Ashok Namdev Kamthane, Amit Ashok Kamthane, McGraw-Hill Education, 2018. ISBN:9789353160968, 9353160960.
2. Introduction to Python Programming, Gowrishankar S, Veena A, CRC Press, 2018. SBN:9781353013222, 135301322X
3. Advanced Python Programming The Insider Guide to Advanced Python Programming Systems Richard Ozer, Python Programming, CreateSpace Independent Publishing Platform, 2017, ISBN:9781979604963, 1979604967

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2. https://www.youtube.com/watch?v=WGJJIrtnfpk
3. https://www.youtube.com/watch?v=BTzav965P7w
4. https://www.youtube.com/watch?v=vaysJAMDaZw
5. https://www.youtube.com/watch?v=2uCXIbkbDSE

Python Programming Lab

Implement the following in Python 3 version:

1. Arithmetic and Boolean Operations
2. Control Structures : Conditional and Looping
3. Creation of User-defined Functions
4. String Operations
5. Errors and Exceptional Handling
6. Create and Import Built-in and Custom Modules
7. Packages
8. Working withFiles
9. Classes, Methods, Object.

Introduction to IoT							
Course Code	**Department**	**Semester**	**Credits**	**Theory Hours**	**Theory**		**Total**
					CFA	**ESE**	
21CSAP02G8	PG (NME)	II	3	3	40	60	100

Cognitive Level
K-1 Define background and overview of IoT.
K-2 Describe architecture of IoT.
K-3 Understand Data analytics and Machine learning.
K-4 Outline the applications of IoT.

Course Objectives
The Course aims

- To introduce the architecture of IoT.
- To make the students familiar with devices of IoT.
- To gain knowledge on data analytics and machine learning.

Learning Outcomes
On completion of the course, students should be able to
   CO1: Understand current state of IoT.
   CO2: Gain familiarity with IoT
   devices. CO3: Identify process of IoT.
   CO4: Employ Machine learning and Data analytics.
   CO5: Know the applications of IoT.

UNIT	Content	No. of Hours
	Introduction	
I	What isIoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack	**8**
II	**Fundamental devices in IoT**	**9**
	Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies, Smart City IoT Architecture.	
III	**Protocols for IoT**	**9**
	IP as the IoT Network Layer, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.	
	Data and Network Analytics in IoT	

IV	An Introduction to Data Analytics for IoT, Machine Learning, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, IT and OT Security Practices.	8
V	**Applications**	
	The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronisation and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging - Case studies: Sensor body-area-network and Control of a smart home	9
	Total Contact Hours	**43**

Text Books:
1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
2. Srinivasa K G, ―Internet of Things, CENGAGE Leaning India, 2017.

Reference Books:
1. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome
2. Henry, 1stEdition, Pearson Education (Cisco Press Indian Reprint), 2017. ISBN: 978-9386873743
3. Internet of Things, Srinivasa K G, CENGAGE Leaning India, 2017.
4. Raj Kamal, ―Internet of Things: Architecture and Design Principles‖, 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224).
5. Internet of Things A to ZTechnologies and Applications, Qusay F. Hassan, Wiley, 2018. ISBN:9781119306742, 1119306746.
6. The Technical Foundations of IoT, Boris Adryan, Dominik Obermaier, Paul Fremantle, Artech House, 2017. ISBN:9781620814663, 1620814660

R Programming							
Course Code	**Department**	**Semester**	**Credits**	**Theory Hours**	**Theory**		**Total**
					CFA	**ESE**	
21CSAP02G9	PG (NME)	II	3	3	40	60	100

Cognitive Level

K-1 Define data structures of R Programming
K-2 Describe matrix operations.
K-3 Practice graphics commands
K-4 Outline models in R programming

Course Objectives

The Course aims
- To introduce the concept of R programming
- To make the students familiar data modelling using R.
- To gain knowledge on programming practices using R.

E-References
1. https://www.youtube.com/watch?v=UrwbeOIlc68
2. https://www.youtube.com/watch?v=LlhmzVL5bm8
3. https://www.youtube.com/watch?v=QSIPNhOiMoE

Learning Outcomes
On completion of the course, students should be able to
 CO1: Understand the concept of basics of R programming
CO2: Practice with syntax of R programs
CO3: Implement mathematical operations
CO4: Employ graphics and visualizations
CO5: Know statistical simulations

UNIT	Content	No. of Hours
I	History and overview of R - R programming Environment - R Basics - Math, Variables and Strings - Vectors and Factors - Vector operations and Objects Reading and writing data.	**8**
II	Basic Data Types -Variables - Vectors - Arithmetic Operations - Logical Statements - Factor in R - Categorical Variable - Continuous Variables	**9**
III	Subsetting objects ,Vectorization,Control structures,	**9**
IV	Functions,ScopingRules,Loop functions	**9**

| V | Graphics and visualization,Debugging/profiling ,Statistical simulation | 8 |
| | **Total Contact Hours** | **43** |

Reference Books
1. R Programming A Step-By-Step Guide for Absolute Beginners, Daniel Bell, Independently Published, 2019. ISBN:9781696769648, 1696769647
2. R Programming A Beginner's Guide to Data Visualization, Statistical Analysis and Programming in R, R. Publishing, 2019.ISBN:9781690113799, 1690113790

E-References:
1. https://www.tutorialspoint.com/r/index.htm
2. http://diytranscriptomics.com/Reading/files/The%20Art%20of%20R%20Programming.pdf
3. http://www.biostat.jhsph.edu/~ajaffe/docs/undergradguidetoR.pdf
4. https://www.guru99.com/r-programming-tutorial-pdf.htmls://www.youtube.com/watch?v=9kYUGMg_14 s
5. https://www.youtube.com/watch?v=fDRa82lxzaU

R Programming Lab

1. Read Structured Data into R from various sources
2. Understand the different data types in R
3. Understand the different data structures in R
4. Date and Times in R
5. Mathematical operations
6. Vectorized calculations
7. Control statements
8. User-defined R functions
9. Loop constructs in R

	Essentials of Virtual Reality						
Course Code	**Department**	**Semester**	**Credits**	**Theory Hours**	**Theory**		**Total**
					CFA	**ESE**	
21CSAP02G10	PG (NME)	II	3	3	40	60	100

Cognitive Level
K-1: Define the basic concepts of Virtual reality
K-2: Describe the working principles of Virtual Reality
K-3: Apply and analyze models developed by virtual reality

Course Objectives
The Course aims
- To introduce the concept of Virtual reality
- To make the students familiar with simulations
- To impart knowledge on VR environment.

Learning Outcomes
On completion of the course, students should be able to
CO1: Outline the concept of Virtual Reality
CO2: Apply Geometric
modelling CO3: Identify virtual
environment
CO4: Know VR hardware and software
CO5: Discuss the applications of VR

UNIT	Content	No. of Hours
I	**Introduction to Virtual Reality** **Virtual Reality and Virtual Environment:** Introduction, Computer graphics, Real time computergraphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality,Historical development of VR, Scientific Landmark. **3D Computer Graphics:** Introduction, The Virtual world space, positioning the virtual observer,the perspective projection, human vision, stereo perspective projection, 3D clipping, Colourtheory, Simple 3D modelling, Illumination models, Reflection models, Shading algorithms,Radiosity, Hidden Surface Removal, Realism-Stereographic image	**30**
II	**Geometric Modelling** **Geometric Modelling**: Introduction, From 2D to 3D, 3D space curves, 3D boundary representationGeometrical Transformations: Introduction, Frames of reference, Modelling transformations,Instances, Picking, Flying, Scaling the VE, Collision detection **Generic VR system**: Introduction, Virtual environment, Computer environment, VR technology,Model of interaction, VR Systems.	**30**

III	**Virtual Environment**		**8**
	Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinearinterpolation, the animation of objects, linear and non- linear translation, shape &objectinbetweening, free from deformation, particle system.		
IV	**VR Hardware and Software**		**8**
	VR Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware,Integrated VR systems.VR Software: Introduction, Modelling virtual world, Physical simulation, VR toolkits,Introduction to VRM		
V	**VR Applications**		**7**
	Introduction, Engineering, Entertainment, Science, Training.The Future: Virtual environment, modes of interaction.		
		Total Contact Hours	**43**

Reference Books
1. Virtual Reality, Samuel Greengard, MIT Press, 2019. ISBN:9780262537520, 0262537524.
2. Virtual Reality, Jack Challoner, DK Publishing, 2017. ISBN:9781465465481, 1465465480
3. Virtual RealityHuman Computer Interaction, Ajit Singh, 2019, ISBN:9783076340100, 3076340308

E-References
1. http://scriptmode.com/virtualrealitytutorial/?utm_source=devglan
2. https://www.digitaltrends.com/computing/what-is-vr-all-the-basics-of-virtual-reality/
3. https://www.youtube.com/watch?v=ufyaV-hRLvg

Machine Learning							
Course Code	**Department**	**Semester**	**Credits**	**Theory Hours**	**Theory**		**Total**
					CFA	**ESE**	
21CSAP02G11	PG (NME)	II	3	3	40	60	100

Cognitive Level
K-1: Define the basic concepts of Machine Learning
K-2: Comprehend supervised and nsupervised learning
K-3: Apply and analyze graphical models

Course Objectives The Course aims
- To introduce the concept of machine learning
- To make the students familiar clustering and classification
- To gain knowledge on advanced machine learning.

Learning Outcomes

On completion of the course, students should be able to

CO1: Summarize the mathematical models for learning.

CO2: Gain familiarity with the learning methods

CO3: Distinguish the different learning methods and its importance.

CO4: Solve the problem by utilizing graphical models

CO5: Discuss the learning methods for various kinds of problems

UNIT	Content	No. of Hours
I	**INTRODUCTION** Machine Learning - Machine Learning Foundations –Overview – applications - Types of machinelearning - basic concepts in machine learning Examples of Machine Learning -Applications – LinearModels for Regression - Linear Basis Function Models - The Bias-Variance Decomposition -Bayesian Linear Regression - Bayesian Model Comparison.	**30**
II	**SUPERVISED LEARNING** Linear Models for Classification - Discriminant Functions - Probabilistic Generative Models -Probabilistic Discriminative Models - Bayesian Logistic Regression. Decision Trees – ClassificationTrees-Regression Trees - Pruning. Neural Networks -Feed-forward Network Functions - Error Backpropagation- Regularization - Mixture Density and Bayesian Neural Networks	**30**
III	**UNSUPERVISED LEARNING** Clustering- K-means - EM - Mixtures of Gaussians - The EM Algorithm in General -Model selectionfor latent variable models - high-dimensional spaces -- The Curse of Dimensionality – DimensionalityReduction .	**8**
	PROBABILISTIC GRAPHICAL MODELS	

IV	Directed Graphical Models - Bayesian Networks - Exploiting Independence Properties – FromDistributions to Graphs -Examples - Markov Random Fields - Inference in Graphical Models – Learning– Naive Bayes classifiers-Markov Models	8
V	**ADVANCED LEARNING**	
	Sampling – Basic sampling methods – Monte Carlo. Reinforcement Learning- K-Armed Bandit-Elements - Model-Based Learning- Value Iteration- Policy Iteration.	7
	Total Contact Hours	**43**

Reference Books
1. Machine Learning Algorithms, Giuseppe Bonaccorso, Packt Publishing, 2017. ISBN:9781785883011, 1785883014
2. Artificial Intelligence, Machine Learning, and Deep Learning, Oswald Campesato, Mercury Learning & Information, 2020. ISBN:9781683924661, 1683924665
3. Machine Learning Tutorial, RB Team, RB Publisher 2019.

E-References:
1. https://www.javatpoint.com/
2. https://intellipaat.com/blog/tutorial/machine-learning-tutorial/
3. https://www.youtube.com/watch?v=cKxRvEZd3Mw
4. https://www.youtube.com/watch?v=9f-GarcDY58
5. https://www.youtube.com/watch?v=GwIo3gDZCVQ