LEARNING OUTCOMES–BASED CURRICULUM FRAMEWORK (LOCF)

in the

UNDERGRADUATE PROGRAMME

BACHELOR OF SCIENCE IN
DATA SCIENCE AND ANALYTICS

FOR THE STUDENTS ADMITTED FROM THE

ACADEMIC YEAR 2022 - 2023 AND ONWARDS

(I & II SEMESTER)

HINDUSTHAN COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)
(Affiliated to Bharathiar University and Accredited by NAAC)
COIMBATORE-641028
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PREAMBLE

Learning Outcome Based Curriculum Framework for Undergraduate education in Bachelor of Science in Data Science and Analytics

It is an emerging field of information technology. The programme schedule is designed to maximize learning, with minimum disruption to professional responsibilities. The programme that provides rigorous theoretical and practical training on data management, programming, statistics, machine learning, and artificial intelligence and business applications and aims to strike a perfect balance between classroom and technology-aided learning.

VISION

To inculcate in depth knowledge of artificial intelligence, machine learning and other domain specific fields like national language processing, Computer vision, etc by imparting Cognitive learning environment with continuous education, research and industrial collaboration in the field of Artificial Intelligence and Data science.

MISSION

The Department of Data Science and Analytics strives to enlighten with niche technologies to update their knowledge in the field of AI and Data science and build strong foundation in Data computation, Intelligent Systems that enables self-development entrepreneurship and Intellectual property.

PROGRAMME EDUCATIONAL OBJECTIVES

Under Graduates of B.Sc. Data Science and Analytics program will,

PEO1 - Apply the knowledge of mathematics, science and computing in the core Information Technology.

PEO2 - Initiate life-long learning to acquire new technologies and adapt to the changing needs of IT industry.

PEO3 - Enable students to develop communication, teamwork and leadership skills necessary to build their career.

PEO4- Able to adapt innovative practices and contribute towards research and technological development in the field of Information Technology through Total Quality Education

PEO5 - Exhibit professional excellence, ethics, soft skills, leadership qualities as a responsible citizen with societal interest.

PROGRAM OUTCOMES

PO1 - Apply the knowledge of mathematics, science and electronic hardware to provide solutions for all kinds of problems in the respective domain.

PO2 - Identify and analyze the complex and real world problems based on the knowledge acquired in the core field.

PO3 - Design an innovative interface method to bring the complete solutions using statistical methods and visualize the results for decision making.

PO4 - Apply the modern tools and technologies to formulate, design, implement and demonstrate a self-designed solution.

PO5 - Apply the scientific knowledge and to provide innovative ideas to shape our society in a better way.

PO6 - Identify and develop solutions to environmental related problems and to enhance the people's quality of life.

PO7 - Understand the societal and ethical responsibilities of the professionals in their respective discipline.

PROGRAMME SPECIFIC OUTCOME

PSO1: Impart education with domain knowledge effectively and efficiently in par with the expected quality standards for Data analyst professional.

PSO2: Ability to apply the mathematical, technical and critical thinking skills in the discipline of Data analytics to find solutions for complex problems.

PSO3: Ability to engage in life-long learning and adopt fast changing technology to prepare for professional development.

PSO4: Expose the students to key technologies in data science and business analytics: data mining, machine learning, visualization techniques, predictive modeling, and statistics.

PSO5: Inculcate effective communication skills combined with professional & ethical attitude.

HINDUSTHAN COLLEGE OF ARTS & SCIENCE (AUTONOMOUS),

COIMBATORE-641028

SCHEME OF EXAMINATIONS - CBCS & LOCF PATTERN

(For the Students admitted from the Academic year 2022-2023 and Onwards)

UG PROGRAMME

Programme: B.Sc. **Branch: DATA SCIENCE AND ANALYTICS**

Part	Course Code	Course Type	Course Title	Credit points	Lecture Hours/ Week		Exam Duration (hours)	MAX. MARKS		
					Theory	Practical		I.E.	E.E	Total
			Semester – I							
I	22LAT01/ 22LAH01/ 22LAM01/ 22LAF01	MIL	Tamil-I/ Hindi-I/ Malayalam – I/ French-I	4	6		3	50	50	100
II	22ENG01	AECC	English – I	4	6		3	50	50	100
III	22BDU01	DSC	**CORE-I** Data Structures and Program Design in C	4	4		3	50	50	100
III	22BDU02	DSC	**CORE-II** Introduction to Data Science	4	4		3	50	50	100
III	22BDU03	DSC	**CORE-III Practical – I :** Programming in C	2		4	3	50	50	100
III	22BDU04	GE	**ALLIED-I** Statistics for Data Science	4	5		3	50	50	100
IV	22BDUE01	AEE	Open Elective – I	2	3		3	100	-	100
IV	22GSU01	AECC	**Skill Based Subject** Environmental Studies	1	2		2	50		50
IV	22BDUV01	SEC	VAC – I / Life Skills-I @ / **SEC-** Communicative English	1*	2		2	50	-	50**
IV	-	SEC	**SDR – Student Development Report**	Assessment will be in the Fifth Semester						
V	-	AECC	Extension Activities NSS/NCC/SPORTS/YRC/SIS/SA	Assessment will be in the Fourth Semester						
Total				**25**	**32**	**4**		**450**	**300**	**750**
			Semester – II							
I	22LAT02/ 22LAH02/ 22LAM02/ 22LAF02	MIL	Tamil-II/ Hindi-II/ Malayalam-II/ French-II	4	6		3	50	50	100
II	22ENG02	AECC	English – II	4	6		3	50	50	100
III	22BDU05	DSC	**CORE- IV -** Python Programming	4	4		3	50	50	100
III	22BDU06	DSC	**CORE-V** Data Visualization	3	3		3	50	50	100
III	22BDU07	DSC	**CORE-VI** Data Analysis using Spreadsheet	2	4		3	50	50	100
III	22BDU08	DSC	**CORE-VII Practical – II:** Python Programming & Spread Sheet	2		4	3	50	50	100
III	22BDU09	GE	**ALLIED-II** Numerical Methods	4	5		3	50	50	100
III	22BDU10	SEC	Internship / Industrial Visit / **Mini Project**	1	-	-		100		100
IV	22BDUV02	SEC	VAC – II / Life Skills-II @ / **SEC – Language**	1*	2		2	50	-	50**

IV	22BDUJ01	SEC	**Aptitude / Placement Training**	Grade*	2		2	50		50**
Total				**24**	**32**		**4**	**450**	**350**	**800**
			Semester – III							
III	22BDU11	DSC	**CORE-VIII** Object Oriented Programming in JAVA	4	5		3	50	50	100
III	22BDU12	DSC	**CORE-IX** Big Data Framework	4	5		3	50	50	100
III	22BDU13	DSC	**CORE-X** Web Analytics	3	3		3	50	50	100
III	22BDU14	DSC	**CORE-XI Practical -III:** Object Oriented Programming in Java	3		5	3	50	50	100
III	22BDU15	DSC	**CORE-XII Practical -IV:** R Programming for Data Science	3		5	3	50	50	100
III	22BDU16	GE	**ALLIED-III** Mathematical Foundation for Data Science	4	5		3	50	50	100
IV	22BDUE02	AEE	Open Elective-II	2	3		3	100		100
IV	22GSU02	AECC	**Skill Based Subject** Human Rights	1	2		2	50		50
IV	22BDUJ02	SEC	**Aptitude / Placement Training**	Grade*	2		2	50		50**
IV	22BDUJ03	SEC	**Online Course**		1			-	-	C/NC
Total				**24**	**26**	**10**		**450**	**300**	**750**
			Semester – IV							
III	22BDU17	DSC	**CORE-XIII** Relational Database Management System	4	5		3	50	50	100
III	22BDU18	DSC	**CORE-XIV** Web Technology	4	5		3	50	50	100
III	22BDU19	DSC	**CORE-XV Practical –V** RDBMS Applications	2		4	3	50	50	100
III	22BDU20	DSC	**CORE-XVI Practical - VI:** Web Technology	2		4	3	50	50	100
III	22BDU21	DSC	**CORE-XVII** Data Analytics using Hadoop and Spark	4	4		3	50	50	100
III	22BDU22	GE	**ALLIED-IV Practical VII :** Data Analytics using Hadoop and Spark	2		4	3	50	50	100
III	22BDU23	DSE	Electives / **DSE-I**	3	3		3	50	50	100
III	22BDU24	SEC	Internship / Institutional Training / **Mini-Project**	1	-		-	100	-	100
IV	22BDUV03	ACC	VAC–III	1*	2		2	50	-	50**
IV	22BDUJ04	SEC	**Aptitude / Placement Training**	Grade*	2		2	50		50**
IV	22BDUJ05	SEC	**Online Course**		1		-	-	-	C/NC≠
IV	22GSU03	AECC	**Skill Based Subject** Internet Security	1	2		2	50	-	50
V	22GSU04	AECC	Extension Activities NSS/NCC/SPORTS/YRC/ SIS/SA	2	-		-		-	C/NC≠
Total				**25**	**24**	**12**		**500**	**350**	**850**
			Semester – V							
III	22BDU25	DSC	**CORE-XVIII** Machine Learning	5	5		3	50	50	100
III	22BDU26	DSC	**CORE-XIX** Artificial Intelligence	4	5		3	50	50	100

III	22BDU27	DSC	**CORE-XX Practical – VIII:** Machine Learning with Python	2		4	3	50	50	100
III	22BDU28	DSC	**CORE- XXI Practical-IX:** Big Database System	2		4	3	50	50	100
III	22BDU29	DSC	**CORE- XXII** Deep Learning	4	5		3	50	50	100
III	22BDU30	DSC	**CORE- XXIII** Deep Learning Mini Project	2		-	3	100	-	100
III	22BDU31	DSE	Electives / **DSE-II**	3	4		3	50	50	100
IV	22BDUE03	AEE	Open Elective-III	2	3		3	100	-	100
IV	22GSU05	AECC	**Skill Based Subject** General Awareness	1	1		2	50	-	50
IV	22GSU06	AECC	**Skill Based Subject** Law of Ethics	1	-		2	50	-	50
IV	22BDUV04	ACC	VAC–IV	1*	2		2	50	-	50**
IV	22BDUJ06	SEC	**Aptitude / Placement Training**	Grade*	2		2	50	-	50**
IV	22BDUJ07	SEC	**Online Course**	-	1		-	-	-	C/NC≠
IV	22BDUJ08	SEC	**SDR- Student Development Report**	2*	-	-	-	-	-	-
Total				**26**	**28**	**8**		**600**	**300**	**900**
			Semester – VI							
III	22BDU32	DSE	Electives / **DSE-III**	4	6		3	50	50	100
III	22BDU33	DSE	Electives/**DSE-IV**	4	6		3	50	50	100
III	22BDU34	DSC	**CORE- XXIV : Self-Study Course**	3	-	-	3	50	50	100
III	22BDU35	SEC	**Project Work /Student Research / Paper**	5	5			50	50	100
Total				**16**	**15**			**200**	**200**	**400**

- * denotes Extra credits which are not added with total credits.
- ** denotes Extra marks which are not added with total marks.
- **VAC**-Value Added Course (Extra Credit Courses)
- * Grades depends on the marks obtained
- $^{\neq}$C – Completed/ NC – Not Completed

Range of marks	**Equivalent remarks**
80 and above	Exemplary
70 – 79	Very good
60 – 69	Good
50 – 59	Fair
40 – 49	Satisfactory
Below 40	Not Satisfactory = Not complete

- Part IV & V not included in total marks and CGPA calculation.
- **I.E**-Internal Exam
- **E.E**-External Exam
- **JOC**-Job Oriented Course

PASSING MINIMUM

- Passing Minimum for UG 40% in both Internal and External

ABSTRACT FOR SCHEME OF EXAMINATION

(For the candidates admitted during the academic year 2022 - 2022 and onwards)

Part	Course	Papers	Credit	Total Credits	Marks	Total Marks
Part I	Languages/ (**MIL**)	2	4	**8**	100	**200**
Part II	English/**AECC-I**	2	4	**8**	100	**200**
Part III	Core /**DSC**	23	3/4/5	**71**	100	**2300**
	Self-Study Course/DSC	1	3	**3**	100	**100**
	Allied /**GE**	4	2/4	**14**	100	**400**
	Electives/**DSE**	4	3/5	**16**	100	**400**
	Project **SEC**	1	5	**5**	100	**100**
	Internship/Institutional Training/Mini-Project	*2*	*1*	**2**	*100*	***200***
Part IV	Open Electives /**AEE**	3	2	**6**	100	**300**
	AECC –EVS/ HR/IS/GA/LE	5	1	**5**	50	**250**
	Value Added Course	*4*	*1*	*2**	*50*	***100*****
	Placement/Aptitude **/ SEC**	4	Grade	Grade	50	**200****
	Online courses / **SEC**	3	C/NC	C/NC	-	**-**
	Life Skills / **SEC**	2	1	2*	50	**100****
	SDR- Student Development Report	*1*	*2*	*2**	-	**-**
Part V	Extension Activities NSS / NCC/Sports/YRC / SIS / SA - **AECC**	1	C/NC	**2**	-	**-**
	Total			**140 (6 Extra Credits)**		**4450+ (400**)**

List of Open Elective Papers & VAC / JOC		
Open Electives	Yoga for Human Excellence Human Health & Hygiene Indian Culture and Heritage Indian Constitution and Political System Consumer Awareness and Protection Professional Ethics and Human Values Human Rights, Women's Rights& Gender Equality Disaster Management Green Farming Campus to Corporate Start-up Business Research Methodology and IPR General Studies for Competitive Examinations IIT JAM Examination (for Science only) CUCET Examination	
VAC PAPERS	Network Security Animation and it Technique Multimedia and its Applications Block Chain E-Learning Web Design SAS (Statistical Analysis System) Big Data Analytics Data Visualization Tools Statistics for Data Analytics Business Analytics	

List of Elective Papers/ DSE

(Can choose any one of the paper as electives)

	Course Code	Title
Electives/ **DSE-I**	22BDU23A	**Elective I :**Information Retrieval Techniques
	22BDU23B	**Elective I :** Cloud Computing
Electives/ **DSE-II**	22BDU30A	**Elective II :** E - Commerce
	22BDU30B	**Elective II :** Business Analytics
Electives/ **DSE-III**	22BDU31A	**Elective III :** Internet of Things for Data Analytics
	22BDU31B	**Elective III :** Data Privacy and Security
	22BDU31C	**Elective III :** Client Server Computing
Electives/ **DSE-IV**	22BDU32A	**Elective IV :** Computer Networks
	22BDU32B	**Elective IV :** Web Application Security
	22BDU32C	**Elective IV :** Agile Software Engineering

Syllabus Coordinator

BOS-Chairman/Chairperson

Dr. S. A. M. ...
M.Sc.,M.B.A.,M.Phil.,PGDCA.,Ph.D.,
Professor & Head,
PG & Research Dept. of Mathematics,
Hindusthan College of Arts & Science,
Coimbatore - 641 028

Academic Council – Member Secretary

PRINCIPAL

PRINCIPAL
Hindusthan College of Arts & Science (Aut
Hindusthan Gardens, Behind Nava
Coimbatore - 641 028.

UG - Scheme of Evaluation (Internal & External Components)

(For the students admitted during the academic year 2022-2023 and onwards)

1. Internal Marks for all UG

Components	Marks
Test I	10
Test II	10
Model Exam	10
Assignment	5
Attendance*	5
Internal Assessment components **	10
TOTAL	50

***Split-up of Attendance Marks**

- ♣ 75-79 - 1 marks
- ♣ 80-84 - 2 marks
- ♣ 85-89 - 3 marks
- ♣ 90-94 - 4 marks
- ♣ 95-100 - 5 marks

**** List of components for Internal Assessment (MCQ Compulsory)**

S.No	Components
1	Multiple choice questions
2	Club activities
3	Assignment
4	Seminar

(Any two components from the above list with five marks each will be calculated .2x5=10 marks)

2. a) Components for Practical I.E.

Components	Marks
Test –I	15
Test - II	15
Observation	10
Application*	10
Total	50

b) Components for Practical E.E.

Components	Marks
Experiments/Exercise	40
Record	5
Viva	5
Total	50

3. Institutional/ Industrial Training, Mini Project and Major Project Work

Institutional /Industrial Training (I.E)		Mini Project (I.E)	Major Project Work		
Component	**Marks**	**Marks**	**Component**	**Marks**	**Total Marks**
Work diary	25	-	I.E: a)Attendance	20	
Report	50	50	b)Review/Work		
Viva-voce	25	50	diary*	30	50
Total	100	100	E.E** :a) Evaluation	30	
			b)Viva-voce	20	50
				Total	100

*Review is for Individual Project and Work Diary is for Group Projects (group consisting of minimum 3 and maximum 5)

**Evaluation of report and conduct of viva voce will be done jointly by Internal and External Examiners

4. Guidelines for Internet Security/Human Rights/ Law of Ethics/ Environmental Studies (Part IV)

Components	Marks
Two Tests (each 2 hours) of 20 marks each [4 out of 7 descriptive type questions 4 x 5 = 20 Marks]	40
Two assignments (2 x 5)	10
Total	50

5. Guidelines for General Awareness (Part IV)

Components	Marks
Two Tests (each 2 hours) of 25 marks each [50 objective type questions 50 x 1/2 = 25 Marks]	50

6. Guidelines for open Elective (Part IV)

Components	Marks
Two Tests (each 2 hours) of 50 marks each [5 out of 8 descriptive type questions 5 x 10 = 50 Marks]	100

7. **Value Added Courses and Aptitude/Placement courses:**

Components	Marks
Two Test (each 1 hour) of 25 marks each QP is objective pattern (25x1=25)	50
Total	50

Guidelines:

1. The passing minimum for these items should be 40%
2. If the candidate fails to secure 40% passing minimum, he / she may have to reappear for the same in the subsequent Semesters
3. Item No's:4,5,6 and 7 are to be treated as 100% Internal papers.
4. For item No.7, Tests conducted through online modules (Google Form/any other)
5. Item No.2: * - Application should be from the relevant practical subject other than the Listed programmes. It must be enclosed in the practical record.

UG PATTERN

QUESTION PAPER PATTERN FOR CIA I and CIA II EXAM

Reg.No:---------- Q.P.CODE:

HINDUSTHAN COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

---------- DEGREE CIA-I/CIA-II EXAMINATIONS ----------20---

(---------- SEMESTER)

BRANCH: ----------

SUBJECT NAME: ----------

Time: Two Hours **Maximum:50 Marks**

SECTION - A (6 x 1 = 6 Marks)

Answer **ALL** Questions

ALL Questions Carry **EQUAL** Marks

(Q.No: 1 to 6: Multiple choice/Fill up the blanks /True or False questions)

SECTION - B (4x 6 = 24 marks)

Answer **ALL** Questions

ALL Questions Carry **EQUAL** Marks

(Q.No: 7 to 10 Either Or type)

SECTION - C (2x10 = 20 marks)

Answer any **TWO** Questions out of **THREE** Questions

ALL Questions Carry **EQUAL** Marks

(Q.No: 11 to 13)

QUESTION PAPER PATTERN FOR MODEL/END SEMESTER EXAMINATION

Reg.No:---------- Q.P.CODE:

HINDUSTHAN COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

---------- DEGREE MODEL EXAMINATIONS ----------20---------

(----------SEMESTER)

BRANCH : ----------

SUBJECT NAME:----------

Duration: Three Hours **Maximum: 70 Marks**

SECTION - A (10x1=10 Marks)

Answer **ALL** Questions

ALL Questions Carry **EQUAL** Marks

(Q.No 1 to 10 Multiple choice/Fill up the blanks /True or False questions)

(Two questions from each unit)

SECTION - B (5x6=30 Marks)

Answer **ALL** Questions

ALL Questions Carry **EQUAL** Marks

(Q.No 11 to 15 Either or type)

(One question from each Unit)

SECTION- C (3x10=30 Marks)

Answer any **THREE** Questions out of **FIVE** Questions

ALL Questions carry **EQUAL** Marks

(Q.No 16 to 20) (One question from each Unit)

Blue Print of Question Paper for all UG Programmes

(For the academic year 2021-22, 2022-23)

FOR CIA I, CIA II - QUESTION PATTERN **Max. Marks: 50**

Sec	Question No	Type	No of Question	Questions to be answered	Mark per question	K-level
A	1 to 6	MCQ/ True or False/ Fill up	6	6	1 (6x1=6)	All Questions will be K1
B	7 to 10	Either or Type (a or b)	8	4	6 (4x6=24)	4 Questions will be in K2 4 Questions will be in K3
C	11 to 13	Open choice	3	2	10 (2x10=20)	1 Question will be in K3 2 Question will be in K4

FOR MODEL/ESE - QUESTION PATTERN **Max. Marks:70**

Sec	Question No	Type	No of Question	Questions to be answered	Mark per question	K-level
A	1 to 10	MCQ/ True or False/ Fill up	10	10	1 (10x1=10)	All Questions will be K1
B	11 to 15	Either or Type (a or b)	10	5	6 (5x6=30)	6 Questions will be in K2 4 Questions will be in K3
C	16 to 20	Open choice	5	3	10 (3x10=30)	2 Question will be in K3 3 Question will be in K4

(For the academic year 2020-21)

FOR CIA I, CIA II - QUESTION PATTERN **Max. Marks:50**

Sec	Question No	Type	No of Question	Questions to be answered	Mark per question	K-level
A	1 to 6	MCQ/ True or False/ Fill up	6	6	1 (6x1=6)	All Questions will be K1
B	7 to 10	Either or Type (a or b)	8	4	5 (4x5=20)	4 Questions will be in K2 4 Questions will be in K3
C	11 to 13	Either or Type (a or b)	6	3	8 (3x8=24)	3 Question will be in K3 3 Question will be in K4

FOR MODEL/ESE - QUESTION PATTERN **Max. Marks:70**

Sec	Question No	Type	No of Question	Questions to be answered	Mark per question	K-level
A	1 to 10	MCQ/ True or False/ Fill up	10	10	1 (10x1=10)	All Questions will be K1
B	11 to 15	Either or Type (a or b)	10	5	4 (5x4=20)	6 Questions will be in K2 4 Questions will be in K3
C	16 to 20	Either or Type (a or b)	10	5	8 (5x8=40)	5 Question will be in K3 5 Question will be in K4

Blue Print of Question Paper

Distribution of section-wise marks with K levels for UG 2021-22, 2022-23

CIA							
Sec.	K1	K2	K3	K4	Total questions	Questions to be answered	Total marks
A -MCQ/T or F / Fill up	6				6	6	6x1=6
B - Either or type		4	4		8	4	4x6=24
C - Open choice			1	2	3	2	2x10=20
Total Marks	6	24	34	20			84
% of marks without choice	7.14	28.57	40.48	23.81			100

Model Exam							
Sec.	K1	K2	K3	K4	Total questions	Questions to be answered	Total marks
A- MCQ/T or F/ Fill up	10				10	10	10x1=10
B - Either or type		6	4		10	5	5x6=30
C - Open choice			2	3	5	3	3x10=30
Total Marks	10	36	44	30			120
% of marks without choice	8.33	30	36.67	25			100

Distribution of section-wise marks with K levels for UG (2020-21)

CIA							
Sec.	K1	K2	K3	K4	Total questions	Questions to be answered	Total marks
A MCQ/T or F/ Fill up	6				6	6	6x1=6
B - Either or type		4	4		8	4	4x5=20
C – Either or type			3	3	6	3	3x8=24
Total Marks	6	20	54	24			104
% of marks without choice	5.77	19.23	51.92	23.08			100

Model Exam							
Sec.	K1	K2	K3	K4	Total questions	Questions to be answered	Total marks
A MCQ/True or False/ Fill up	10				10	10	10x1=10
B - Either or type		6	4		10	5	5x4=20
C – Either or type			5	5	10	5	5x8=40
Total Marks	10	24	56	40			130
% of marks without choice	7.69	18.46	43.08	30.77			100

UG Programme Regulations for the academic year 2022-2023

1. Internal marks components for the candidates admitted from the academic year 2022-2023 and onwards is as follows.

For Theory courses

Components	Marks
Test I	10
Test II	10
Model Exam	10
Assignment	5
Attendance	5
Internal Assessment components	10
TOTAL	50

For Practical courses

Components	Marks
Test –I	15
Test – II	15
Observation/Exercise	10
Application*	10
TOTAL	50

2. The pattern of the question paper for External Examination will be maximum of 70 marks for theory courses, the marks obtained will be converted into 50 as per the scheme.

3. Passing minimum for all UG programme is 40% in Internal and 40 % in External and the composition of total 40 marks out of 100 marks.

4. Internship / Institutional Training / Mini-Project is related to the discipline. The students can be permitted to complete the Internship / Institutional Training / Mini-Project before the end of First year (end of II semester) and before the end of the second year (end of IV semester) and submit a report.

Internship / Institutional Training	Duration: Not more than seven days
Mini project	During the course of study for not more than seven days.

5. Project work is considered as a special course involving application of knowledge in problem solving/analyzing/exploring a real-life situation. A Project work may be given in lieu of a discipline specific elective paper. Distribution of marks for major project for all UG programme will be 50:50 pattern for both Internal and External in total of 100/200 marks.

6. Two tests for fully internal subjects should be conducted during CIA-I and CIA –II by the department.

7. Retest for the failure candidates in CIA I or CIA II or Part IV or Part V or Extra credit courses should be conducted during the model examination after getting approval from the COE office. The candidates who are not able to complete the minimum pass mark in internal components even getting chance of reappearance, will be treated as arrear candidates.

8. For the Theory cum Practical blended courses, 50:50 Internal and External pattern will be followed for theory examination and Fully internal pattern will be followed for Practical examination. For theory part, External examination will be conducted as regular pattern (max of 70 marks) and it will be converted into 25 marks.

Course	Internal Marks		External marks		Total marks (Max. marks 50)	
	Min.	Max.	Min.	Max.	Min.	Max.
Theory	10	25	10	25	20	50
Practical	20	50	-		20	50

For Practical components for Theory cum Practical courses (Fully Internal)

Components	Marks
Test I	10
Test II	10
Experiment/Excercise	20
Record	5
Viva	5
Total	50

The Internal mark 50 will be converted into 25.

9. For the candidates admitted under the Fast Track System (FTS) must register their names to their concerned department heads and get approval from the COE office at the beginning of the III semester.

10. Students who are not willing to select the Project/Research work in Semester VI, can chose the theory papers offered by their departments as per the prescribed theory pattern.

11. Self Study will be a Core Paper of the department for which the examination pattern will be as like part III courses is followed.

12. NSS / NCC/Sports/YRC / SIS / SA is mandatory for all students as per New Education Policy and the students must attend the allocated hours within two years and complete the programme. They will be evaluated during the end of second year (Fourth Semester) and also a certificate will be issued.

13. SDR – Student Development Report to be received by the department from the students till end of the fifth semester. (Evidences of Curricular activities and Co-curricular activities)

14. For online courses minimum of 2 certificates in any of the online platform is mandatory.

15. Open elective courses:

Departments can offer list of subjects which teaches moral ethics to the young community for the better future. The topics relevant to Indian ethics, Culture, Women rights, Yoga, Green farming, Indian constitution etc., as an open elective courses. These courses can be offered by the department or other department as inter department courses. Marks earned for this courses will not be included for CGPA calculations.

Extension Activities

NSS – National Service Scheme, as enrolled member with the College Unit.
NCC – National Credit Corps, as enrolled member with the College Unit.
SPORTS – Sports & Games Participation with College Team
YRC/RRC–Youth Red Cross / Red Ribbon Club, as enrolled member with the College Unit.
Rotaract Club - Rotaract Club, as enrolled member with the College Unit.
SIS – Special Interest Subjects, as approved by the Academic Council
SA – Social Activity for not less than 50 hours with NGGO like Aram Foundation / Shanthi Social Service /Siruthuli /Kulangal Pathukappu Amaipu /Old age Home / Nature Foundation / etc.

Regulations of Fast Track System (FTS)

- From the academic year 2021-22, our college is offering Fast Track System (FTS) for all UG and PG programmes. In this system, we are offering two courses under the course type of Discipline Specific Elective (DSE) in the sixth semester for all UG programmes and fourth semester for all PG programmes, which are equivalent and related with **National Programme on Technology Enhanced Learning/Study Webs of Active–Learning for Young Aspiring Minds** (NPTEL/SWAYAM) courses.

- The students have the option of taking two subjects of the sixth semester of their programme through NPTEL/SWAYAM portal from the list given by NPTEL and can complete the online course before fifth semester and submit the received original certificates to the COE office for getting approval. If the student completes these courses before the beginning of the sixth semester (UG)/fourth semester (PG), the candidate can be considered and exempted to write the examination from the assigned DSE courses in the sixth semester/fourth semester. They should complete only the self study course and project work during the VI/IV semester as assigned in the scheme. The candidate who completes the online courses and submits the successful course completion credentials, the credit transfer will be considered as per our Scheme of Examination for qualifying the degree. **The minimum duration of the registered online course must be 12 weeks.** Course duration of less than 12 weeks will not be considered.

- For all PG programmes, the candidates who were admitted during the academic year 2021-2022 under the Fast track system, for the self study course, the internal mark component will be as follows. For others regular internal pattern follows.

TEST	Max. Marks	Mode
CIA I	50 (50x1=50)	Online objective type
Model Exam.	50 (50x1=50)	Online objective type

Out of these two tests, the total marks will be converted into 40 marks as Internal.

- For all UG programmes, the candidates who were admitted during the academic year 2021-2022 under the Fast track system, for the self study course, the internal mark component will be as follows. For others regular internal pattern follows.

TEST	Max. Marks	Mode
CIA I	50 (50x1=50)	Online objective type
CIA II	50 (50x1=50)	Online objective type
Model Exam.	50 (50x1=50)	Online objective type

Out of three tests, the total mark will be converted into 30 marks as Internal.

- For the students admitted in Fast Track System, must enroll their names to the concerned department heads and get approval from the COE office at the beginning of III semester for all UG Programmes and at the beginning of II semester for all PG programmes.

- The students who cleared and got certified for online courses under the fast track system, the grade obtained will be converted into average marks of range. The received certificates must be submitted to the COE office for approval of the Controller and the Principal. The FTS courses will be treated as fully external.

DEPARTMENT OF DATA SCIENCE & ANALYTICS				CLASS: I B.Sc Data Science & Analytics				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**Ext**	**Total**
I	DSC	22BDU01	**Data Structures and Program Design in C**	4	4	50	50	100

Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	
	Skill Development	✓

Course Objectives

1. To impart the basic concepts of data structures and algorithms
2. To understand basic concepts about stacks, queues, lists, trees and graphs
3. Illustrate the Sorting interplay between algorithms and the associated abstract data types, data structures, and implementations
4. Solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps, tournament trees, binary search trees, and graphs and writing programs for these solutions
5. Intended to provide the foundations of the practical implementation and usage of Algorithms and is also capable of designing and analyzing implementations of algorithms and data structures for different kinds of problems.

Unit	Course Contents	Hours	K Level
I	Introduction and Overview of Data Structure, How to Create Programs, How to Analyze Programs, Definition of Stacks and Queue, Evaluation of Expressions, Multiple Stacks and Queues, Linked lists: Linked Stacks and Queues, Equivalence Relations, Sparse Matrices, Doubly Linked Lists.	**10**	Up to K4
II	Definition of data structure, data structure operations. Algorithms : Complexity, Time Space tradeoff, Complexity of Algorithms, Asymptotic Notations for Complexity of Algorithms, Sub algorithms, Variables, data.	**10**	Up to K4
III	Introduction and Definition of Trees, Tree Terminology, Binary Tree, Representing Binary Tress in Memory, Traversing Binary Tree: Preorder, In-order, Post-ordered traversal, Traversal algorithms using stacks, Headed nodes: Threads, Binary Search trees, Searching and Inserting in Binary Search trees, Deleting in a Binary search tree. AVL trees, m-trees and B-Trees.	**10**	Up to K4
IV	Introduction, Graph theory terminology: Graph and multigraphs. Directed Graphs, Sequential representation of graphs: Adjacent matrix, Path matrix, Linked representations of a Graph, Operations on Graphs: Searching in a Graph, Inserting in a graph, Traversing a graph: Breadth- First search, Depth Final search, Spanning tree.	**9**	Up to K4
V	Sorting, Bubble Sort, Insertion sort, Quick Sort, Selection sort, Merging, Merge-sort. Searching :Sequential and binary searches, Indexed search, Hashing Schemes	**9**	Up to K4

Note: Distribution of marks for Internal Examination -50 and External Examination –50

Book for Study

1.SeymourLipchutz, "Theory and Problems of Data Structures", Tata Mc Grew

Books for Reference

1.Robert Kruse, C.L Tondo and Bruce Leung, "Data Structure and Programming in C", Pearson Education.

2. *YedidyahLangsam, Moshe J. Augenstein, and Aaron M. Tenenbaum, "Data Structure using C and C++", Pearson Education 2nd Edition.*
3. *Samiran Chattopadhyay, Debabrata Ghosh Dastidar and Matagini Chattopadhyay, " Data Structures through C Language", BPB Publication.*

*4. Jean paul tremplay ,"*An Introduction to Data Structures with Application" 2nd Edition.

5. Jean paul tremplay"Data structure and software development and object oriented domain",java Edition.

Web Resources

Web Link:

1. https://www.javatpoint.com/
2. Web Link: https://towardsdatascience.com/
3. https://www.tutorialspoint.com/data_structures_algorithms/data_structures_basics.html/

Application Links :

Unit I - https://www.simplilearn.com/tutorials/data-structure-tutorial/time-and-space-complexity
Unit II - https://www.youtube.com/watch?v=r58oVFCaJRw.
Unit III - https://www.webhopers.in/data-structure-course
Unit IV - https://www.youtube.com/watch?v=2guA5uMEmZQ
Unit V - https://learn.saylor.org/mod/page/view.php?id=19001

Pedagogy : Lecturing**,** PowerPoint Projection through LCD, Assignment, Discussion and Activity.

Rationale for Nature of the Course :

Data Structures in C are used to store data in an organized and efficient manner. The C Programming language has many data structures like an array, stack, queue, linked list, tree, etc. A programmer selects an appropriate data structure and uses it according to their convenience.

Activities to be given :

1. Prepare Customer billing system using C
2. Assignment to create Employee record system using C

Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K – Level
CLO1	Analyze the culture and historic context of each story.	Up to K4
CLO2	Illustrate the writing styles of various writers of different ages.	Up to K4
CLO3	Discover and categorize variety of forms of poetry.	
CLO4	Determine the dramatic elements and analyze how they are used in practice.	Up to K4
CLO5	Deduce and examine the factors that influence the use of grammar and vocabulary in speech and writing.	Up to K4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	Programme Outcomes (with Graduate Attributes)				
CLOs	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	3	2	2	2	3
CLO 2	2	2	3	3	3
CLO 3	3	2	3	2	2
CLO 4	3	3	3	3	2
CLO 5	3	3	3	3	3

3 – Advance Application 2 – Intermediate Level 1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Coordinator
Santhi	For Prabavathi. P	
Mrs. V.Santhi Name & Signature of the Staff	Dr. Priya Sharon Thomas Name & Signature	Name & Signature

Curriculum Development Cell
Hindusthan College of Arts & Science,
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Dr. P. PRABAVATHI
Associate Professor in English
Hindusthan College of Arts & Science
Coimbatore.

DEPARTMENT OF DATA SCIENCE & ANALYTICS				CLASS: I B.Sc Data Science & Analytics				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**Ext**	**Total**
I	DSC	22BDU02	**Introduction to Data Science**	4	4	50	50	100

Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	
	Skill Development	✓

Course Objectives

1. Defining Core Concepts about Data Science.
2. Learning about Predictive Analytics using Python.
3. Demonstrate proficiency with statistical analysis of data
4. Develop the ability to build and assess data-based models
5. Execute statistical analyses with professional statistical software

Unit	Course Contents	Hours	K Level
I	Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.	**9**	Upto K4
II	Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources.	**10**	Up to K4
III	Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.	**10**	Up to K4
IV	Data visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, mapping variables to encodings, Visual encodings.	**10**	Up to K4
V	Applications of Data Science, Technologies for visualization, Bokeh (Python), recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.	**9**	Up to K4

Note: Distribution of marks for Internal Examination -50 and External Examination –50

Book for Study

1.Cathy O'Neil, Rachel Schutt, Doing Data Science, Straight Talk from The Frontline. O'Reilly, 2013.

Books for Reference

1. Rachel Schutt, Cathy O'Neil, "Doing Data Science: Straight Talk from the Frontiline" by Schroff/O'Reilly, 2013.

2. S. 2. Russell and P. Norvig, Artificial Intelligence A Modern Approach, 2nd Edition. Pearson Education, 2007.

3. Jure Leskovek, AnandRajaraman, Jeffrey Ullman, Mining of Massive Datasets. v2.1, Cambridge University Press, 2014.

4.V.K Jain "Data science and analytics.

5. Alex cambell"Introduction to Data science".

Web Resources

Web Link:

1. **https://www.googleadservices.com/pagead/aclk?sa=L&ai=DChcSEwi6mqzcsaPyAhUcmWYCHRScB0oYABAAGgJzbQ&ae=2&ohost=www.google.com&cid=CAASEuRoFAdhgGIYezUGxKylwYQnVg&sig=AOD64_3HTEdBQvQUSiyYZzxCJCW8gUvD9g&q&adurl&ved=2ahUKEwjipKXcsaPyAhXhwzgGHa5BCvsQ0Qx6BAgDEAE**
2. **https://www.googleadservices.com/pagead/aclk?sa=L&ai=DChcSEwiItYr7saPyAhWZMCsKHQcoClAYABABGgJzZg&ae=2&ohost=www.google.com&cid=CAASEuRo9xRSlAx6z0AifywG4eRLkw&sig=AOD64_04wlXlU8EJ1oXGCZSdoarGorE-sg&q&adurl&ved=2ahUKEwiVp4H7saPyAhUN4jgGHcxBCx4Q0Qx6BAgIEAE**
3. **https://www.googleadservices.com/pagead/aclk?sa=L&ai=DChcSEwiItYr7saPyAhWZMCsKHQcoClAYABAHGgJzZg&ae=2&ohost=www.google.com&cid=CAASEuRo9xRSlAx6z0AifywG4eRLkw&sig=AOD64_2eZBLUh3eVQ3xhqTrOvClh7kf4zQ&q&adurl&ved=2ahUKEwiVp4H7saPyAhUN4jgGHcxBCx4Q0Qx6BAgGEAE**

Application Links :

Unit I - https://www.heavy.ai/learn/data-science

Unit II – https://www.techtarget.com/searchbusinessanalytics/definition/data-preparation

Unit III – https://www.youtube.com/watch?v=sjUDlJfdnKM

Unit IV – https://www.oracle.com/in/business-analytics/what-is-data-visualization/

Unit V – https://www.techtarget.com/searchbusinessanalytics/feature/8-top-data-science-applications-and-use-cases-for-businesses

Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO 1	Ability to choose appropriate data structures to represent data items in real world	Up to K4
CLO 2	Ability to analyze the time and space complexities of Algorithms	Up to K4
CLO 3	Implement and know the application of algorithms for sorting and pattern matching	Up to K4
CLO 4	Ability to design programs using a variety of data structures such as stacks, queues, hash tables, binary trees, search trees, heaps, graphs, and B-trees	Up to K4
CLO 5	Implement the sorting algorithm and searching techniques to solve the problems	Up to K4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	Programme Outcomes (with Graduate Attributes)						
CLOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CLO 1	3	3	3	3	3	3	3
CLO 2	3	2	3	3	3	3	2
CLO 3	3	2	2	3	3	3	2
CLO 4	3	3	3	2	2	2	3
CLO 5	3	3	3	3	3	3	3

3 – Advance Application 2 – Intermediate Level 1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Co-ordinator
Ms.K.Tamilarasi Name & Signature of the Staff	Dr.S.Anuradha Name & Signature	Name & Signature

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Professor & Head,
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Co-ordinator
Curriculum Development Cell
Hindusthan College of Arts & Science
Coimbatore-641 028.

DEPARTMENT OF DATA SCIENCE & ANALYTICS				CLASS: I B.Sc Data Science & Analytics				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**Ext**	**Total**
I	DSC	22BDU03	**Practical I - Programming in C**	2	4	50	50	100

Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	
	Skill Development	✓

Course Objectives

1. Understand and remember algorithms and its analysis procedure.
2. Introduce the concept of data structures through ADT including List, Stack, Queues .
3. To design and implement various data structure algorithms.
4. To introduce various techniques for representation of the data in the real world.
5. To develop application using data structure algorithms.

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	PRACTICAL - I : PROGRAMMING IN C	**I**	**K Level**
Ex. No.	**Program List**	**Hours**	
1	Write a menu driven C program to perform the following string operations without using string functions: (i) String Length (ii) String Concatenation (ii) String Reverse	4	Up to K4
2	Write a C program to search for an element in an array using Binary search	4	Up to K4
3	Write a C program to sort a list of N elements using Selection Sort Algorithm.	4	Up to K4
4	Write a C program to construct a singly linked list and perform insertion, deletion and Display operations.	4	Up to K4
5	Write a C program to demonstrate the working of stack using liked list.	4	Up to K4
6	Write a C program for Towers of Hanoi problem.	4	Up to K4
7	Write a C program to find GCD of two numbers using recursion	4	Up to K4
8	Write a C program to convert infix arithmetic expression to post fix expression.	4	Up to K4
9	Write a C program to simulate the working of Circular Queue using an array.	4	Up to K4

Pedagogy : Lecturing, PowerPoint Projection through LCD, Assignment, Discussion and Activity.

Rationale for Nature of the Course :

It helps the students to understanding the concept of Data Science which gives meaning to raw data and converts it into meaningful insights that can be used to grow the business and recognize market trends.

Activities to be given :

1. Prepare Impact of Climate Change On Global Food Supply using Data Science
2. Earth Surface Temperature Visualization

Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO 1	Select the appropriate Data Science toolkit	Up to K4
CLO 2	Explanation about API used in Data science	Up to K4
CLO 3	Concepts of Data Analysis and Algorithms	Up to K4
CLO 4	Comparing different Data Visualization Techniques	Up to K4
CLO 5	Determining different Application strategies	Up to K4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	Programme Outcomes (with Graduate Attributes)						
CLOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CLO 1	3	2	3	3	3	2	2
CLO 2	3	3	2	3	3	3	2
CLO 3	3	2	3	3	3	2	2
CLO 4	3	3	3	2	3	2	2
CLO 5	3	3	2	3	2	3	3

3 – Advance Application 2 – Intermediate Level 1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Co-ordinator
Ms.K.Tamilarasi Name & Signature of the Staff	Dr.S.Anuradha Name & Signature	Name & Signature

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DEPARTMENT OF DATA SCIENCE & ANALYTICS				CLASS: I B.Sc Data Science & Analytics				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**Ext**	**Total**
I	GE	22BDU04	**Statistics for Data Science**	4	5	50	50	100

Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	✓
	Skill Development	✓

Course Objectives

1. Execute statistical analyses with professional statistical software
2. To acquire knowledge about the basics in statistics.
3. To enrich the students in solving statistical problems by using method of dispersion.
4. To gain the knowledge on application of correlation and regression for business operations.
5. To study about the time series and probability.

Unit	Course Contents	Hours	K Level
I	Nature and scope of Statistics ,Limitation, types of Data- Primary Data & Secondary Data- Presentation of data: Construction of Tables with one or more factors of classification, Diagrammatic representations: - Line diagram, bar diagram, pie diagram and sub-divided bar diagram, Frequency distribution and cumulative frequency distribution and their graphical representations, Frequency polygon, histogram, Ogives, frequency curves, stem and leaf displays. **Applications of Statistics.**	**12**	Up to K4
II	Measures of location, measures of dispersion, Box-plot and Whisker Plot - Simple problems only. **Applications of Measures of location, measures of dispersion.**	**12**	Up to K4
III	**Correlation and Regression** Correlation: Introduction - Scatter Diagram – Karl Pearson's Correlation Coefficient – Rank Correlation. Regression: Introduction – Uses of regression analysis – regression lines – regression equations of X on Y and Y on X- **Applications of Correlation and Regression**	**12**	Up to K4
IV	**Time Series** Time Series – Meaning – Components – Models – Methods of Estimating Trend – Graphic Method, Semi average, Moving average and Least square method – Seasonal variation – Method of simple average only – **Applications of Time series**.	**12**	Up to K4
V	**Probability Theory** Random Experiment – Sample Space – Events – Axiomatic Definition of Probability – Addition Theorem – Multiplication Theorem – Baye's Theorem -Applications.	**12**	Up to K4

Note: Distribution of marks for Internal Examination -50 and External Examination –50

Note: The Questions should be asked in 80% Problems and 20 % for theory

Book for Study

*1. Dr. S.P.Gupta, '**Statistical Methods**', Sultan Chand and Sons Publishers, New Delhi.*
*2. R.Wilcox , '**Basic Statistics**', Oxford University Press, 2009*

Books for Reference

1. *Murray R Spiegel and Larry J Stephens: Statistics, Schaum's Outline, Fourth edition, 2008*
2. *Fundamentals of Mathematical Statistics", Sultan & Chand & Sons, New Delhi, 11th Ed, 2002.*
3. *The elements of Statistical Learning", Springer, 2009.*
4. *Practical Statistics for Data Scientists, 2nd Edition, Peter Bruce, Andrew Bruce and Peter Gedeck, May 2020*
5. *Statistics for Machine Learning, By Pratap Dangeti, July 2017*

Web Resources

Web Link:

1. **https://cims.nyu.edu/~cfgranda/pages/stuff/probability_stats_for_DS.pdf**
   https://ocw.mit.edu/courses/15-075j-statistical-thinking-and-data-analysis-fall-2011/resources/mit15_075jf11_chpt02/
2. **https://ocw.mit.edu/courses/15-075j-statistical-thinking-and-data-analysis-fall-2011/resources/mit15_075jf11_chpt03/**
3. **https://ocw.mit.edu/courses/18-440-probability-and-random-variables-spring-2014/pages/lecture-notes/**

Application Links :

Unit I : https://youtu.be/_1ffmGXhr8Q
Unit II : https://youtu.be/E6jNADpaY2Q
Unit III : https://youtu.be/e3RP2x9hjLQ
Unit IV: https://youtu.be/b0oNfeJlSPA
Unit V: https://onlinecourses.nptel.ac.in/noc21_ma74/preview

Pedagogy : Lecturing**,** PowerPoint Projection through LCD, Assignment, Discussion and Activity

Rationale for Nature of the Course :

These concepts will help you make better business decisions from data.

Activities to be given :

1. Building formal statistical models.
2. Assignment on Predictive Model Linear Regression.

Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO 1	Recall the basic concepts of data collection and types of diagram.	Up to K4
CLO 2	Apply measures of dispersion in real life situation.	Up to K4
CLO 3	Analyze the correlation and regression analysis.	Up to K4
CLO 4	Understand the meaning of time series.	Up to K4
CLO 5	Ability to analyze the probability concepts.	Up to K4

10	Write a C program to create and traverse a binary search tree.	4	Up to K4
11	Write a C program to sort the given set of names.	4	Up to K4
12	Write a C program to second largest number from an array of numbers.	4	Up to K4

1. **Pedagogy :** PowerPoint Projection through LCD, Demonstration

Rationale for Nature of the Course: Can be professionals in solving advanced problems using software.

Activities to be given:

1. Write a C program for calculating result analysis for a class.
2. Write a C program to prepare family budget expense chart.

Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO 1	Create the programs in C to solve problems using algorithm design techniques	Up to K4
CLO 2	Ability to write programs in data structure to solve problems using divide and conquer strategy..	Up toK4
CLO 3	Illustrate C program for Linear data structure operations and its applications.	Up toK4
CLO 4	Implement various searching and sorting algorithms.	Up toK4
CLO 5	Develop C program for Linear data structure operations and its applications	Up toK4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	Programme Outcomes (with Graduate Attributes)						
CLOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CLO 1	3	3	2	3	3	3	3
CLO 2	3	3	2	3	2	3	3
CLO 3	3	3	3	3	3	3	2
CLO 4	3	3	3	3	3	2	2
CLO 5	3	3	3	3	3	3	3

3 – Advance Application 2 – Intermediate Level 1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Co–ordinator
Ms.K.Tamilarasi Name & Signature of the Staff	Dr.S.Anuradha Name & Signature	Name & Signature

Dr. S. ANURADHA,
M.Sc.,M.B.A.,M Phil.,PGDCA.,Ph.D.,
Professor & Head,
PG & Research Dept. of Mathematics,
Hindusthan College of Arts & Science,
Coimbatore - 641 028

Co-ordinator
Curriculum Development
Hindusthan College of Arts &
Coimbatore-641 028.

DEPARTMENT OF DATA SCIENCE AND ANALYTICS				CLASS: I B.Sc Data Science & Analytics				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**Ext**	**Total**
II	DSC	22BDU05	**Python Programming**	4	4	50	50	100

Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	
	Skill Development	✓

Course Objectives

1. Designed to engage in the basic knowledge of Python
2. Intended to learn the concepts of Statements, Tuples and Functions
3. To Understand conditionals, iteration, functions and strings in Python
4. Engage in gaining the concepts of Lists and Tuples.
5. To apply the knowledge regarding dictionaries and files.

Unit	Course Contents	Hours	K Level
I	**PYTHON BASICS, LIBRARIES** **Overview of Python**-History of Python- Origins Features- Downloading and Installing Python- Running Python. **Basic Syntax**–Hello World–Interactive mode Programming –Script mode Programming –A simple Python Example-Python Libraries.	**9**	Up to K4
II	**DATA, EXPRESSIONS, STATEMENTS** Python Interpreter and Interactive mode -**Values and Types:** Int, Float, Boolean, String and List; Variables – Expressions – Statements, Tuple Assignment - Precedence of Operators – Comments. **Modules And Functions**: Function Definition and Use, Flow Of Execution, Parameters And Arguments.	**10**	Up to K4
III	**CONTROL FLOW, FUNCTIONS** **Conditionals:** Boolean Values and Operators - Conditional (if), Alternative (if-else), Chained Conditional (if-elif-else); **Iteration:** State, While, For, Break, Continue, Pass. **Fruitful Functions:** Return Values – Parameters - Local And Global Scope - Function Composition – recursion. **Strings:** String Slices - String Functions And Methods - Lists as Arrays.	**10**	Up to K4
IV	**LISTS, TUPLES** **Lists:** List Operations - List Slices - List Methods - List Loop – Mutability – Aliasing - Cloning Lists - List Parameters. **Tuples:** Tuple Assignment - Tuple as Return Value.	**9**	Up to K4
V	**DICTIONARIES, FILES** **Dictionaries:** Operations and Methods- Advanced List Processing - List Comprehension. **Files And Exception:** Text Files - Reading	**10**	Up to K4

	And Writing Files - Format Operator - Command Line Arguments.		

Note: Distribution of marks for Internal Examination -50 and External Examination –50

Book for Study

1. *Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition*

Books for Reference

1. *Mark Lutz ,”Programming Python “, O Reily, 4thEdition, 2010, ISBN 9780596158118*
2. *Tim Hall and J-P Stacey ,”Python 3 for Absolute Beginners” , 2009, ISBN:9781430226322*
3. *Magnus Lie Hetland , “Beginning Python: From Novice to Professional”, 2nd Edition, 2009, ISBN:9781590599822.*
4. *Updated for Python 3, Shroff/O‘Reilly Publishers, 2016*
5. *Thomas J.Stephenson,”python computer programming for beginners.*

Web Resources

Web Link:

1.https://greenteapress.com/thinkpython2/thinkpython2.pdf
2.https://static.realpython.com/python-basics-sample-chapters.pdf
3.https://www.guru99.com/python-tutorials.html

Application Links :

Unit I - https://onlinecourses.nptel.ac.in/noc21_cs21/preview
Unit II - https://www.youtube.com/watch?v=UVjc6swTkhs
Unit III - https://www.youtube.com/watch?v=zw2Kf13aNcI
Unit IV - https://www.youtube.com/watch?v=mzx74TdGYbg
Unit V - https://www.youtube.com/watch?v=4Q0pW8XBOkc

Pedagogy : Lecturing**,** PowerPoint Projection through LCD, Assignment, Discussion and Activity.

Rationale for Nature of the Course : Can be expert in Python for Data Science

Activities to be given :

1. To create Python programming for Sentiment Analysis of Product Reviews.
2. Assignment on Build a Chatbot from Scratch in Python using NLTK.

Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO 1	Recall the structure of Python Programming.	Up to K4
CLO 2	Develop, Test and Debug various expressions, statements and functions in Python.	Up to K4
CLO 3	Analyse the need for working with control statement, iteration, and functions.	Up to K4
CLO 4	Discover the application of lists and tuples.	Up to K4
CLO 5	Illustrate the working of dictionaries and files.	Up to K4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	Programme Outcomes (with Graduate Attributes)						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CLO 1	3	3	3	3	3	3	3
CLO 2	3	2	3	3	3	3	2
CLO 3	2	2	3	3	3	3	3
CLO 4	3	3	3	3	2	2	3
CLO 5	3	2	3	3	3	3	2

3 – Advance Application 2 – Intermediate Level 1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Co–ordinator
Ms.K.Tamilarasi Name & Signature of the Staff	Dr.S.Anuradha Name & Signature	Name & Signature

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DEPARTMENT OF DATA SCIENCE & ANALYTICS				CLASS: I B.Sc Data Science & Analytics				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**Ext**	**Total**
II	DSC	22BDU06	**Data Visualization**	3	3	50	50	100

Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	
	Skill Development	✓

Course Objectives

1. Know the basics of data visualization
2. Understand the importance of data visualization and the design and use of many visual components
3. Learn to wisely use various visualization structures such as tables, spatial data, time-varying data, tree and network, etc.
4. Learn the basics of colors, views, and other popular and important visualization-based issues

Unit	Course Contents	Hours	K Level
I	Context of data visualization – Definition, Methodology, Visualization design objectives. Key Factors – Purpose, visualization function and tone, visualization design options – Data representation, Data Presentation, Seven stages of data visualization, widgets, data visualization tools.	**7**	Up to K4
II	Mapping - Time series - Connections and correlations - Scatter plot maps - Trees, Hierarchies and Recursion - Networks and Graphs, Info graphics.	**7**	Up to K4
III	Acquiring data, - Where to Find Data, Tools for Acquiring Data from the Internet, Locating Files for Use with Processing, Loading Text Data, Dealing with Files and Folders, Listing Files in a Folder, Asynchronous Image Downloads, Advanced Web Techniques, Using a Database, Dealing with a Large Number of Files. Parsing data - Levels of Effort, Tools for Gathering Clues, Text Is Best, Text Markup Languages, Regular Expressions (regexps), Grammars and BNF Notation, Compressed Data, Binary Data Formats.	**8**	Up to K4
IV	Drawing with data – Scales – Axes – Updates, Transition and Motion – Interactivity - Layouts – Geomapping – Exporting, Framework – T3, .js, tablo.	**7**	Up to K4
V	Port scan visualization - Vulnerability assessment and exploitation - Firewall log visualization - Intrusion detection log visualization - Attacking and defending visualization systems - Creating security visualization system.	**7**	Up to K4
Note: Distribution of marks for Internal Examination -50 and External Examination –50			

Book for Study

1. Scott Murray, "Interactive data visualization for the web", O"Reilly Media, Inc., 2013.

Books for Reference

1.Greg Conti, "Security Data Visualization: Graphical Techniques for Network Analysis", No Starch Press Inc, 2007. B

2. Ben Fry, "Visualizing Data", O"Reilly Media, Inc., 2007.

3.Alex Campbell "data visualization proper guide for data scientists.

4.claus O.wilke "Fundamentals of data visualization ".

5.Telea and alexandru C," Data visualization Principles and practice,2nd Edition.

Web Resources

Web Link:

1. **https://www.udemy.com/topic/data-visualization/**
2. **https://online-learning.harvard.edu/course/data-science-visualization**
3. **https://www.edx.org/learn/data-visualization**

Application Links :

Unit I - https://depictdatastudio.com/data-visualization-design-process-step-by-step-guide-for-beginners/

Unit II - https://www.coursera.org/lecture/information-visualization-advanced-techniques/visualizing-maps-time-9Llya

Unit III - https://firebase.google.com/docs/storage

Unit IV - https://www.youtube.com/watch?v=2LhoCfjm8R4

Unit V - https://geekflare.com/edr-tools/

Pedagogy : Lecturing**,** PowerPoint Projection through LCD, Assignment, Discussion and Activity.

Rationale for Nature of the Course :

The main goal of data visualization is to make it easier to identify patterns, trends and outliers in large data sets

Activities to be given:

1. To Create a scatter plot for Cost of Living Index and family income
2. Draw a line plot for corona affected people for past two years in Coimbatore district

Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO 1	Create skills to both design and critique visualizations	Up to K4
CLO 2	Able to understand and identify appropriate design process for mapping and graphics	Up to K4
CLO 3	Apply visual design principles to simple and complex models that tell the stories found in data.	Up to K4
CLO 4	Able to merge the drawing approaches to visualization with design principles to reveal patterns in data and present information from a human-centered perspective.	Up to K4
CLO 5	Apply the knowledge to interaction and immersive experiences can encourage the security visualization today and in the future.	Up to K4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	Programme Outcomes (with Graduate Attributes)						
CLOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CLO 1	3	3	3	2	3	3	3
CLO 2	3	3	3	3	2	3	2
CLO 3	2	2	3	3	3	3	3
CLO 4	3	3	3	3	3	2	3
CLO 5	2	3	3	3	3	3	2

3 – Advance Application 2 – Intermediate Level 1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Co–ordinator
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DEPARTMENT OF DATA SCIENCE & ANALYTICS				CLASS: I B.Sc Data Science & Analytics				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**Ext**	**Total**
II	DSC	22BDU07	**Data Analysis Using Spreadsheet**	2	4	50	50	100

Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	
	Skill Development	✓

Course Objectives

1. Prepare a spreadsheet file and enter data into the sheet
2. Illustrate formatting and editing capabilities on the data using formulas and functions
3. Demonstrate basic operations using charts
4. Demonstrate basic visualizing, analyzing, organizing and sharing techniques using pivot tables
5. Compute the multiple spread sheets and macros

Unit	Course Contents	Hours	K Level
I	About Excel & Microsoft, Uses of Excel, Excel software, Spreadsheet window pane, Title Bar, Menu Bar, Standard Toolbar, Formatting Toolbar, the Ribbon, File Tab and Backstage View, Formula Bar, Workbook Window, Status Bar, Task Pane, Workbook & sheets Columns & Rows Selecting Columns & Rows, Changing Column Width & Row Height, Auto fitting Columns & Rows, Hiding/Unhiding Columns & Rows, Inserting & Deleting Columns & Rows, Cell, Address of a cell, Components of a cell – Format, value, formula, Use of paste and paste special Functionality Using Ranges.	**12**	Up to K4
II	Using Ranges, Selecting Ranges, Entering Information Into a Range, Using AutoFill Creating Formulas. Using Formulas, Formula Functions – Sum, Average, if, Count, max, min, Proper, Upper, Lower, Using AutoSum, Advance Formulas Concatenate, Vlookup, Hlookup, Match, Countif, Text, Trim Spreadsheet Charts.	**12**	Up to K4
III	Creating Charts, Different types of chart, Formatting Chart Objects, Changing the Chart Type, Showing and Hiding the Legend, Showing and Hiding the Data Table, Data Analysis Sorting, Filter, Text to Column, Data Validation PivotTables.	**12**	Up to K4
IV	Creating PivotTables, Manipulating a PivotTable, Using the PivotTable Toolbar, Changing Data Field, Properties, Displaying a PivotChart, Setting PivotTable Options, . Adding Subtotals to PivotTables Spreadsheet Tools.	**12**	Up to K4
V	Moving between Spreadsheets, Selecting Multiple Spreadsheets, Inserting and Deleting Spreadsheets Renaming Spreadsheets, Splitting the Screen, Freezing Panes, Copying and Pasting Data between	**12**	Up to K4

	Spreadsheets, Hiding, Protecting worksheets Making Macros Recording Macros, Running Macros, Deleting Macros.		

Note: Distribution of marks for Internal Examination -50 and External Examination –50

Web Resources

Web Link:

1. **https://www.oreilly.com/library/view/excel-2013-the/9781449359492/ch01.html**
2. **https://guides.lib.umich.edu/c.php?g=283162&p=1886443**

Application Links :

Unit-I https://www.youtube.com/watch?v=rwbho0CgEAE

Unit-II https://www.youtube.com/watch?v=0_w0LVBQ_t4

Unit-III https://support.microsoft.com/en-us/office/video-use-slicers-timelines-and-pivotcharts-to-analyze-your-pivottable-data-4db5de3b-735e-4b03-b3b2-f2105d79dcb5

Unit-IV https://www.myexcelonline.com/blog/50-things-you-can-do-with-excel-pivot-tables/

Unit-V https://www.howtoexcel.org/pivot-table-tips-and-tricks/

Pedagogy : Lecturing**,** PowerPoint Projection through LCD, Assignment, Discussion and Activity.

Rationale for Nature of the Course : A successful Excel spreadsheet will organize raw data into a readable format that makes it easier to extract actionable insights

Activities to be given :

1. Create a pivot table in Excel for windows.
2. Create A Dynamic Chart In Google Sheets With A Drop-Down Menu.

Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO 1	Perform basic operations and formatting and use different formulae and functions in spreadsheets.	Up to K4
CLO 2	Illustrate the spreadsheets to perform data analysis.	Up to K4
CLO 3	Apply the visualization effects in charts to develop the result of data analysis in spreadsheets.	Up to K4
CLO 4	Analyze flexible data aggregations using pivot tables	Up to K4
CLO 5	Interpret skills to analyze the movement of data between multiple sheets and use macros .	Up to K4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	Programme Outcomes (with Graduate Attributes)						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
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CLO 2	2	3	3	3	3	3	2
CLO 3	2	3	3	3	3	3	3
CLO 4	3	3	3	3	3	2	3
CLO 5	2	3	3	3	3	3	3

3 – Advance Application 2 – Intermediate Level 1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Co-ordinator
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DEPARTMENT OF DATA SCIENCE & ANALYTICS				CLASS: I B.Sc Data Science & Analytics				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**Ext**	**Total**
II	DSC	22BDU08	**Pratical –II Python Programming & Spread Sheet**	2	4	50	50	100

Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	
	Skill Development	✓

Course Objectives

1. To understand the basic concepts of arrays and queue.
2. To illustrate the knowledge on stack and search operations.
3. To demonstrate linear search and sorting techniques.
4. To apply tools to perform interactive applications.
5. To implement the concept of bio computing techniques.

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	PRACTICAL – II PYTHON PROGRAMMING & SPREAD SHEET		**K Level**
Ex. No.	**Program List**	**Hours**	
1	Program to perform selection sort.	4	Up to K4
2	Create an application to get the currently selected radio button value using UI with TKinter in python.	6	Up to K4
3	Create an application window has two text input fields and another one to display the result using TKinter in Python.	6	Up to K4
4	Gene Sequence mining using Python.	6	Up to K4
5	Bio computing in Python.	6	Up to K4
6	Create a Bar Chart for the sales report of a company for the past three years and compare the result with its 4 branches sales and examine which branch is more profitable.	4	Up to K4
7	In cells A1 and A2, type 1000 and 1500 respectively. Use auto-complete to fill cells A3-	4	Up to K4

	A8. Calculate the following values for cells A1-A8 using built in excel functions: a. Sum b. Maximum c. Minimum d. Average e. Median f. Standard Deviation		
8	Create Spreadsheet by using the following functions Vlookup, Hlookup and Countif for result analysis of a class.	4	Up to K4
9	Apply Regression Analysis for particular company information.	4	Up to K4
10	Analyze data by: a. Creating a pivot table b. Filtering data using Slicers c. Analyzing data using Pivot Charts	4	Up to K4

Pedagogy : PowerPoint Projection through LCD, Demonstration

Rationale for Nature of the Course: Can be professionals in solving advanced problems using software.

Activities to be given

1. Create a pivot table in Excel for windows.
2. Create a Python Programming for sales report of a company for 5 years.

Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO 1	Recall the fundamentals concepts of arrays and queues.	Up to K4
CLO 2	Construct the program for stack, search operation.	Up toK4
CLO 3	Summarize the searching and sorting techniques	Up toK4
CLO 4	Explain the concepts on user interface to build GUI applications.	Up toK4
CLO 5	Identify certain types of biological problem like sequence alignment, gene detection, structure prediction.	Up toK4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	Programme Outcomes (with Graduate Attributes)						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CLO 1	3	3	3	3	3	2	3
CLO 2	3	3	3	3	2	3	3
CLO 3	3	3	3	3	3	3	2
CLO 4	3	3	3	3	3	2	2
CLO 5	3	2	3	3	3	3	3

3 – Advance Application 2 – Intermediate Level 1 – Basic Level

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DEPARTMENT OF DATA SCIENCE & ANALYTICS				CLASS: I B.Sc Data Science & Analytics				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**Ext**	**Total**
II	GE	22BDU09	**NUMERICAL METHODS**	4	5	50	50	100

Nature of Course		
Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	
	Skill Development	✓

Course Objectives

1. To find the solution of numerical Algebraic and Transcendental Equations.
2. To study various method for solving simultaneous linear algebraic equations.
3. To gain knowledge about finite difference operators.
4. To understand the concept of interpolation with equal intervals.
5. To know about interpolation with unequal intervals

Unit	Course Contents	Hours	K Level
Unit I	**The Solutions of Numerical Algebraic and Transcendental Equations** Bisection method – Iteration Method – Convergence condition –RegulaFalsi Method – Newton Raphson method – Geometrical meaning of Newton's method – Convergence Criteria – Order of Convergence. **Application of Iterative Method.**	**12**	Up to K4
Unit II	**Solution of Simultaneous Linear Algebraic Equations** Gauss Elimination method – Gauss Jordan method – Gauss Jacobi method – Gauss Seidel method **Applications of Linear Algebra.**	**12**	Up to K4
Unit III	**Interpolation (for equal intervals)** Gregory-Newton's forward and backward formulae – Equidistant terms with one or more missing values — Stirling's formula- simple problems **Applications of Interpolation.**	**12**	Up to K4
Unit IV	**Interpolation (for unequal intervals)** Divided differences – Properties – Relations between divided differences and forward differences – Newton's divided differences formula – Lagrange's formula and inverse interpolation. **Applications of Lagrange's formula.**	**12**	Up to K4

Unit V	**Numerical Differentiation** Newton's forward and back ward difference formula to get the derivatives. **Numerical Integration** Trapezoidal rule –Truncation error in Trapezoidal rule –Simpson's one –third rule –Simpsons three-eight rule (Problems only)	**12**	Up to K4

Note: The Questions should be asked in 80% Problems and 20 % for theory

Note: Distribution of marks for Internal Examination -50 and External Examination –50

Book for Study

1. Kandasamy. P, Thilagavathi. K and Gunavathi. K, *"Numerical methods", S. Chand and Company Ltd, New Delhi – Revised Edition 2007.*

Books for Reference

1. ***K.E.Atkinson****"An Introduction to Numerical Analysis", John Wiley & Sons Inc.,U.K., Second edition, 2008.*
2. ***S.S.Sastry****"Introductory Methods of Numerical Analysis", Prentice Hall of India Pvt. Ltd., New Delhi, Fourth edition, 2005.*
3. ***Numerical methods for scientific and Engineering computation by M.K.Jain, S.R.K.Iyengar and R.K.Jain***
4. *Introductory Methods of Numerical analysis by S.S.Sastry,, Prentice Hall of India Pvt Ltd, New Delhi 2000*

5.Numerical Methods by Balagurusamy, Tata Me Graw Hill Publishing Company Ltd, NewDelhi, 2002

Web Resources

1. *https://nptel.ac.in/courses/111/107/111107105/*
2. https://www.coursera.org/lecture/computers-waves-simulations/w8v5-python-lagrange- interpolation

Pedagogy : Chalk& Talk, Exercise, Assignments & PPTs.

Rationale for Nature of the Course

Can be professionals in solving advanced Numerical methods problems.

Activities to be given

1. Prepare advanced problems on Applications problems in Numerical methods.
2. Assignment on the Solutions of Numerical Algebraic and Transcendental Equations, Simultaneous Linear Algebraic Equations, Interpolation for both equal and unequal intervals, Numerical Differentiation and integration.
3. Preparing the students to appear professional courses by giving Advanced Exercise and Workout problems on Numerical methods.

Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO1	Solving and classify the Algebraic and Transcendental Equations.	Up to K4
CLO2	Classifying and analyze the Simultaneous Linear Algebraic Equations.	Up to K4
CLO3	Understanding and compare the concept of Finite difference.	Up to K4
CLO4	Finding and analyzing the Interpolation for equal intervals.	Up to K4
CLO5	Analyzing the Interpolation for unequal intervals.	Up to K4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	Programme Outcomes (with Graduate Attributes)						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CLO 1	3	3	2	3	3	3	3
CLO 2	3	3	2	3	3	3	3
CLO 3	3	3	2	3	3	3	3
CLO 4	3	3	2	3	3	3	3
CLO 5	3	3	2	3	3	3	3

3 – Advance Application 2 – Intermediate Level 1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Co-ordinator
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