

Centre for Distance and Online Education (VTU-CDOE)



Scheme and Syllabus

Post Graduate Diploma in Big Data Analytics



SEMESTER-I

Sl. No	Code	Course Name	Credit
1	OPGDBA101	Programming Using C	5
2	OPGDBA102	Database Management System	5
3	OPGDBA103	Computer Organization	5
4	OPGDBA104	DBMS Lab	2
5	OPGDBA105	C Programming Lab	3
TOTAL			20

SEMESTER-II

Sl. No	Code	Course Name	Credit
1	OPGDBA201	Data Structures Using C++	5
2	OPGDBA202	Python Programming	5
3	OPGDBA203	Software Engineering	5
4	OPGDBA204	Data Structures Lab	2
5	OPGDBA205	Python Lab	3
TOTAL			20

SEMESTER-III

Sl. No	Code	Course Name	Credit
1	OPGDBA301	Data Warehousing & Data Mining	5
2	OPGDBA302	Data Analytics Using Python	5
3	OPGDBA303	Fundamentals of Artificial Intelligence and Machine Learning	5
4	OPGDBA304	Data Analytics Lab	2
5	OPGDBA305	Mini-Project	3
TOTAL			20



SEMESTER-IV

Sl. No	Code	Course Name	Credit
1	OPGDBA401	Project Work	10
2	OPGDBA402	Big Data Analytics	5
3	OPGDBA403X	Elective – I	5

Elective –I			
Sl. No Course Code		Course Name	
1	OPGDBA403A	Natural Language Processing	
2	OPGDBA403B	Artificial Intelligence	
3	OPGDBA403C	Deep Learning	



Course	Programming in C	Semester	Ι		
Course Code	OPGDBA101	CIE Marks	30		
Credits	05	SIE Marks	70		
	MOD	ULE 1			
Introduction to progra simple programs. Intr character set, Identifie operators, constants, E output function	Introduction to programming – definitions and developing Algorithms and flowcharts for simple programs. Introduction to C Programming: Origin and history of c programming character set, Identifiers and keywords data types, constants, variables, operators, special operators, constants, Expressions, compound statements, structure of C program, Input and output function				
	MOD	ULE 2			
C Statements – selection statements – if nested if's, the if-else –if ladder the conditional expressions, switch statement nested switch statements, iteration statements – the for loop, for loop variations, the while loop, the do-while loop, declaring variable with in selection and iteration statements, jump statement, the return statement, the go to submit, break statement, exit () function, the continue statement, expression statement. Block statements.					
	MOD	ULE 3			
Arrays – Array what individual elements of an array element to a f Manipulation.	Arrays – Array what is an array? – Array Declaration, Array Initialization – Accessing individual elements of an array – Two Dimensional Arrays – Multi Dimensional Array, Passing an array element to a function – Rules of using an array. What are strings? String I/O, string Manipulation				
MODULE 4					
Functions – The General Form of a Function, Math functions, elements of function, function categories, types of functions, Function Arguments Call by value, Call by Reference, return statement. Uses of functions. C pre – processor, storage classes – Automatic – Register, Static and external. Pointers – definition, pointer variables, pointer expressions, arithmetic pointers, pointers and arrays, initializing pointers and functions and problems with pointers.					
MODULE 5					
Structures definition accessing structure members structure assignments array of structures					

Structures – definition, accessing structure members, structure assignments, array of structures, passing structures, structure pointers, uses of structures Unions – definitions, difference between structure and union, type def. Files – introduction to streams and files, basics of files – file pointer, opening and closing files, writing and reading character, file functions.

Recommended Text and Reference Books:

1. Let Us C by Yashwanth Kanethar.

2. "Programming in ANSI C" by E. Balaguruswamy.

3. Complete Reference of C++ by Herbert Schilde.

Course outcomes :

CO1: Describe the C Programming language which includes the structure of a C program, Tokens, Expressions, Operators etc.

CO2: Demonstrate conditional and iterative statements to write C programs.

CO3: Construct the C programs that use pointers to access arrays and strings.

CO4: Illustrate the user defined functions to solve real time problems.



Course	Database Management System	Semester	Ι	
Course Code	OPGDBA102	CIE Marks	30	
Credits	05	SIE Marks	70	
MODULE 1				

Introduction: Characteristics of Database approach, Actors on the Scene, Workers behind the scene, Advantages of using DBMS approach, Data models, schemas and instances, Three - schema architecture and data independence, Database languages and interfaces, the database system environment, Centralized and client -server architectures, Classification of Database Management systems, Entity-Relationship Model: Conceptual Database using high level conceptual data models for Database Design, A Sample Database Application, Entity types, Entity sets Attributes and Keys Relationship types, Relationship Sets, Roles and Structural Constraints Weak Entity Types.

MODULE 2

Relational Model Relational Model and Relational Algebra: Relational Model Concepts, Relational Model Constraints and Relational Database Schema Update Operations, Transactions and Dealing with Constraint violations, Unary Relational operations, Relational Algebra Operations from Set Theory, Binary Relational Operations, JOIN and DIVISION, Additional Relational Operations, Examples of Queries in Relational Algebra Relational Database Design Using ER-to Relational Mapping.

MODULE 3

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic structure of SQL Queries, Additional Basic Operations, Null values, Aggregate Functions, nested Sub queries, Modification of the Database, Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas, Authorization.

MODULE 4

Database Design: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms based on Primary Keys, General Definitions of 2nd and 3rd Normal Forms, Boyce Codd Normal Forms, Stored Procedures and functions, Triggers.

MODULE 5

Transaction Management: Transaction Concept, A Simple Transaction Model, Transaction Atomicity and Durability, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels. Concurrency Control: Lock Based Protocols, Deadlock Handling. Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm.

Recommended Text and Reference Books:

1. RamezElmasri, Shamkant B. Navathe, Fundamentals of Database Systems ,7th Edition, Pearson Education, 2017

2. Silberschatz, Korth and Sudharshan Data base System Concepts,6th Edition, Tata McGraw Hill, 2011.



Course Outcomes:

CO1: Figure out the concepts of database objects, enforce integrity constraints on a database using RDBMS.

CO2: Demonstrate Structured Query Language (SQL) for database manipulation and also the basic of query evaluation.

CO3: Develop application to interact with databases, relational algebra expression,

CO4: Construct an application using tuple and domain relation expression from queries.



Course	Computer Organization	Semester	I	
Course Code	OPGDBA103	CIE Marks	30	
Credits	05	SIE Marks	70	
	MODULE 1			
Basic Functional units	s of Computers: Functional units,	, basic Operationa	l concepts, Bus	
structures. Software,	Performance, Multiprocessors, Mu	ulticomputer. Data	Representation:	
Signed number represe	ntation, fixed and floating point Rep	presentations. Comp	puter Arithmetic:	
Addition and subtraction	on, multiplication Algorithms, Divis	ion Algorithms. Err	or detection and	
correction codes.				
	MODULE 2			
Register Transfer Lang	uage and Micro Operations: RTL- R	Registers, Register tr	ansfers, Bus and	
memory transfers. Mic	ro operations: Arithmetic, Logic, and	d Shift micro operat	tions, Arithmetic	
logic shift unit. Basic	Computer Organization and Desig	gn: Computer Regi	sters, Computer	
instructions, Instruction	n cycle. Instruction codes, Timing	and Control, Types	of Instructions:	
Memory Reference Inst	ructions, Input - Output and Interru	.pt.		
	MODULE 3	-		
Central Processing U	nit organization: General Register	Organization, Sta	ck organization,	
Instruction formats, A	ddressing modes, Data Transfer ar	nd Manipulation, P	rogram Control,	
CISC and RISC process	sors Control unit design: Design app	proaches, Control m	nemory, Address	
sequencing, micro prog	ram example, design of CU. Micro P	Programmed Control	1.	
	MODULE 4	0		
Memory Organization:	Semiconductor Memory Technologi	ies, Memory hierarc	hy, Interleaving,	
Main Memory-RAM	and ROM chips, Address map	p, Associative me	emory-Hardware	
organization. Match lo	ogic. Cache memory-size vs. block	size, Mapping fun	ctions-Associate,	
Direct, Set Associative	mapping. Replacement algorithms	, write policies. Au	uxiliary memory	
Magnetic tapes etc		-		
	MODULE 5			
Input -Output Organiz	ation: Peripheral devices, Input-outp	out subsystems, I/O	device interface,	
I/O Processor, I/O tra	nsfers-Program controlled, Interrup	ot driven, and DMA	A, interrupts and	
exceptions. I/O device	interfaces - SCII, USB Pipelining an	d Vector Processing	g: Basic concepts,	
Instruction level Parallelism Throughput and Speedup, Pipeline hazards.				
Recommended Text and Reference Books:				
1. Computer Organization – Carl Hamacher, Zvonks Vranesic, SafeaZaky, Vth Edition, McGraw Hill.				
2. Computer Systems Architecture – M.Moris Mano, IIIrd Edition, Pearson/PHI.				
Course Outcome (CO):				
CO1: Understand the Basics of Digital System				
CO2: Understand the Base	ics of Computer System Organization			
CO3: Apply the concepts	of the number system in Designing Digi	tal System.		
CO4: Analyze the need of	CO4: Analyze the need of Logic circuits in digital system			

CO5: Create logic circuits for real time requirement



Course	DBMS Lab	Semester	Ι
Course Code	OPGDBA104	CIE Marks	70
Credits	02	SIE Marks	30

1. Students should be allowed to choose appropriate DBMS software, install it, configure it and start working on it. Create sample tables, execute some queries, use SQLPLUS features, Use PL/SQL features like cursors on sample database. Students should be permitted to practice appropriate User interface creation tool and Report generation tool.

2. A college consists of number of employees working in different departments. In this context, create two tables' employee and department. Employee consists of columns empno, empname, basic, hra, da, deductions, gross, net, date-of-birth. The calculation of hra, da are as per the rules of the college. 1. Create tables department and employee with required constraints. 2. Initially only the few columns (essential) are to be added. Add the remaining columns separately by using appropriate SQL command 3. Basic column should not be null 4. Add constraint that basic should not be less than 5000. 5. Calculate hra, da, gross and net by using PL/SQL program.

3. Students may be divided into batches and the following experiments may be given to them to better understand the DBMS concepts. Students should gather the required information, draw ER diagrams, map them to tables, normalize, create tables, triggers, procedures, execute queries, create user interfaces, and generate reports.

- Student information system
- KSRTC reservation system
- Hostel management
- Library management
- Indian Railways reservation

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

CO1: Design entity-relationship diagrams to solve given database applications.

CO2: Implement a database schema for a given problem.

CO3: Formulate SQL queries in Oracle for the given problem.

CO4: Design and Develop suitable database and verify for its appropriate normalization for any given problem.



Course	C Programming Lab	Semester	Ι
Course Code	OPGDBA105	CIE Marks	30
Credits	03	SIE Marks	70

1. Write a C program to find roots of a Quadratic equation.

2 Write a C program to find the total no. of digits and the sum of individual digits of a positive integer.

3 Write a C program to generate the Fibonacci sequence of first N numbers.

4 Write a C program to compute Sin(x) using Taylor series approximation given by Sin(x) = x- x 3 3! + x 5 5! - x 7 7! + Compare output of the program with the built- in Library function. Print both the results with appropriate messages.

5 Write a C program to arrange the elements of an integer array using Bubble Sort algorithm.

6 Write a C program to search for an element in an array using Binary Search algorithm and print appropriate message.

7 Write a C program to input two matrices and perform matrix multiplication on them.

8. Write a C program to check whether the given string is palindrome or not without using Library functions.

9 Write a C program to count the number of lines, words and characters in a given text.

10 Write a C program to generate Prime numbers in a given range using user defined function.

11 Write a C program to find factorial of a given number using recursive function.

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1: Make use of IDE for programming, identify and correct the syntax and syntactic errors using various programming constructs.

CO2: Demonstrate use of functions, recursive functions, arrays, strings, structures and pointers in problem solving.

CO3: Design and development of C programs to implement different searching and

sorting techniques.



CourseData Structures Using C+++SemesterIICourse CodeOPGDBA201CIE Marks30Credits05SIE Marks70MODULE 1Introduction to Data Structure and its Characteristics Array Representation of single and multidimensional arrays; Sparse arrays - lower and upper triangular matrices and Tri-diagonal matrices with Vector Representation.70MODULE 2Stacks and QueuesIntroduction and primitive operations on stack; Stack application; Infix, postfix, prefix expressions; Evaluation of postfix expression; Conversion between prefix, infix and postfix, introduction and primitive operation on queues, D- queues and priority queues.MODULE 3ListsIntroduction to linked lists; Sequential and linked lists, operations such as traversal, insertion, deletion searching, two way lists.MODULE 4TreesIntroduction and terminology; Traversal of binary trees; Recursive algorithms for tree operations such as traversal, insertion, deletion; Binary Search TreeMODULE 5GraphsGraphsGraphsGraphsGraphsGraphsGraphsGraphsGraphsGraph terminology, Representation of graphs, path matrix, BFS (breadth first search), DFS (depth first search), topological sorting, Warshall's algorithmsCourse outcomes:CO1: Identify different types of data struct			r		
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El l' Dittil E (LE 1') 2010	3 Balagurusamy F	Object Oriented Programming wi	th C++. Tata	McGraw Hill	
Education PVt.Ltd., Fourth Edition 2010.	Education Pvt.Ltd . Fe	ourth Edition 2010.			
4. R.S. Salaria, " Data Structures & Algorithms", Khanna Book Publishing Co.	4. R.S. Salaria, "D	4. R.S. Salaria, " Data Structures & Algorithms", Khanna Book Publishing Co.			

(P)Ltd..,2002



Course	Python programming	Semester		
Course Code	OPGDBA202	CIE Marks	30	
Credits	05	SIE Marks	70	
	MODULE 1			
Python Basic Concepts	and Programming			
Parts of Python Pi	ogramming Language, Identifier	s, Keywords, S	tatements and	
Expressions, Variables	, Operators, Precedence and Associ	iativity, Data Type	es, Indentation,	
Comments, Reading I	nput, Print Output, Type Conversion	ons, The type() F	unction and Is	
Operator, Control Flo	w Statements, The if Decision Cont	trol Flow Statemer	nt, The ifelse	
Decision Control Flow	V Statement, The ifelifelse Decis	sion Control States	ment, Nested if	
Statement, The while	Loop, The for Loop, The continue	e and break State	ments, Built-In	
Functions, Commonly	Used Modules, Function Definitio	n and Calling the	Function, The	
return Statement and	void Function, Scope and Lifetime	of Variables, Defa	ult Parameters,	
Keyword Arguments,	*args and **kwargs, Command Line	Arguments.		
	MODULE 2			
Python Collection Ob	ects, Strings- Creating and Storing	Strings, Basic Stri	ng Operations,	
Accessing Characters	in String by Index Number, Str	ing Slicing and	Joining, String	
Methods, Formatting	Strings, Lists-Creating Lists, Basic	: List Operations,	Indexing and	
Slicing in Lists, Buil	lt-In Functions Used on Lists, L	ist Methods. Set	s, Tuples and	
Dictionaries. Files: read	ding and writing files		1	
	MODULE 3			
Object-oriented Desig	zn :Introducing object-oriented ,C	Objects and class	ses, Specifying	
attributes and behavio	ours : Data describes objects , Behav	viours are actions	Hiding details	
and creating the p	ublic interface: Composition, Inl	heritance: Inherit	ance provides	
abstraction, Multiple	inheritance Objects in Python : Cr	reating Python cla	asses , Adding	
attributes, Making a	function work: passing argumer	nts, Initializing t	he object, self	
argument	1 0 0	0	,	
	MODULE 4			
Modules and packag	es: Organizing the modules, Abso	olute imports, Re	lative imports,	
Organizing module	contents: Access control, Third-pa	arty libraries, Bas	sic inheritance,	
Extending built-ins, C	Overriding and super, Multiple inh	eritance, The dia	nond problem,	
Different sets of argun	nents		1	
MODULE 5				
Polymorphism , Abstr	cact base classes, Using an abstract	base class, Creat	ing an abstract	
base class Exceptions: Raising exceptions, The effects of an exception, Handling exceptions,				
The exception hierarchy, Defining our own exceptions				
Course outcome (Course Skill Set)				
At the end of the course the student will be able to:				
CO1 : Demonstrate proficiency in handling loops and creation of functions				
CO2 : Illustrate the methods to create and manipulate lists, tuples and dictionaries.				
CO3: Design and Develop programs for string processing and file organization.				

CO4: Interpret the concept of OOP as used in Python



Suggested Learning Resources: Books

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016

2. Python 3 Object Oriented Programming, 2nd Edition, Unleash the power of Python 3 Objects by Dusty Phillips, PACKT Publishing.

3. Python Object–Oriented Programming :Build robust and maintainable Object-oriented python applications and libraries, Steven F. Lott, Dusty Philips,4th Edition, Packt Publishing Limited; 2021

4. Python the complete reference ,Martin C. Brown,4th Edition, McGraw Hill Education ,2018

Web links and Video Lectures (e-Resources): http://greenteapress.com/wp/thinkpython/



Course	Software Engineering	Semester	II	
Course Code	OPGDBA203	CIE Marks	30	
Credits	05	SIE Marks	70	
	MODULE 1			
Introduction: Software	e Products and Software process, P	rocess models: W	aterfall modal,	
Evolutionary Develop	oment, Bohemia's Spiral model, G	Overview of risk	management,	
Process Visibility, Pr	rofessional responsibility. Comput	ter based System	n Engineering:	
Systems and their env	ironment, System Procurement, System	tem Engineering I	Process, System	
architecture modeling.	Human Factors, System reliability F	Engineering.		
	MODULE 2			
Requirements and Sp	pecification: The requirement Eng	ineering Process,	The Software	
requirement documen	t, Validation of Evolution of requir	ements, Viewpoir	nt – oriented &	
method based analy	sis, system contexts, Social 7 org	ganizational facto	rs. Data flow,	
Semantic, Objects, mod	dels, Requirement Specification, Non	n functional requir	ement.	
	MODULE 3			
Software Prototyping	: Prototyping in software process	s, Prototyping tee	chniques, User	
interface prototyping.	Software Design: Design Process, D	esign Strategies, I	Design Quality,	
System Structuring con	ntrol models, Modular decompositio	n, Domain Specifi	c architecture.	
	MODULE 4			
Object Oriented& fun	ction oriented design: Objects, objec	ct Classes and inh	eritance Object	
identification, An obje	ect oriented design example, Concu	arrent Objects, Da	ta flow design	
Structural decomposi	tion, Detailed Design, A Compari	ison of design S	trategies. User	
interface design: Desig	n Principles, User System interaction	n, Information Pre	esentation, User	
Guidance, Interface Ev	valuation.			
	MODULE 5			
Software Verification	and Validation : The testing Proce	ess , Test Plannin	g & Strategies,	
Black Box , Structura	ll, interface testing , Program insp	pections , Mathen	natically based	
verification, Static ana	lysis tools, Clean room software de	evelopment. Mana	gement Issues:	
Project management	, Quality management, Softwa	re cost estimat	ion, Software	
maintenance.				
Course outcomes:				
CO 1: Describe a software system, component, or process to meet desired needs within				
realistic constraints.				
CO 2: Compare professional and ethical responsibility'				
CO 3: Apply the techniques, skills, and modern engineering tools necessary for engineering				
practice, design, implement, verify, validate, implement, and maintain software systems or				

parts of software systems



(State University of Government of Karnataka Established as per the VTU Act, 1994)

Centre for Distance and Online Education (VTU-CDOE)

Suggested Learning Resources: Books

1. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012.

2. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005.

3. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.

4. Stephan R. Schach, "Object oriented software engineering", Tata McGrawHill,2008



Course	Data Structure Lab	Semester	II
Course Code	OPGDBA204	CIE Marks	30
Credits	02	SIE Marks	70

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

2. Write a C++ program to search for an element in an array using Binary search.

3. Write a C++ program to sort a list of N elements using Merge sort technique.

4. Write a C++ program to sort a list of N elements of integer type using Quick Sort technique.

5. Write a C++ program to find the Binomial Coefficient using recursion.

6. Write a C++ program to simulate the working of Towers of Hanoi problem for N disks, print the moves taken by the problem using recursion.

7. Write a C++ program to demonstrate the working of a stack using an array. The elements of the stack may be integers. Operations to be supported are 1.PUSH, 2.POP 3.DISPLAY. The program should print appropriate messages for STACK overflow, Underflow.

8. Write a C++ program to implement the operations of a Queue using linked list.

Course outcomes:

CO 1 : Illustrate different types of data structures, operations and algorithms, searching and sorting operations on files

CO 2: Design & develop the working of stack, Queue, Lists in problem solving & implement all data structures



Course	Python Lab	Semester	II	
Course Code	OPGDBA205	CIE Marks	30	
Credits	03	SIE Marks	70	
Course Learning Obj	ectives:			
CLO1: To be able to	introduce core programm	ning basics and p	program design with	
functions using Pytho	n programming language.			
CLO2: To understand	d a range of Object-Orient	ed Programming	, as well as in-depth	
data and information	processing techniques.			
CLO3: To understan	d the high-performance p	orograms designe	ed to strengthen the	
practical expertise.				
1. Write a progra	am to sum all the elements	s from n1 to n2	where n1 and n2 are	
positive integer	rs.			
2. Input an array and negative n	of n numbers and find se umbers.	parately the sum	of positive numbers	
3. Write a program	n to search an element using	linear search		
4. Write a program	n to search an element using	binary search.		
5. Write a program	n to simulate stack.	2		
6. Using a stack ev	aluate an arithmetic express	sion.		
7. Write a program	n to multiply two matrices			
8. Write a program	n to find the roots of a quad	atic equation		
9. Write a program	n to Insert a number in a sor	ted array.		
10. Write a Python	Program to check whether	the given string is	palindrome or not	
using built in st	ring manipulation methods.			
11. Write a Python	Program to read a word an	d prints the num	ber of letters, vowels	
and percentage of vowels in the word using dictionary				
12. Write a Python Program to check a given sentence is a pangram or not using				
function/Modu	ule.			
Course Outcomes: At the end of the course the student will be able to:				

CO1: Demonstrate proficiency in handling loops and creation of functions.

CO2: Illustrate the methods to create and manipulate lists, tuples and dictionaries in Python Programme.

CO3: Design and Develop programs for string processing and file organization and use the concept of OOP as used in Python.



Course	Data Warehousing & Data Mining	Semester	III	
Course Code	OPGDBA301	CIE Marks	30	
Credits	05	SIE Marks	70	
	MODULE 1			
Data warehousing a	ind OLAP Data Warehouse basi	c concepts, Da	ata Warehouse	
Modeling, Data Cube	e and OLAP: Characteristics of OLA	AP systems, Mu	ultidimensional	
view and Data c	ube, Data Cube Implementation	ns, Data Cul	be operations,	
Implementation of OI	LAP and overview on OLAP Softwa	re.		
	MODULE 2			
Data Mining and its	6 Applications Introduction, What	is Data Mini	ng, Motivating	
Challenges, Data Mir	ing Tasks, Which technologies are u	used for data m	ining, Kinds of	
pattern that can be	mined, Data Mining Application	ns, Data Prepr	ocessing, Data	
cleaning, data integra	tion, data reduction and data transfe	ormation.		
	MODULE 3			
Association Analysis	: Basic Concepts and Algorithms l	Frequent Item s	set Generation,	
Rule Generation, Con	npact Representation of Frequent I	tem sets, Altern	native methods	
for generating Frequ	ent Item sets, FP Growth Algorith	nm, Evaluation	of Association	
Patterns				
	MODULE 4		1 1	
to solve classification Classifiers. Bayesian methods, Improving classification methods	problem, Decision Trees, Rule Based Classifiers, Estimating Predictiv accuracy of classification meth , Multiclass Problem.	d Classifiers, Ne e accuracy o ods, Evaluatic	earest Neighbor f classification on criteria for	
	MODULE 5			
Clustering Techniques Overview, Features of cluster analysis, Types of Data and Computing Distance, Types of Cluster Analysis Methods, Partition Methods, Hierarchical Methods, Density Based Methods, Quality and Validity of Cluster Analysis				
Recommended Text a	and Reference Books:			
1. Jiawei Han and M	IichelineKamber: Data Mining - C	Concepts and To	echniques, 2nd	
Edition, Morgan Kaufmann Publisher, 2006.				
2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining,				
Addison- Wesley, 2005.				
3. Arun K Pujari: Data Mining Techniques University Press, 2nd Edition, 2009.				
4. G. K. Gupta: Introduction to Data Mining with Case Studies, 3rd Edition, PHI, New Delhi, 2009.				
5. Alex Berson and	Stephen J.Smith: Data Warehousi	ng, Data Minii	ng, and OLAP	
Computing McGrawHill Publisher, 1997.				



Course Outcome (CO): At the end of this course, the students will be able to

CO1: Learn the concept of Data warehousing and OLAP.

CO2: Understand storage and retrieval technique of data from DATA CUBE.

CO3: Analyze different types of data and different preprocessing techniques.

CO4: Evaluate various Association algorithms and its applications.

CO5: Apply different Classification technique.

CO6: Evaluate different types of classifiers.

CO7: Analyze different clustering techniques and their applications



Course	Data Analytics Using Python	Semester	III	
Course Code	OPGDBA302	CIE Marks	30	
Credits	05	SIE Marks	70	
	MODULE 1			
Revisiting Python: Stri	ngs- String Slicing and Joining, Stri	ng Methods, Lists	G-Creating Lists,	
Indexing and Slicing in	n Lists, List Methods. Sets, Tuples an	d Dictionaries. Fi	les: reading and	
writing files. Loading	from CSV files, Accessing SQL datab	oases.		
	MODULE 2			
USING NUMPY: Basic	s of NumPy-Computation on NumP	Py-Aggregations-O	Computation on	
Arrays Comparisons, N	Masks and Boolean Arrays-Fancy Ind	dexing-Sorting Ar	rays-Structured	
Data: NumPy's Structu	ired Array.			
	MODULE 3			
DATA MANIPULATI	ON WITH PANDAS: Introduction to	o Pandas Objects	- Data indexing	
and Selection - Operation	ing on Data in Pandas Handling Mis	sing Data - Hiera	rchical Indexing	
- Combining Data Sets	- Aggregation and Grouping - Pivot	Tables.		
	MODULE 4			
Web Scraping And N	umerical Analysis Data Acquisition	by Scraping web	o applications -	
Submitting a form -	Fetching web pages - Downloa	ding web pages	through form	
submission - CSS Selec	ctors.			
	MODULE 5			
VISUALIZATION AN	D MATPLOTLIB Basic functions of	of matplotlib - Sin	mple Line Plot,	
Scatter Plot - Density	and Contour Plots Histograms, Bini	nings and Density	<i>-</i> Customizing	
Plot Legends, Colour H	Bars – Three Dimensional Plotting in	Matplotlib.		
Textbooks/References				
[1] Jake VanderPlas, Py	thon Data Science Handbook - Essenti	al Tools for Worki	ng with Data,	
O Kelly Media Inc., 2010	o.	mming Coringon	Dublications	
[2] Zhang, Y, An Introdu 2016	iction to Python and Computer Progra	amming, Springer	Publications,	
References :				
[1] Joel Grus, Data Scie	ence from Scratch First Principles with	n Python, O'Reilly	Media, 2016. [2]	
T.R.Padmanabhan, Prog	gramming with Python, Springer Publ	ications, 2016.		
Course Outcomes				
CO1 Demonstrate the use of built in objects of Python				
CO2 Demonstrate sig	nificant experience with python pro	ogram developm	ent	
environment				
CO3 Implement num	erical programming, data handling	and visualization	n through	
NumPy, Pandas and MatplotLib modules				



Course	Fundamentals of Artificial	Semester	III	
	Intelligence and Machine Learning			
Course Code	OPGDBA303	CIE Marks	30	
Credits	05	SIE Marks	70	
MODULE 1: Introduc	ction to AI and Machine Learning			
Introduction to AI and	d ML (2 hour): Definition of Artificial	Intelligence (AI)	and Machine	
Learning (ML), Historical context and key milestones, Applications of AI and ML in real-				
world scenarios, Types of Machine Learning (4 hour): Supervised learning, unsupervised				
learning, and reinforcement learning, Examples of applications for each type, Overview of				
supervised and unsupervised algorithms, Basics of Data and Feature Engineering (2 hours):				
Importance of data quality and pre-processing, Data representation and feature extraction,				

Handling missing data and categorical variables Evaluation Metrics (2 hour): Accuracy, precision, recall, F1-score, ROC curve, AUC

Selecting appropriate metrics for different tasks, Trade-offs between different metrics

MODULE 2: Supervised Learning

Linear Regression (2 hours): Introduction to linear regression, Simple and multiple linear regressions, Model training, evaluation, and interpretation. Classification Algorithms (5 hours): Logistic regression, Decision trees and random forests, Naive Bayes classifier, Support Vector Machines (2 hours): Introduction to SVM, Linear SVM and kernel trick Hyperparameter tuning and model evaluation

MODULE 3: Unsupervised Learning

Clustering (4 hours): K-means clustering, Hierarchical clustering, Evaluating cluster quality, Dimensionality Reduction (3 hours): Principal Component Analysis (PCA) t-Distributed Stochastic Neighbor Embedding (t-SNE), Applications and benefits of dimensionality reduction. Anomaly Detection (3 hours): Identifying anomalies in data, Approaches to anomaly detection, Real-world use cases.

MODULE 4: Neural Networks and Deep Learning

Introduction to Neural Networks (3 hours): Basics of artificial neurons, Activation functions and network architectures, Feed forward and back propagation, Convolutional Neural Networks (4 hours): Basics of CNNs, Image classification and object detection, Transfer learning and pre-trained models, Recurrent Neural Networks (3 hours), Understanding RNNs, Applications in sequential data processing

Long Short-Term Memory (LSTM) and Gated Recurrent Units (GRU).

MODULE 5: Practical Applications and Future Trends

Natural Language Processing (4 hours), Introduction to NLP and its challenges

Text pre-processing and tokenization, Basics of sentiment analysis and text generation AI Ethics and Bias (3 hour), Ethical considerations in AI and ML, Addressing bias and fairness in algorithms, Responsible AI development, Future Trends in AI and ML (3 hour), Reinforcement learning advancements, Generative Adversarial Networks (GANs), Explainable AI and interpretable models.



Course outcome (Course Skill Set):

At the end of the course the student will be able to :

CO1. Illustrate the foundational principles, mathematical tools and program paradigms of AI and fundamental principles of machine learning.

CO2. Demonstrate the formal methods of knowledge representation and Formulation of a Machine Learning problem.

CO3. Showcase the usage of intelligent agents for Artificial Intelligence programming techniques and Develop a model using supervised/unsupervised machine learning algorithms for classification/prediction/clustering.

CO4. Interpret logic reasoning and problem solving techniques for AI applications

Reference Book

1. AurolienGeron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow, Shroff/O'Reilly", 2017

2. Andreas Muller and Sarah Guido, "Introduction to Machine Learning with Python: A Guidefor Data Scientists", Shroff/O'Reilly, 2016

3. Andrew Ng, Machine learning yearning, https://www.deeplearning.ai/machine-learningyearning/

4. Russell, Norvig, Artifificial Intelligence: A Modern Approach, Third edition, Prentice Hall,2010



Course	Data Analytics Lab	Semester	III		
Course Code	OPGDBA304	CIE Marks	30		
Credits	02	SIE Marks	70		
Course objectives:					
CLO 1. Illustrate the	easoning on Uncertain Kno	wledge			
CLO 2. Explore the ex	xplanation-based learning in	solving AI probl	ems		
CLO 3. To explore ad	vanced career opportunities	5			
CLO 4. Demonstrate	the applications of soft comp	puting and Evolution	tionary Computing		
algorithms					
Laboratory Experime	ents:				
1. Write a Python pro	gram to insert an element in	to a sorted list			
2. Write a python pro	gram using object oriented j	programming to c	lemonstrate		
encapsulation, over	loading and inheritance				
3. Demonstrate Aggre	egation				
4. Demonstrate handl	ing of missing data				
5. Demonstrate Index	ing and Sorting				
6. Implement a pytho	n program to demonstrate t	he following usin	g NumPy - Array		
manipulation, Sear	ching, Sorting and splitting.				
7. Demonstrate hierar	chical indexing				
8. Demonstrate Scatte	r Plot				
9. Demonstrate 3D pl	otting				
Course outcome (Cou	ırse Skill Set)				
At the end of the course the student will be able to:					
CO1. Demonstrate the use of built-in objects of Python					
CO2. Demonstrate significant experience with python program development					
environment	environment				
CO3. Implement numerical programming, data handling and visualization through					
NumPy, Pandas	s and MatplotLib modules				



Course	Mini Project	Semester	III
Course Code	OPGDBA305	CIE Marks	30
Credits	03	SIE Marks	70

1. Must develop the mini project using the using technologies learnt in the current semester and previous semesters – A with user interfaces and database connectivity. During the examination, student must demonstrate the project.

- 2. Student must submit a brief project report (20-25 pages) that must include the following
- a. Introduction
- b. Requirement Analysis
- c. Software Requirement Specification
- d. Analysis and Design,
- e. Implementation
- f. Testing

3. Brief synopsis not more than two pages to be submitted by the Student. It is recommended that students to do prior art search as part of literature survey before submitting the synopsis for the Mini/Major projects.

4. Rubrics may be used to evaluate the Mini-Project.

The goal of this Mini Project course is to help the student apply the theories and important tools they studied in this program to practice and mobilize the students for the next semester Major Project.

Course outcomes: At the end of this course, the students will be able to

- Illustrate effective user interfaces
- Develop applications using the technologies learnt
- Establish various methods to integrate database
- Design and develop open source software based applications



Course	Project Work	Semester	IV	
Course Code	OPGDBA401	CIE Marks	30	
Credits	10	SIE Marks	70	
	General Rules			
• The candidate should	carry out the project individually in any	industry or R&	D	
institution or education	onal institution under a guide/co-guide.			
• The candidate has to	present the work carried out before the e	xaminers during	g the	
University examination	on.			
• The work out carried	out should be free from plagiarism as pe	r the guideline		
provided by the univ	ersity.	<i>.</i>		
• The literature study n	nay be clearly written which may be sum	mary of existing	g project	
and highlight of what	t are the functionalities that are proposed	to this project.	and a f	
• Student shall indicate	the different research papers, document	s refereed as a p	part of	
une merature study. It	ing the supersister the projects	s part of interact	lle	
• This is an individual	project for a duration of minimum of 4 m	onthe or duratio	on of the	
semester				
Regular project work	weekly diary should be maintained by the	ne students, siør	ned by	
the external guide an	d internal guide in order to verify the res	gularity of the st	udent.	
• Project work may be a	application/testing or research-oriented	and accordingly	the	
project report content	s may vary.	05		
• The presentation show	ıld be given at various levels such as Syr	opsis, SRS, Des	ign and	
Project implementation	on/ completion levels.	-	0	
 Student has to publish 	h a paper in conference or journal of eithe	er National or		
International level				
Paper publication in a	an indexed journal/conference is compu	sory as part of t	he	
project work.				
• Publications follow th	ne Thesis. 10% weightage is given in SEE.		V0 15	
• There shall be three p	roject presentations each to be considere	d for 5 marks (5	X3=15	
marks) and a final pre	esentation for 15 marks. Presentation may	y be given using	Power	
point presentation/ de	monstrations of the work. Synopsis such	hitted in a prope	er	
• The students are infer	ed for 10 marks.	as proscribed by	the	
University However	as por the title / domain of the project wi	th a suitable	ule	
iustification guide / department can make the minor changes				
• If the project report is not as per the format internal guide / external examiner will				
have every right to reject the project				
• The Students are encouraged and appreciated to show their project demo along with				
their power point during their viva-voce exams as an added advantage.				
• In case of the paper p	ublication could not be completed before	the submission	of the	
report, or acceptance	received from the organizer of the confer	ence / journal		
authorities should be i	ncluded while uploading/submitting the	e report to the u	niversity.	
	<u>_</u>			



Course outcomes: At the end of the course the student will be able to:

 \Box Present the project and be able to defend it.

 $\hfill\square$ Make links across different areas of knowledge and to generate, develop and evaluate ideas

and information so as to apply these skills to the project task.

□ Habituated to critical thinking and use problem solving skills

□ Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.

□ Work in a team to achieve common goal.

□ Learn on their own, reflect on their learning and take appropriate actions to improve it.



Course	Big Data Analytics	Semester	IV
Course Code	OPGDBA402	CIE Marks	30
Credits	05	SIE Marks	70

Course Objectives:

CLO 1. To provide an overview of an exciting growing field of big data analytics.

- CLO 2. To introduce the tools required to manage and analyze big data like Hadoop, NoSQL, and Map-Reduce.
- CLO 3. To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
- CLO 4. To enable students to have skills that will help them to solve complex real-world problems for decision support

MODULE 1

Introduction to Big Data: What is big data, why big data, the convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open-source technologies, cloud and big data, mobile business intelligence, Crowd-sourcing analytics, inter and trans firewall analytics.

MODULE 2

No SQL: Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, masterslave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.

MODULE 3

Hadoop: Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures.

MODULE 4

MapReduce: MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats.

MODULE 5

Recent Trends in Big Data Analytics: HBase, data model and implementations, HBase clients, HBase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration, Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.



Textbooks / References:

- 1. Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning, Raj Kamal, Preeti Saxena, McGraw Hill, 2018.
- 2. Big Data, Big Analytics: Emerging Business intelligence and Analytic Trends for Today's Business, Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, John Wiley & Sons, 2013.

Reference Books:

- 1. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013
- 2. Hadoop: The Definitive Guide, Tom White, Third Edition, O'Reilly, 2012.
- 3. Hadoop Operations, Eric Sammer, O'Reilly, 2012.
- 4. Programming Hive, E. Capriolo, D. Wampler, and J. Rutherglen, O'Reilly, 2012.
- 5. HBase: The Definitive Guide, Lars George, O'Reilly, 2011.
- 6. Cassandra: The Definitive Guide, Eben Hewitt, O'Reilly, 2010.
- 7. Programming Pig, Alan Gates, O'Reilly, 2011.

E-Books:

1.http://index-of.co.uk/Big-

DataTechnologies/Data%20Science%20and%20Big%20Data%20Analytics.pdf

Course Outcomes

CO1 Describe big data and use cases from selected business domains.

CO2 Explain NoSQL big data management.

CO3 Install, configure, and run Hadoop and HDFS.

CO4 Perform mapreduce analytics using Hadoop.

CO5 Use Hadoop related tools such as HBase, Cassandra, and Hive for big data



Course	Natural Language Processing	Semester	IV	
Course Code	OPGDBA403A	CIE Marks	30	
Credits	05	SIE Marks	70	
	MODULE 1			
Basics of Machine I	earning, Python Programming la	anguage, Basics	of Probability,	
Introduction - termi	nologies - empirical rules - Sta	tistical Properti	ies of words -	
Probability and NLP	- Vector Space Models - Pre-pro	cessing Tokeniz	ation, Parts-Of-	
Speech (POS) tagging	, chunking, syntax parsing, Depen	dency parsing.		
	MODULE 2			
Vector Representation	n of words – Contextual Understa	nding of text – (Cooccurrence of	
matrix - N-grams - I	Dense Word Vector. Word2Vec – O	CBOW and Skip	-gram Models -	
One-word learning an	chitecture- Forward pass for Word	l2Vec – Reductic	on of complexity	
- subsampling and 1	negative sampling. Continuous Sk	kip-Gram Model	l, GloVe, BERT,	
XLNet.				
	MODULE 3			
NLP Applications: N	amed Entity Recognition, Sentime	ent analysis, Tex	t categorization	
using Machine learn	ing algorithms, SVD and Latent s	semantic Indexir	ng, Probabilistic	
Latent Semantic Inde	xing (pLSI) and Latent Dirichlet Al	location (LDA).		
	MODULE 4			
Deep Learning for	NLP: Neural Networks Basics, 2	Feedforward N	eural Network,	
Recurrent Neural Ne	tworks, LSTM, An Introduction to	Transformers an	nd Sequence-to-	
Sequence Learning.				
Historical Approach	es to Machine Translation - Sta	itistical Machine	e Translation –	
Translation Models -	Healthcare Data analysis and Text	visualization:		
	MODULE 5			
Summarizing length	y blocks of narrative text, such	as a clinical no	te or academic	
journal article. Answe	ering unique free-text queries that	require the synth	nesis of multiple	
data sources. Introd	uce Mathematical and programm	ning tools to vi	isualize a large	
collection of text docu	iments.			
Textbooks / Reference	25:			
1. C.D. Manning et al,	"Foundations of Statistical Natural I	Language Process	sing," MIT Press.	
MIT Press, 1999. isbn:	9780262133609.			
2. James Allen, "Natur	al Language Processing with Pythor	n", O'Reilly Medi	a, July 2009.	
3. NiladriSekhar Dash	and S. Arulmozi, Features of a Corp	us. Singapore: Sp	oringer	
Singapore,2018, pp. 17	-34. ISBN: 978-981-10-7458-5.	- ·		
4. Ian Goodfellow, YoshuaBengio, and Aaron Courville, Deep Learning,				
http://www.deeplear	ningbook.org. MIT Press, 2016.	1 1	. "	
5. NitinIndurkhya and	5. NitinIndurkhya and Fred J Damerau, "Handbook of natural language processing,"			
Chapman and Hall/CRC, 2010.				
o. Daniel Juratsky and	James H. Martin Speech and Lang	uage Processing:	An introduction	
to Natural Language Processing, Computational Linguistics, and Speech Recognition," 1st.				
opper Saddie Kiver, N	ј, USA: ГТЕПИСЕ ПАП РТК, 2000. ISDI	11. 0130930096.		
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Course Outcomes

CO1 Discern the concept of POS tagging and CFG for the English language.

CO2 Cognize the Vector Representation of words and skip gram models

CO3 Explore semantic analysis algorithms and deep learning techniques, to apply them in various NLP applications.

CO4 Acquainted with Mathematical and programming tools for implementing NLP applications.



Course

IV

Semester

Artificial Intelligence

Course Code	OPGDBA403B	CIE Marks	30
Credits	05	SIE Marks	70
Course Objectives: CLO 1. Illustrate the re CLO 2. Explore the exp CLO 3. To explore adv CLO 4. Demonstrate the algorithms	easoning on Uncertain Knowledge planation-based learning in solving ranced career opportunities he applications of soft computing and	AI problems Evolutionary Com	puting
	MODULE 1		
Artificial Intelligence – Basics, The AI Problems – The Underlying Assumption – What is an AI technique – Criteria for Success. Problems, Problem Spaces and Search – Defining Problem as a State Space Search – Production Systems – Problem Characteristics – Production System Characteristics – Issues in the design of Search			
	MODULE 2		
Heuristic Search Techniques - Generate – and – Test – Hill Climbing – Best-First Search – Problem Reduction – Constraint Satisfaction - Means - Ends Analysis. Knowledge Representation issues – Representations and Mapping - Approaches to knowledge Representation			
	MODULE 3		
Issues in knowledge Representation – The Frame Problem. Case study based on search algorithms. Using Predicate Logic – Representing simple facts in Logic – Representing Instance and Isa Relationship – Computable Functions and Predicates – Resolution – Natural Deduction. Representing Knowledge Using Rules – Procedural versus Declarative knowledge.			
	MODULE 4		
Logic Programming – Forward versus Backward Reasoning – Matching – Control Knowledge. Case study based on reasoning Reasoning under Uncertainty – Introduction to Non-monotonic Reasoning – Augmenting a Problem Solver – Implementation: Depth - First Search, Fuzzy Logic.			
MODULE 5			
Game Playing - The Minimax Search Procedure – Adding Alpha-Beta Cut-offs. Applications of artificial intelligence- Case study on social networks using neural networks, DNA sequencing using AI techniques.			



Textbooks / References:

1. Artificial Intelligence (Second Edition) – Elaine Rich, Kevin knight (Tata McGraw-Hill)

2. A Guide to Expert Systems – Donald A. Waterman (Addison-Wesley)

3. Principles of Artificial Intelligence – Nils J. Nilsson (Narosa Publishing House)

4. Introduction to Artificial Intelligence – Eugene Charnaik, Drew McDermott (Pearson Education Asia)

Course Outcomes

- **CO1** To be aware of the basics of AI and its need along with the issues in designing search problems.
- CO2 Understand and apply various search algorithms in real world problems.
- **CO3** To get a thorough idea about the fundamentals of knowledge representation, inference and theorem proving.

CO4 Express and comprehend the working knowledge of reasoning in the presence of incomplete and/or uncertain information.

CO5 To gain the aptitude to apply knowledge representation and reasoning to real world problems



Course	Deep Learning	Semester	IV	
Course Code	OPGDBA403C CIE Marks 30			
Credits	05	SIE Marks	70	
Course Objectives:				
CLO 1. Figure out the	e context of neural networks and d	leep learning.		
CLO 2. Know how to	use a neural network			
CLO 3. Explore the da	ata needs of deep learning			
CLO 4: Have a working	ng knowledge of neural networks	and deep learning	r)	
CLO 5: Explore the pa	arameters for neural networks			
	MODULE 1			
Machine Learning Basics: Learning Algorithms, Capacity, Overfitting and Underfitting,				
Hyperparameters ar	nd Validation Sets, Estimator,	Bias and Varian	ce, Maximum	
Likelihood Estimation, Bayesian Statistics, Supervised Learning Algorithms,				
Unsupervised Learni	Unsupervised Learning Algorithms, Stochastic Gradient Decent, building a Machine			
Learning Algorithm,	Learning Algorithm, Challenges Motivating Deep Learning.			
MODULE 2				
Deep Feedforward Networks: Gradient-Based Learning, Hidden Units, Architecture				
Design, BackPropagation. Regularization: Parameter Norm Penalties, Norm Penalties as				
Constrained Optimization, Regularization and Under-Constrained Problems, Dataset				
Augmentation, Noise Robustness, SemiSupervised Learning, Multi-Task Learning,				
Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations,				
Bagging, Dropout.				
MODULE 3				
Optimization for T	Training Deep Models: How	Learning Differs	s from Pure	

Optimization for Training Deep Models: How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms. Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates. Convolutional Networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution

Algorithms, Random or Unsupervised Features. MODULE 4

Sequence Modelling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks. Long short-term memory

MODULE 5

Practical Methodology: Performance Metrics, Default Baseline Models, Determining Whether to Gather More Data, Selecting Hyperparameters, Debugging Strategies, Example: Multi-Digit Number Recognition. Applications: Vision, NLP, Speech.



Text Books:

1. Deep Learning , Ian Good fellow and YoshuaBengio MIT Press https://www.deeplearn ingbook.org/2016.

Reference Books:

- 2. Neural Networks: Asystematic Introduction, Raúl Rojas 1996.
- 3. Pattern Recognition and machine Learning, Chirstopher Bishop 2007.

Web links and Video Lectures (e-Resources):

- https://www.simplilearn.com/tutorials/deep-learning-tutorial
- https://www.kaggle.com/learn/intro-to-deep-learning
- <u>https://www.javatpoint.com/deep-learning</u>

Course Outcomes

- CO1: Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
- CO2: Implement deep learning algorithms and solve real-world problems.
- CO3: Execute performance metrics of Deep Learning Techniques.







Postgraduate Diploma in Software Testing / Postgraduate Diploma in Postgraduate Diploma in Cyber Security and Cloud Computing / Postgraduate Diploma in Big Data Analytics / Postgraduate Diploma in Artificial Intelligence and Data Science

ASSESSMENT GUIDELINES (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 30% and for Semester End Exam (SEE) is 70%. The minimum passing marks for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 50% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements (passed) and earned the credits allotted to each course if the student secures not less than 50% in the sum total of the CIE and SEE taken together.

Continuous Internal Evaluation:

The CIE will be for 30 Marks. A candidate shall obtain not less than 50% of the maximum marks prescribed for the CIE. CIE Marks will be based on 30 objective type questions (MCQ's, Fill in the blanks, one word answer, etc.) from all the Modules. Equal weightage should be given to all the modules.

Semester End Examination:

The SEE question paper will be set for 70 marks & will have three sections

- Section-A consists of 20 objective type questions carrying 1 mark each. All questions are compulsory
- Section-B consists of 8 questions carrying 10 marks each. The students will have to answer 5 complete questions





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CD

Postgraduate Diploma in Software Testing / Postgraduate Diploma in Postgraduate Diploma in Cyber Security and Cloud Computing / Postgraduate Diploma in Big Data Analytics / Postgraduate Diploma in Artificial Intelligence and Data Science

Project Work	Semester	IV		
Course Code	OPGDAD401/ OPGDBA401/ OPGDST401/ OPGDCC401	CIE Marks	30	
Teaching Hours/Week (L: P: SDA)	0:4:0	SEE Marks	70	
Credits	10	Exam Hours	03	

PROJECT WORK GUIDELINES

Objective

To expose the students to understand the working of the organization/company/ industry and take up an in-depth study of an issue/problem in the area of specialization.

General guidelines

- Each candidate shall carry out the project work independently as per Scheme of Teaching and Evaluations under the guidance of one of the faculty members of the Department.
- If the project is of inter-disciplinary nature, a co-guide shall be allotted by the University from the other concerned department.
- The topic and title of the dissertation shall be chosen by the candidate in consultation with the guide and co-guide, if any, before the commencement of fourth semester.
- The subject and topic of the dissertation shall be from the major field of studies of the candidate. Modification of only the title but not the field of work may be permitted at the time of final submission of dissertation report during fourth semester.
- The Project Work and Dissertation preparation could be carried out by the students either in their work place/ institution/ any industry/ R&D labs/ business organizations.
- The candidate shall submit a soft copy of the dissertation work to the University.





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- The soft copy shall contain the entire Dissertation on the project work in monolithic form as a PDF file (not separate chapters).
- The Guide, after satisfying himself/herself on the suitability of the dissertation and checking the report for completeness and shall upload the Dissertation along with the name, University Seat Number, address, mobile number of the candidate etc., as prescribed in the form available on online Dissertation evaluation portal.
- Once the Guide uploads the dissertation, the same shall be linked for plagiarism check. The allowable plagiarism index shall be less than or equal to 25%. If the check indicates a plagiarism index greater than 25%, he/she shall, resubmit the dissertation to the Registrar (Evaluation)/Regional Centre/ Head Office, VTU along with the penal fees.
- By keeping the business trend in the present scenario, university has given an option to the students to select the research problem either from business organization or they can carry out the project on freelance basis subject to the approval of department committee. It is the total responsibility of the internal guide to monitor the freelance project.
- In case, business problem selected from a Company, no two students of an institute shall work on the same problem in the same organization.
- The student shall seek the guidance of the internal guide on a continuous basis, and the guide shall give a certificate to the effect that the candidate has worked satisfactorily under his/her guidance.
- On completion of the project work, student shall prepare a report with the following format.
 - The Project report shall be prepared using word processor viz. MS Word with New Times Roman, 12 font size and shall be in the A4 size 1" margin on all the sides (1.5 inch on left side) and 1.5 line spacing. The Project report shall not exceed 100 pages.
 - ii. The report shall have a title sheet with the title of the project, guide details and month & year of admission.
 - iii. A certificate by the guide, Programme Coordinator and the Director indicating the bonafide performance of the project by the student to be enclosed.
 - iv. An undertaking by the student to the effect that the work is independently carried out by him/her.





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v. The certificate from the organization if applicable (if its Freelance project, certificate is not required and internal guide can issue a certificate for successful completion).

Project Report Evaluation:

- Internal evaluation will be done by the internal guide.
- External valuation shall be done by faculty members of PG centers of VTU and VTU affiliated institutes with minimum of 10 years experience.
- Viva-Voce / Presentation: A viva-voce examination shall be conducted online where a student is expected to give a presentation of his/ her work.
- Minimum passing marks of the Project work is 50% in each of the components such as Internal Marks, report evaluation and viva-voce examination.

PROJECT STRUCTURE

Abstract

Acknowledgement

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- 1.3 Purpose, Scope, and Applicability
 - 1.3.1 Purpose
 - 1.3.2 Scope
 - 1.3.3 Applicability
- 1.4 Achievements
- 1.5 Organisation of Report

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- 3.1 Functional and Non functional Requirements
- 3.2 Software and Hardware Tools
- 3.3 Software Requirements Specification

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CHAPTER 4: SYSTEM DESIGN

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- 4.2 Data Design
 - 4.2.1 Schema Design
 - 4.2.2 Data Integrity and Constraints
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GLOSSARY APPENDIX A APPENDIX B

Abstract

This should be one/two short paragraphs (400 words), summarising the project work. It is important that this is not just a re-statement of the original project outline. A suggested flow is background, project aims and main achievements.

NOTE: From the abstract, a reader should be able to ascertain if the project is of interest to them and, it should present results of which they may wish to know more details.

Chapter 1: Introduction

The introduction has several parts as given below:

Background:

A description of the background and context of the project and its relation to work already done in the area. Summarise existing work in the area concerned with your project work.

Objectives:

Concise statement of the aims and objectives of the project. Define exactly what you are going to do in the project; the objectives should be about 30 /40 words.

Purpose, Scope and Applicability:

The description of Purpose, Scope, and Applicability are given below:

• Purpose:

Description of the topic of your project that answers questions on why you are doing this project. How your project could improve the system its significance and theoretical framework

• Scope:

A brief overview of the methodology, assumptions and limitations.

You should answer the question: What are the main issues you are covering in your project? What are the main functions of your project?



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Applicability:

You should explain the direct and indirect applications of your work. Briefly discuss how this project will serve the computer world and people.

Achievements:

Explain what knowledge you achieved after the completion of your work. What contributions has your project made to the chosen area?

Goals achieved - describes the degree to which the findings support the original objectives laid out by the project. The goals may be partially or fully achieved, or exceeded.

Organisation of Report:

Summarising the remaining chapters of the project report, in effect, giving the reader an overview of what is to come in the project report.

Chapter 2: SURVEY OF TECHNOLOGIES

In this chapter

• You should demonstrate your awareness and understanding of Available Technologies related to the topic of your project.

• You should give the detail of all the related technologies that are necessary to complete your project.

• You should describe the technologies available in your chosen area and present a comparative study of all those Available Technologies.

• Explain why you selected the one technology for the completion of the objectives of your project.

Chapter 3: REQUIREMENTS AND ANALYSIS

3.1 Problem Definition:

Formulate/define the problem on which you are working in the project.

Provide details of the overall problem and then divide the problem in to sub- problems. Define each sub-problem clearly.



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3.2 Proposed Solution:

Define briefly the methodology/technology you are proposing to solve the problem on which you are working in the project.

3.3 Planning and Scheduling:

Planning and scheduling is a complicated part of software development. Planning, for our purposes, can be thought of as determining all the small tasks that must be carried out in order to accomplish the goal. Planning also takes into account, rules, and known as constraints, which, control when certain tasks can or cannot happen. Scheduling can be thought of as determining whether adequate resources are available to carry out the plan. You should show the Gantt chart and Program Evaluation Review Technique (PERT).

3.4 Software and Hardware Tools used:

Define the details of all the software and hardware needed for the development and implementation of your project.

• Hardware Requirement: In this section, the equipment, graphics card, numeric coprocessor, mouse, disk capacity, RAM capacity etc. necessary to run the software must be noted.

• Software Tools used: In this section, the operating system, the compiler, testing tools, linker, and the libraries etc. necessary to compile, link and install the software must be listed.

3.5 **Preliminary Product Description:**

Identify the requirements and objectives of the new system. Define the functions and operation of the application/system you are developing as your project.

3.6 Conceptual Models:

You should understand the problem domain and produce a model of the system, which describes operations that can be performed on the system, and the allowable sequences of those operations. Conceptual Models could consist of complete Data Flow Diagrams, ER diagrams, Object-oriented diagrams, System Flowcharts etc.



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3.7 Software Requirements Specification:

- In this phase you should define the requirements of the system, INDEPENDENT of how these requirements will be accomplished.
- The Requirements Specification describes the things in the system and the actions that can be done on these things.
- Identify the operation and problems of the existing system.
- i. USER REQUIREMENTS
- ii. SYSTEM REQUIREMENTS
- FUNCTIONAL REQUIREMENTS
- NON-FUNCTIONAL REQUIREMENTS
- DOMAIN REQUIREMENTS

Chapter 4: SYSTEM DESIGN

Describes desired features and operations in detail, including screen layouts, business rules, process diagrams, pseudo code and other documentation.

Basic Modules:

You should follow the divide and conquer theory, so divide the overall problem into more manageable parts and develop each part or module separately. When all modules are ready, you should integrate all the modules into one system. In this phase, you should briefly describe all the modules and the functionality of these modules.

Data Design:

Data design will consist of how you organise, managing and manipulate the data.

- Schema Design: Define the structure and explanation of schemas used in your project.
- Data Integrity and Constraints: Define and explain all the validity checks and constraints you are providing to maintain data integrity.

Procedural Design:

Procedural design is a systematic way for developing algorithms or procedurals.





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Logic Diagrams:

Define the systematically flow of procedure that improves its comprehension and helps the programmer during implementation. e.g., Control Flow Chart, Process Diagrams etc.

Data Structures:

Create and define the data structure used in your procedures.

• Algorithms Design:

With proper explanations of input data, output data, logic of processes, design and explain the working of algorithms.

User Interface Design:

- Define user, task, environment analysis and how you intend to map those requirements in order to develop a "User Interface".
- Describe the EXTERNAL and INTERNAL components and the architecture of your user interface.
- Show some rough pictorial views of the user interface and its components.

Security Issues:

Discuss Real-time considerations and Security issues related to your project and explain how you intend avoiding those security problems. What are your security policy plans and architecture?

Test Cases Design:

Define test cases, which will provide easy detection of errors and mistakes within a minimum period of time and with the least effort. Explain the different conditions in which you wish to ensure the correct working of your software.

Chapter 5: IMPLEMENTATION AND TESTING

Implementation Approaches:

Define the plan of implementation, and the standards you have used in the implementation.



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Coding Details and Code Efficiency:

Students not need include full source code, instead, include only the important codes (algorithms, applets code, forms code etc). The program code should contain comments needed for explaining the work a piece of code does. Comments may be needed to explain why it does it, or, why it does a particular way.

You can explain the function of the code with a shot of the output screen of that program code.

• **Code Efficiency:** You should explain how your code is efficient and how you have handled code optimisation.

Testing Approach: Testing should be according to the scheme presented in the system design chapter and should follow some suitable model – e.g., category partition, state machine-based. Both functional testing and user-acceptance testing are appropriate. Explain your approach of testing.

• Unit Testing:

Unit testing deals with testing a unit or module as a whole. This would test the interaction of many functions but, do confine the test within one module.

Integrated Testing:

Brings all the modules together into a special testing environment, then checks for errors, bugs and interoperability. It deals with tests for the entire application. Application limits and features are tested here.

Modifications and Improvements:

Once you finish the testing you are bound to be faced with bugs, errors and you will need to modify your source code to improve the system. Define what modification you implemented in the system and how it improved your system.



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Test Reports:

Explain the test results and reports based on your test cases, which should show that your software is capable of facing any problematic situation and that it works fine in different conditions. Take the different sample inputs and show the outputs.

User Documentation:

Define the working of the software; explain its different functions, components with screen shots. The user document should provide all the details of your product in such a way that any user reading the manual, is able to understand the working and functionality of the document.

Chapter 7: CONCLUSION:

The conclusions can be summarised in a fairly short chapter (2 or 3 pages). This chapter brings together many of the points that you would have made in the other chapters.

Limitations of the System:

Explain the limitations you encounterd during the testing of your software that you were not able to modify. List the criticisms you accepted during the demonstrations of your software.

Future Scope of the Project:

It describes two things: firstly, new areas of investigation prompted by developments in this project, and secondly, parts of the current work that were not completed due to time constraints and/or problems encountered.

REFERENCES

It is very important that you acknowledge the work of others that you have used or adapted in your own work, or that provides the essential background or context to your project. The use of references is the standard way to do this. Please follow the given standard for the references for books, journals, and online material.



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GLOSSARY

If you use any acronyms, abbreviations, symbols, or uncommon terms in the project report then their meaning should be explained where they first occur. If you go on to use any of them extensively then it is helpful to list them in this section and define the meaning.

APPENDICES

These may be provided to include further details of results, mathematical derivations, certain illustrative parts of the program code (e.g., class interfaces), user documentation etc.

Rubrics for Project Work

Sl.	Evaluation	Doutionland		
No.	Туре	Particulars		
1	CIE	Internal Assessment by the Guide- Based on the	20	
		Presentations by Students	- 50	
	· · · · ·	Report Evaluation by the Guide & External Examiner.		
2	SEE	Average of the marks awarded by the two Examiners	35	
		shall be the final evaluation marks for the Dissertation		
		Viva-Voce Examination to be conducted by the Guide and		
3	SEE	an External examiner from the Industry/ Institute (Joint	35	
	Evaluation)			
		Total	100	

Rubrics for Project Evaluation and Viva voce Examination

A. Internal Assessment by the Guide- Based on three Presentations by Students

Sl. No.	Aspects	Marks
1	Three Presentations	5
2	Introduction and Methodology	5
3	Industry and Company Profile	5
4	Theoretical background of study	5
5	Data analysis and interpretation	5
6	Summary of findings, suggestions and conclusion	5
	Total	30





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B	Report	Eva	luation	hv	the	Guide	&	External	Examiner
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Sl. No.	Aspects	Marks
1	Introduction & Relevance of the project	5
2	Conceptual background and literature review	5
3	Research design	5
4	Analysis and interpretation	10
- 5	Summary of findings, suggestions and conclusion	10
	Total	35

C. Viva-Voce Examination to be conducted by the Guide and an External examiner from the Industry/ Institute (Joint Evaluation)

Sl. No.	Aspects	Marks
1	Presentation and Communication Skills	5
2	Subject knowledge	5
3	Objectives of the study and Methodology	5
4	Analysis using statistical tools and statistical packages	10
5	Findings and appropriate suggestions	10
	Total	35

Activity Chart to be followed during Project Work

Activity	Remarks
Identifying the organization and	Student individually identifies an organization or
Problem identification	identifies problem for his/her study, according to
	his/her interest.
Problem statement & Research	His/ Her interests are discussed with project guides.
Design	Discussion with Internal Guide to decide on suitable
	design for the research
Synopsis Preparation	Preparation of Synopsis* & formulating the objectives
Presentation of Synopsis	The student will present the synopsis with the
	detailed execution plan to the Internal Guide and
	Programme Coordinator who will review and may: a.
	Approve b. Approve with modification or c. Reject
	for fresh synopsis

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Approval Status	The approval status is submitted to Programme
	Coordinator who will officially give concurrence for
	the execution of the Project
Understanding Structure,	Student should understand products / services and
Culture and functions of the	the problems of the organization
organization / Identifying of	
business problem from the	
Industry through the literature	
study	
Preparation of Research design	Discussion with the guide for finalization of research
and Research instrument for data	design and instrument in his/her domain and present
collection	the same to the guide. (First Presentation)
Data collection	Date collected to be edited, coded, tabulated and
	presented to the guide for suggestions for analysis.
	(Second Presentation)
Analysis and finalization of	Students must use appropriate and latest statistical
report	tools and techniques for analyzing the data. (Third
	Presentation)
Submission of Report	Final Report should be submitted to the University
	before one week of the commencement of theory
	examination.

*Synopsis of 3-4 pages to be submitted to the Programme Coordinator through the Guide

Page 1	Title, Contact Address of student- with details of Internal and External
	Guide (if applicable)
Pages 2-4	Short introduction with objectives and summary (300 words), Review of
	Articles / Literature about the topic with source of information.

Formats for Project Report

- Format of Cover Page
- Format of certificate by Company/Institution or from both
- Format of Declaration Page
- Format of Contents
- Format of List of Tables and Charts
- Format of Bibliography





Centre for Distance and Online Education (CDOE), Mysuru

(Title of the Project Work)

Submitted by

(Student Name) (USN)

Submitted to

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAVI

In partial fulfillment of the requirements for the award of the degree of [Postgraduate Diploma in Software Testing / Postgraduate Diploma in Postgraduate Diploma in Cyber Security and Cloud Computing / Postgraduate Diploma in Big Data Analytics / Postgraduate Diploma in Artificial Intelligence and Data Science]

Under the guidance of

INTERNAL GUIDE (Name & Designation) EXTERNAL GUIDE (Name & Designation)

(Institute Logo)

Department of Computer Applications VTU's Centre for Distance and Online Education Mysuru

(Month & Year of submission)



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COOE PARTIE

CERTIFICATE

This is to certify that (Name of the Student) bearing USN (xxxx), is a bonafide student of [Postgraduate Diploma in Software Testing / Postgraduate Diploma in Postgraduate Diploma in Cyber Security and Cloud Computing / Postgraduate Diploma in Big Data Analytics / Postgraduate Diploma in Artificial Intelligence and Data Science] course of the Institute (Batch), affiliated to Visvesvaraya Technological University, Belgavi. Project Report on "(Title of Report)" is prepared by him/her under the guidance of (Name of the Guide), in partial fulfilment of the requirements for the award of the degree of [Postgraduate Diploma in Software Testing / Postgraduate Diploma in Postgraduate Diploma in Cyber Security and Cloud Computing / Postgraduate Diploma in Big Data Analytics / Postgraduate Diploma in Artificial Intelligence and Data Science] of Visvesvaraya Technological University, Belagavi, Karnataka.

Signature of Internal Guide

Signature of PC

Signature of Director



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DECLARATION

I, (Student Name), hereby declare that the Project report entitled "(Title)" with reference to (Organization with place) prepared by me under the guidance of (Guide Name), faculty of Computer Application Department, (Institute name) and external assistance by (External Guide Name, Designation and Organization). I also declare that this Project work is towards the partial fulfilment of the university Regulations for the award of degree of [Postgraduate Diploma in Software Testing / Postgraduate Diploma in Postgraduate Diploma in Cyber Security and Cloud Computing / Postgraduate Diploma in Big Data Analytics / Postgraduate Diploma in Artificial Intelligence and Data Science] by Visvesvaraya Technological University, Belagavi. I have undergone a summer project for a period of Twelve weeks. I further declare that this Project is based on the original study undertaken by me and has not been submitted for the award of any degree/diploma from any other University / Institution.

Signature of the Student

Place: Date:

> PROGRAMME CO-ORDINATOR COMPUTER APPLICATIONS Visvesvaraya Technological University Centre for Distance and Online Education MVSURU-570 029