# Scheme & Syllabus for II Year

## B. E. Computer Science and Business System

## Academic Year 2024-25

## **Fourth Semester**

	Fourth Semester			
Course Code	Course Title	L-T-P in hours	Credit	Contact Hours
23MACB401	Linear Algebra	2-2-0	3	4
23CB402	Theoretical Foundations Of Computation	3-0-0	3	3
23CB403	Design and Analysis of Algorithms	3-0-2	4	5
23CB404	Entrepreneurship and Business Development	3-0-0	3	3
23CB405	Database Management Systems	2-0-2	3	5
23CB406	Web Application Development Laboratory	0-0-2	1	2
23CB407B	<b>Python for Data Science</b> ESC/ETC/PLC	2-0-2	3	4
23UHV	Universal Human Values	0-0-2	1	2
23BOK409	Biology For Engineers	0-0-2	1	2
23CB458B	Data Visualization using Tableau and Power BI Ability Enhancement Course/Skill Enhancement Course-III	0-0-2	1	2
23NYS2	NSS, YOGA, PE	0-0-2	A	2
	Total		23	34

# **SEMESTER -IV**

Course little LINEAR ALGEBRA	
Course Code         23MACB401         L-T-P-C         (2-2-0) 3	
Exam Hrs.3Hours / Week4	
SEE50 MarksTotal Hours28L+12T	
Course Objective: Students will be trained to acquire knowledge in linear algebra and its app	olications.
Course Outcomes (COs): Having studied this course, students will be able to:	r •
No. Course Outcomes Mapping Ma	lapping
to POS         to           Annly suitable solution precedure to solve the linear models         Image: solution precedure to solve the linear models	PSUs
Apply suitable solution procedure to solve the linear models	
factorization to applications such as computer graphics	-
To compute suitable matrices arising in magnification	
2 rotation of images using the knowledge of vector space. 1.2	_
matrix of linear transformations.	
Analyze the application-oriented problems connected with	
3. difference equations, Markov chain, discrete dynamical 1,2	-
systems by using the concept of Eigen values, Eigen vectors.	
Apply the techniques of singular value decomposition, PCA,	
4. to analyze the process of data compression/image processing.	-
Course Contents:	
Module 1 0'	7 Hours
Linear Algebra: Importance of Matrices in engineering. Rank of a matrix. Consistenc	cy of non-
homogeneous and homogeneous system of equations, Solution of the system of linear	equations
by Gauss elimination method and Gauss – Seidel iterative method. Linearly depen	ndent and
independent vectors. Applications of solution of system of equations to balance the	chemical
equations. Iraffic flow problem. To find the suitable combination of food stuff so as t	to get the
desired nutrients as prescribed by a dictician.	Mateix
factorization the Leontief input output model application to computer graphics	s, matrix
Module 2	0 Hours
Vector space subspace basis of a vector space dimension of a vector space introd	duction to
linear transformation rank nullity of a linear transformations matrix of a linear transformation	formation
Special matrices-matrix of rotation, reflection, translation.	ionnation.
Self-Study- To find the matrix of transformation when the image of some points is give	ven.
Module 3	0 Hours
Eigen value, Eigen vectors, applications of diagonalization, Jordan canonical form. ar	pplication
to discrete dynamical systems- coupled differential equations governing the electrica	al circuits
systems, applications to difference equations, applications to web page ranking.	
Self-Study- Stretching of an elastic membrane, to determine the growth of a populatic	on model.
Role of eigenvalues, eigenvectors in determining natural frequency, mode shapes of e	equations
of motions (Spring mass system).	
Module 4 10	) Hours
Orthogonal sets, orthogonal projections, Gram Schmidt process, QR-factorization, le	est square

examples. Principal component analysis- applications of PCA to data compression, image processing.

**Self-Study-** Application of eigen-value eigen-vectors in Signature testing, Face recognition. Stability analysis of differential equations which governs the dynamical systems using the concept of eigen value, eigen vectors.

Note:

- Theorems and properties without proof. Applicable to all the modules.
- Self study part is not included for Semester End Examination.

## **Text Books:**

• Linear Algebra and its Applications, David C. Lay, Steven R. Lay and J.J. Mc Donald: 5th Edition, Pearson Education Ltd., 2015.

## **Reference Books:**

- "Advanced Engineering Mathematics", E. Kreyszig, 10th edition, Wiley, 2015.
- Numerical methods, R. K. Jain and S. R. K. Jain & S. R. K. Iyengar, New age International pvt. Publishers, 6<sup>th</sup>edition, 2014.
- Linear Algebra and its Applications, Gilbert Strang: 4th Edition, Cenage publications, 2014.

## Activity

- Role of eigenvalues, eigenvectors in determining natural frequency, mode shapes of equations of motions (Spring mass system).
- Lenovo input output method application to balance the economy of a Country.
- Applications of factorization of matrices-google recommendation.
- Jordan canonical form when minimal polynomial and characteristic polynomial is given and its application in Engineering.
- Diagonalize a matrix and determining the principal stresses.
- Application of eigen value eigen vectors in data compression, Signature testing, Face recognition.
- Least square solution of system of equations- a matrix approach.
- Application of eigen value eigen vectors in Google page ranking.

Course						Pı	ogram	Outcom	es [POs	]				
Outcomes														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2												
CO2	2	2												
CO3	2	2												
CO4														
	3	2												

Cours	se Title	THEORETIC	AL FOUNDATIO	ONS OF COM	IPUTATIO	N
Cours	se Code	23CB402	L-T-P-C	(3-0-0) 3		
Exam	n Hrs.	3	Hours / Week	3		
SEE		50 Marks	<b>Total Hours</b>	40 Hrs		
Cours	se Objecti	ve: The course provides	a basic understan	nding of theor	y of compu	itation and
studer	nts will be	able to design various ki	nds of automata, f	formal languag	ges and gran	nmars as a
first st	tep towards	s learning advanced topic	s such as compile	r design.		
Cours	se Outcom	es (COs): Upon complet	tion of the course,	students shall l	be able to:	
No.		Course O	utcomes		Mapping	Mapping
				1 1	to POs	to PSOs
1.	Understa	nd the fundamental cor	ncepts of formal	languagesand	1	-
2	Design [	EAs NEAs and perform	n conversions amo	ng them	3	
	Design r	agular avprassions agot	avt free grommars	Duch Down	5	-
2	Automat	a and Turing machines	for different leve	els of formal	3	_
5.	language	s and running machines				_
	Construc	s t and simulate different k	rinds of automata i	ising		
4.	simulatio	on tool		asing .	5	-
Cours	se Content	:s:				
		Modul	e 1		10	) Hours
Intro	duction to	Finite Automata: Wh	y Study Automata	a Theory? The	e Central C	oncepts of
Auton	nata Theor	ry. Finite Automata: An	Informal Picture	of Finite Au	tomata, De	terministic
Finite	Automata,	on Deterministic Finite	Automata, Finite A	Automata with	Epsilon-Tra	ansitions.
		Modul	e 2		10	) Hours
Regu	lar Expre	ssions and Languages:	Regular Express	ions, Finite A	utomata an	d Regular
Expre	essions, Ap	plications of Regular Exp	pressions. Propert	ties of Regula	r Language	es: Proving
Langu	lages Not	to Be Regular – Pumpir	ng Lemma, Closur	e Properties o	of Regular I	Languages,
Equiv	alence and	Minimization of Automa	ata.			
<u> </u>		Modul	<u>e 3</u>			) Hours
Conte	ext-Free G	rammars and Languag	es: Context-Free (	Frammars, Par	se Trees, Aj	pplications
OI CO	ition of the	Grammars, Ambiguity	in Grammars and	Languages. P	ushdown A	Automata:
CEG'	nuon or inc	e Fushdown Automata,	the languages of	a FDA, Equiv	alence of r	DA S allu
	s, Determin	Modul	ο <b>1</b>		10 H	ours
Prone	arties of	Context_Free Langua	<del>64</del> ges: Normal Fo	rms for Con	text_Free (	Jrammars_
Elimi	nating Use	less symbols Eliminatir	ges. Normai Po	tions Eliminat	ting Unit n	oductions
Chom	nating 050 Isky Norma	al Form (CNF). Griebach	Normal Form (G)	NF).	ing one pi	oddettollb,
Intro	duction to	Turing Machines: P	roblems that Cor	nputers canno	ot Solve. T	he Turing
Mach	ine Program	nming Techniques for Tu	uring Machines.			8
Text	Books:	<u> </u>				
	DUaparaft	Daiaay Matwani II	D Ullman "Intr	aduction to	Automoto	Theory
	anguages a	nd Computation" Pearso	n Education 3rd F	Edition 2007	Automata	Theory,
	inguages al			Juition, 2007		
Refer	ence Book	S:				
• Jo	hn Martin,	, "Introduction to Langu	ages and Theory	of Computation	on", Tata M	IcGraw-

Hill, 2003.

• 2. Peter Linz, "An Introduction to Formal Languages and Automata", 4th Edition, Narosa Publishing House, 2007An Introduction to Data Structures with Applications- Jean-Paul Tremblay & amp; Paul G. Sorenson, 2ndEdition, McGraw Hill, 2013.

## **MOOC Course:**

• Theory of Computation <a href="https://onlinecourses.nptel.ac.in/noc22\_cs63">https://onlinecourses.nptel.ac.in/noc22\_cs63</a>

Course						Pı	ogram	Outcom	es [POs	;]				
Outcomes														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
	2													
CO2			2											
CO3			2											
CO4					3									

	se l'itle	Title         DESIGN AND ANALYSIS OF ALGORITHMS								
Cour	se Code	23CB403	(L-T-P)C	(3-0-2)	) 4					
Exan	n	3Hrs	Hours/Week	5	, 					
SEE		50 Marks	Total Hours	36L+1	4P					
Cour	se Object	ive: Students will b	e able to design algorithms using v	various strate	gies and					
analy	ze it mathe	matically.			0					
Cour	se outcom	es: At the end of cou	urse, student will be able to:							
No.		Cours	e Outcomes	Mapping to POs	Mapping to PSOs					
1.	Apply va problem.	rious algorithm desi	gn techniques to solve the given	1	-					
2.	Analyse asymptot	the time complexic notations.	xity of the algorithm using	2	-					
3.	Different technique power.	iate tractable & i es that help to cope	ntractable problems & apply up with limitation of algorithm	3	-					
4.	Conduct	experiments to imple	ement the designed algorithms	3, 5	-					
Cour	se Content	s:								
1			Module 1		10 Hours					
Exha Divid proper	ustive sear e-and-Con rties, Multip ease-and-Co	ch. quer: Binary Search,								
Algoi	ithma for a	onquer: Insertion So	Module 2 Merge Sort, Quick Sort, Binary tree ers, Strassen's Matrix multiplication. rt, Depth First and Breadth First Searc	traversals ar	<b>10 Hours</b> nd related al sorting,					
	ithms for ge	onquer: Insertion So enerating combinatoria	Module 2 Merge Sort, Quick Sort, Binary tree ers, Strassen's Matrix multiplication. rt, Depth First and Breadth First Searc I objects.	traversals ar	<b>10 Hours</b> and related al sorting,					
Trans	ithms for ge	onquer: Insertion So enerating combinatoria	Module 2 Merge Sort, Quick Sort, Binary tree ers, Strassen's Matrix multiplication. rt, Depth First and Breadth First Search l objects. Module 3 P Balanced Search Trees Heaps and	traversals ar h, Topologica	10 Hours ad related al sorting, 10 Hours Problem					
Trans reduct Space Horsp Dyna algori	ithms for ge sform-and- tion. e and Tim pool), Hashin mic Progr thms, The k	Conquer: Insertion So enerating combinatoria Conquer: Pre-sorting e Trade-off: Sorting ng. amming: Computing Capsack problem.	Module 2 Merge Sort, Quick Sort, Binary tree ers, Strassen's Matrix multiplication. rt, Depth First and Breadth First Search al objects. Module 3 g, Balanced Search Trees, Heaps and by counting, Input enhancement in g a Binomial coefficient, Warshall'	traversals ar ch, Topologica d Heap Sort, string Match s Algorithm,	10 Hours         ad related         al sorting,         10 Hours         Problem         ing (only         , Floyd's					
Trans reduct Space Horsp Dyna algori	ithms for ge sform-and- tion. e and Tim bool), Hashin mic Progr thms, The K	Conquer: Insertion So enerating combinatoria Conquer: Pre-sorting e Trade-off: Sorting ng. camming: Computing Knapsack problem.	Module 2 Merge Sort, Quick Sort, Binary tree ers, Strassen's Matrix multiplication. rt, Depth First and Breadth First Searce il objects. Module 3 g, Balanced Search Trees, Heaps and by counting, Input enhancement in g a Binomial coefficient, Warshall' Module 4	traversals ar h, Topologica d Heap Sort, string Match s Algorithm,	10 Hours         ad related         al sorting,         10 Hours         Problem         ing (only         Floyd's         10 Hours					
Trans reduct Space Horsp Dyna algori Greee Limit Proble	ithms for ge sform-and- tion. e and Tim pool), Hashin mic Progr thms, The k dy Techniq cations of A ems, coping	Conquer: Insertion So enerating combinatoria Conquer: Pre-sorting e Trade-off: Sorting ng. amming: Computing (napsack problem. ue: Prim's algorithm, lgorithm Power: Low with the Limitations of	Module 2 Merge Sort, Quick Sort, Binary tree ers, Strassen's Matrix multiplication. rt, Depth First and Breadth First Search a bijects. Module 3 g, Balanced Search Trees, Heaps and by counting, Input enhancement in g a Binomial coefficient, Warshall' Module 4 Kruskal's algorithm, Dijkstra's algorithm wer-bound arguments, Decision trees, Prof Algorithm Power: Backtracking, Bra	traversals ar ch, Topologica d Heap Sort, string Match s Algorithm, um, Huffman t P, NP and NP- nch-and-boun	10 Hours         ad related         al sorting,         10 Hours         Problem         ing (only         Floyd's         10 Hours         rees,         Complete         d.					
Trans reduct Space Horsp Dyna algori Greec Limit Proble	ithms for ge sform-and- tion. e and Tim bool), Hashin mic Progr thms, The k dy Techniq sations of A ems, coping	Conquer: Insertion So enerating combinatoria Conquer: Pre-sorting a Trade-off: Sorting ng. amming: Computing Chapsack problem. ue: Prim's algorithm, Igorithm Power: Low with the Limitations of Prace	Module 2 Merge Sort, Quick Sort, Binary tree ers, Strassen's Matrix multiplication. rt, Depth First and Breadth First Search a objects. Module 3 g, Balanced Search Trees, Heaps and by counting, Input enhancement in g a Binomial coefficient, Warshall' Module 4 Kruskal's algorithm, Dijkstra's algorithm wer-bound arguments, Decision trees, P of Algorithm Power: Backtracking, Bra etical Component/Tutorial:	traversals ar th, Topologica d Heap Sort, string Match s Algorithm, m, Huffman t NP and NP- nch-and-boun	10 Hours         ad related         ad sorting,         10 Hours         Problem         ing (only         , Floyd's         10 Hours         rees,         Complete         d.					

- Print all the nodes reachable from a given starting node in a graph using Depth First Search method and Breadth First Search. Also check whether a graph is connected.
- Obtain the topological ordering of vertices in a given digraph.
- Implement Horspool algorithm for String Matching.
- Sort a given set of elements using the Heap sort method.
- Implement Floyd's algorithm and Warshall's algorithm for a given graph.
- There are n different routes from hostel to college. Each route incurs some cost. Find the minimum cost route to reach the college from the hostel using Prim's algorithm.
- Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm
- Implement 0/1 Knapsack problem using dynamic programming.
- Implement N Queen's problem using Backtracking.

## **Open ended Experiments**

Students have to solve a given problem using any suitable design technique and demonstrate its efficiency. Sample list of problems (but not limited to this) that can be considered are

- Josephus problem
- Travelling salesman problem
- Job assignment problem
- Boyre Moore string matching algorithm
- Searching problem like Given a string, find all possible palindromic substrings in it, Given a sequence of numbers between 2 and 9, print all possible combinations of words formed from the mobile keypad which has English alphabets associated with each key.
- Sorting problem like Given two integer arrays, reorder elements of the first array by the order of elements defined by the second array.

## **Text Books:**

• Introduction to the Design and Analysis of Algorithms, Anany Levitin, 3rd Edition, Pearson Education, 2017.

## **Reference Books:**

- Introduction to Algorithms, Thomas H. Coremen, Charles E. Leiserson, Ronald L. Rivest, 3rd Edition PHI
- Computer Algorithms, Horowitz E., Sahani S., Rajasekharan S., Galgotia Publications

#### **MOOC Course:**

• Design and Analysis of Algorithms <u>https://nptel.ac.in/courses/106/106/106106131/</u>

Course A	Articulati	on M	latrix	K											
	Course					P	rogra	ım O	utco	mes	[POs]				
	Outcomes						0								
	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1														
		2													
	CO2														
			2												
	CO3			3											
	CO4														
				2		2									

Cou	rse Title	ENTREPRENEURSH	IIP AND BUSINESS D	<b>EVELOPM</b>	ENT
Cour	se Code	23CB404	L-T-P-C	(3-0-0) 3	
Exam	ı Hrs.	3	Hours / Week	3	
SEE		50 Marks	Total Hours	40	
Cour	se Objective	: Entrepreneurship and busine	esses are the basis for ec	onomic grow	wth all over
the v	vorld. They	play an important role in	employment, income	and societa	l changes,
partic	ularly in tran	sition economies.			
Cour	se Outcomes	s (COs): Upon completion of t	he course, students shal	l be able to:	
No.		<b>Course Outcomes</b>		Mapping to POs	Mapping to PSOs
1.	Describe th industries a	e structure of modern busine nd government policies in deve	ess enterprise, role of eloping business	6	-
2.	Classify the characteristi	e different types of entrepren cs of a successful entrepreneu	neurs and identify the ar	6,8	-
3	Motivate to	take-up entrepreneurship		6	2
5.	Apply the	stages involved in starting a	an enterprise, develop		
4.	and implem	ent a business plan		6	-
Cour	se Contents:	1			1
		Module 1			10 Hours
Mode Gover small indust Entre of a Entre Wom challe entre Any t	ern Business rnment policy scale indust tries in a free preneurship successful preneurial dev en Entreprene enges in the preneurs, Insti wo case studio orting Small	Enterprises: Role of small so and Development of the small ries in India. Problems for su economy. : Importance of Entrepreneursh Entrepreneur, classification of relopment models, Profiles of su <u>Module 2</u> neurs: Women Entrepreneurship path of women entrepreneurship tutions supporting women entre es Institutions	cale industries, Concept I scale sector in India, G mall-scale industries, Pr hip, concepts of Entrepre of Entrepreneurs, Myth accessful entrepreneurs. p defined, Women entrep hip, Strategies for the epreneurs in India, wome	and definition rowth & Perf rospects for a eneurship, chans of entrep oreneurship end development en entrepreneurship	ons of SSI, formance of small scale aracteristics oreneurship, <b>10 Hours</b> nvironment, of women urs in India,
institu	itions. Other a	agencies, Industry associations	succion, contrai lever	institutions,	State level
		Module 3			10 Hours
Settin oppor Sickn SSIs sickne	ng up a Sm tunities in var ess in Small in India, Crit ess in SSI, Sp agia Manage	Business         Enterprise:         I           tious sectors.         Formalities for set         Business         Enterprises:         Definities           Business         Enterprises:         Definities         Definities         Definities           teria         for         identifying         sickness/in         Sickness         Definities           ymtoms         of         sickness,         Cures         for         Module 4           mont         in         Small         Businesse         Operations         Definities	Identifying the business ting up a small business ion of sickness and Prese cipient sickness, causes r SSIs sickness, Any two comparison life such at	s opportunity enterprise ent status of for sickne to case studies 10	y, Business sickness of ss/incipient b D Hours
Strat	egic Manage	ment in Sman Business: Or	gamzation life cycle, strained the strain small business.	rategic manag	gement, the
mana	vement work	ing canital management	ont in sman ousiness:	mportance (	n mancial
Fami	ly Business.	Importance of family business	Various types of family	business. Hi	story of the
family	y business. Re	esponsibility and rights of family	y shareholders of a famil	y business. st	rategies for
impro	ving the capa	ability of a family business, ma	anagement development	plan in famil	y business,
famil	y reunion gam	nes promote family value, how to	o save the family busines	SS.	- ,
Text	Books:		<b>t</b>		
Entrep Educa	preneurship D ation in South	evelopment-Small Business En Asia	terprises, Poornima. M. (	Charatimat, Po	earson

#### **Reference Books:**

1. Dynamics of entrepreneurial development and Management, Vasant Desai, Himalayan Publishing House Entrepreneurship development, S.S. Khanka, S. Chand& Co, New Delhi.

## MOOC's:

1. https://onlinecourses.nptel.ac.in/noc21\_mg70/preview

#### Activity:

20 Hours

Further, the topic for class discussion will be mentioned beforehand.

Students are required to meet in groups before coming to class and prepare for the topic to be discussed. Instructor may ask the student groups to present their analysis and findings to the class. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.

1. Topic: Understanding the issues and challenges involved in managing a diverse workforce

2. Topic: Is The Only Purpose of a Corporation to Maximize Profit?

3. Topic: Similarities and Differences in Manufacturing and Service Sector - Impact on HR Practices

Course Outcomes		Program Outcomes [POs]												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
						2								
CO2														
						2		2						
CO3														
						2								
CO4														
						2								

Cour	se Title	DATA	BASE MANAGEM	ENT	SYSTEM	
Cours	e Code	23CB405	L-T-P-C	(2-0	-2) 3	
Exam	Hrs.	3	Hours / Week	5		
SEE		50 Marks	<b>Total Hours</b>	28T	+12L	
Cours	e Objective: S	Students will acquire the	e concepts of databas	es, an	d application	of SQL for
solving	g problems.					
Cours	e Outcomes (O	COs): Upon completion o	f the course, students	shall	be able to:	
No.		Course Outcor	nes		Mapping	Mapping
					to POs	to PSOs
1	Apply the c	oncepts of SQL and r	elational algebra to	find	1	
1.	solution to the	e given problem			1	-
2.	Analyze a giv	ven scenario and use appr	opriate database techn	ique	2	-
3.	Design ER di	agram or database for a g	iven scenario		3	1
	Conduct exp	eriments of database usi	ng modern tools: Ora	acle,	3, 5, 9, 10,	
4.	MongoDB, N	MySQL	-		12	-
Cours	e Contents:					
		Module	1			07 Hours
Introd	luction to Da	tabases: Introduction, C	Characteristics of data	ıbase	approach, Ad	lvantages of
using t	the DBMS appr	roach, History of database	e applications.			

Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces,

The Database System environment. Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, Examples

Module 207 HoursRelational Model: Relational Model Concepts, Relational Model Constraints and relational<br/>database schemas, Update operations, transactions, and dealing with constraint violations.<br/>Relational Algebra: Unary and Binary relational operations, additional relational operations<br/>(aggregate, grouping, etc.) Examples of Queries in relational algebra. Mapping Conceptual Design<br/>into a Logical Design: Relational Database Design using ER-to-Relational mapping.

**SQL:** SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.

Module 3	07 Hours
Normalization: Database Design Theory - Introduction to Normalization using Fu	nctional and
Multivalued Dependencies: Informal design guidelines for relation schema,	Functional
Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Fo	orms, Boyce-
Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependency	ndencies and
Fifth Normal Form. Examples on normal forms. Normalization Algorithms: Inference R	lules
	1
Module 4	07 Hours
Transaction Processing: Introduction to Transaction Processing, Transaction and Syste	em concepts,
Desirable properties of Transactions, Characterizing schedules based on re	coverability,
Characterizing schedules based on Serializability, Transaction support in SQL.	

**Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.

### Self Study Components:

Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL

## **Text Books:**

- Fundamentals of Database Systems", Elmasri and Navathe, 7th Edition, Addison-Wesley, 2015.
- "Database Management Systems", Raghu Ramakrishnan and Johannes Gehrke, 3rd Edition, McGraw-Hill,2007

## **Reference Books:**

- Database System Concepts, Silberschatz, Korth and Sudharshan, 5th Edition, Mc-Graw Hill, 2006.
- An Introduction to Database Systems, C.J. Date, A. Kannan, S. Swamynatham, Pearson education, 8 th Edition, 2006.

## **MOOC Course:**

- https://onlinecourses.swayam2.ac.in/cec19\_cs05/preview
- <u>https://onlinecourses.nptel.ac.in/noc19\_cs46/preview</u>

## **Practical Component**

• Consider the following schema: EMPLOYEE (Ename, Ssn, Bdate, Sex, Address, salary, Mgrssn, Dno) DEPARTMENT (Dname, Dnumber, Mgrssn, Mgr\_start\_date) PROJECT (Pname, Pnumber, Plocation, Dnum) WORKS\_ON (Essn, Pno, Hours) DEPENDENT (Essn, Dependent\_name,Sex) Create above tables by specifying primary key, foreign key and other suitable constraints.

Insert atleast 5 tuples to each created table.

- Retrieve the name and address of all employees who work for the "CSBS" department.
- For each employee, retrieve the employee's name and the name of his or herimmediate supervisor
- Find the sum of all salaries of all employees
- For each department, retrieve the department number, the number of employees in the department and their average salary.
- Consider the following relation schema: SAILORS (Sid: integer, Sname: string, Rating: integer, Age: real) BOATS (Bid: integer, Bname: string, Color: string) RESERVES (sid: integer, bid: integer, Day: date) Create above tables by specifying primary key, foreign key and other suitable constraints. Insert atleast 5 tuples to each created table. Design a database to the satisfy the above requirements and answer following queries
  - Find all sailors with a rating above 7
  - Find the names of sailors who have reserved boat number 103
  - Find the names of sailors who have reserved a red boat
  - Find the names of sailors who have reserved a red or a green boat
- Consider the following relation schema: STUDENT (Snum: integer, Sname: string, Major: string, Level: string, Age: integer) CLASS (Cname: string, meets at: string, Room:

string, Fid: integer) ENROLLED (Snum: integer, Cname: string) FACULTY (Fid: integer, Fname: string, Deptid: integer) The meaning of these relations is straightforward; for example, enrolled has one record per student-class pair such that the student is enrolled in the class. Level is a two-character code with 4 different values (example: Junior: JR etc) Write the following queries in SQL. No duplicates should be printed in any of the answers.

- Find the names of all Juniors (level = JR) who are enrolled in a class taught by Prof. Harshith
- Find the names of all classes that either meet in room R128 or have five or more Students enrolled.
- Find the names of all students who are enrolled in two classes that meet at the same time.
- Find the namesof faculty members who teach in every room in which some class is taught.
- Consider the relation schema for book dealer database: AUTHOR (Author-id:int, Name: string, City: string, Country: string) PUBLISHER (Publisher-id:int, Name: string, City: string, Country: string) CATALOG (Book-id: int, Title: string, Author-id: int, Publisher-id: int, Category-id: int, Year: int, Price: int) CATEGORY (Category-id: int, Description: string) ORDER-DETAILS (Order-no: int, Book-id: int, Quantity: int) Create the above tables by properly specifying the primary keys and the foreign keys. Enter at least five tuples for each relation.
  - Give the details of the authors who have 2 or more books in the catalog and the price of the books is greater than the average price of the books in the catalog and the year of publication is after 2000.
  - Find the author of the book which has maximum sales.
  - Demonstrate how you increase the price of books published by a specific publisher by 10%
  - List any department that has all its adopted books published by a specific publisher
- Consider the schema for Movie Database: ACTOR (Act\_id, Act\_Name,Act\_Gender) DIRECTOR(Dir\_id, Dir\_Name, Dir\_Phone) MOVIES (Mov\_id, Mov\_Title, Mov\_Year, Mov\_Lang, Dir\_id) MOVIE\_CAST (Act\_id, Mov\_id, Role) RATING (Mov\_id, Rev\_Stars) Write SQL queries to Create the above tables by properly specifying the primary keys and the foreign keys. Enter at leastfive tuples for each relation.
  - List the titles of all movies directed by 'Hitchcock'.
  - Find the movie names where one or more actors acted in two or more movies.
  - List all actors who acted in a movie before 2000 and also in a movie after 2015.
  - Update rating of all movies directed by 'Steven Spielberg' to
- Consider the following database for a banking enterprise BRANCH (branch-name: String, branch-city: String, assets: real) ACCOUNTS (accno: int, branch-name: String, balance: real) DEPOSITOR (customer-name: String, customer-street: String, customer-city: String) LOAN (loan-number: int, branch-name: String, amount: real) BORROWER (customer-name: String, loan-number: int) Create the above tables by properly specifying the primary keys and the foreign keys. Enter atleastfive tuples for each relation.
  - Find all the customers who have at least two accounts at the Main branch.
  - Find all the customers who have an account at all the branches located in a specific city.

• Demonstrate how you delete all account tuples at every branch located in a specific city.

Course A	rticulati	on M	latriv	ζ.											
	Course			•			Pro	ogram (	Outcom	nes [PO	s]				
	Outcomes														
	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
-	CO1														
		2													
-	CO2		2												
	CO3														
				2											
	CO4			2		2					2				
												2			

Cour	Course Title     WEB APPLICATION DEVELOPMENT LABORATORY       Course Code     23CP406											
Cour	rse Code	23CB406	L-T-P-C	(0-0-2) 1	l							
Exan	n Hrs.	3	Hours / Week	2								
SEE		50 Marks	<b>Total Hours</b>	40								
Cour	se Objective:Deve	elop practical skills in Jav	aScript, HTML, XMI	and PHP pr	ogramming by							
imple	ementing a variety	of tasks such as creating	calculators, manipula	ting text and	building web-							
based	l applications.											
Cour	rse Outcomes (CO	s): Upon completion of th	e course, students shal	l be able to:								
No.		Mapping to POs	Mapping to PSOs									
1.	Apply the basic webpages	1	-									
2.	Analyze the giv suitable web dev	the webpage using	2	-								
3.	Design and deve		3	1								
4.	Create an end-to	-end webpages connected	ed to database using	4, 5, 9, 10,	1							
Cour	IIIOUEIII tools allo	a present the results		12								
Cour	se contents.	List of Experime	nts									
• V	Vrite a JavaScript t	to design a simple calcula	ntor to perform the fol	llowing opera	tions:							
sum.	product, differenc	e and quotient										
• V	Vrite a JavaScript utputs HTML text	that calculates the square that displays the resultin	es and cubes of the nu g values in an HTML	umbers from table format	0 to 10 and							
• V ir	Vrite a JavaScript the interval of 1 TEXT-SHRINKIN	code that displays text " 00ms in RED COLOR, NG" in BLUE color. The	TEXT-GROWING" when the font size the font size decreas	with increasing reaches 50pt sets to 5pt.	ng font size t it displays							
• D fo	Develop and demor or the following pr	nstrate a HTML5 file that roblems:	tincludes JavaScript s	script that use	es functions							
a C b	<ul><li>a. Parameter: A string</li><li>Output: The position in the string of the left-most vowel</li><li>b. Parameter: A number</li><li>Output: The number with its digits in the reverse order</li></ul>											
C     a:     B     st	<ul> <li>Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, and Name of the College, Branch, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.</li> </ul>											
• V d	• Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.											
• v	Vrite a PHP program	n to display a digital clocl	c which displays the cu	arrent time of	the server.							

• Write the PHP programs to do the following:

- a. Implement simple calculator operations.
- b. Find the transpose of a matrix.
- c. Multiplication of two matrices.
- d. Addition of two matrices.
- Write a PHP program named states.py that declares a variable state with value "Mississippi Alabama Texas Massachusetts Kansas". write a PHP program that does the following:

a. Search for a word in variable states that ends in xas. Store this word in element 0 of a list named statesList.

b. Search for a word in states that begins with k and ends in s. Perform a caseinsensitive comparison. [Note: Passing re.Ias a second parameter to method compile performs a case-insensitive comparison.] Store this word in element1 of states List.

c. Search for a word in states that begins with M and ends in s. Store this word in element 2 of the list.

d. Search for a word in states that ends in a. Store this word in element 3 of the list.

• Write a PHP program to sort the student records which are stored in the database using selection sort.

#### **Text Books:**

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• Robert W Sebesta, "Programming the World Wide Web", 8<sup>th</sup> Edition, Pearson Edition, 2014.

## **Reference Books:**

- Chris Bates, "Web Programming Building Internet Applications", 3rd Edition, Wiley India, 2014.
- James Lee, Brent Ware, "Open Source Web Development with LAMP", Pearson Education, 2013.

#### MOOCS:

<u>https://online-degree.swayam2.ac.in/mri22\_01\_d03\_s1\_el10/preview</u>

Course Outcomes		Program Outcomes [POs]													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
C01	2														
													2		
CO2															
		2											2		
CO3			2												
CO4				1	3				2	2	2				

# ENGINEERING SCIENCE COURSE/ EMERGING TECHNOLOGY COURSE/ PROGRAMING LANGUAGE COURSE

Cou	rse Title	РҮТН	ON FOR DATA SCIEN	ICE						
Cou	rse Code	23CB407B	L-T-P-C	(2-0-2)3	6					
Exa	m Hrs.	3	Hours / Week	4						
SEE	1	50 Marks	Total Hours	28T+12	28T+12L					
Cou	rse Objectiv	e: utilize the python constructs	and libraries to perform d	ata analysis.						
Cou	rse Outcom	es (COs): Upon completion of	the course, students shall	be able to:						
NO.		Course Outcome	S	Mapping to POs	Mapping to PSOs					
	Apply the	nython libraries to load nre-n	rocess analysis and	10105						
1.       Apply the python libraries to load, pre-process, analysis and visualize the data.       1										
2.	Analyze th	e given data and interpret the	results using python	2	1					
3	Develop a	nython program to solve the	viven nrohlem	3	1					
<u> </u>	Work colla	boratively and demonstrate t	he applicability of	5	1					
4.	python lib	raries to solve real world data	science problems	5,9,10	-					
Cou	rse Contents	8:			I					
		Module	l		07 Hours					
Intr	oduction to	NumPy: Understanding data	types in python, basics of	of NumPy arr	ays, NumPy					
array	y attributes,	array indexing, array slicing,	reshaping array, array co	ncatenation a	ind splitting,					
com	putations on	NumPy Arrays.								
Intro	duction to	UFuncs, advanced UFancs for	eatures, Aggregation: Mi	n, Max and	in between,					
com	putation on	arrays, rules of broadcasting,	broadcasting in practice,	comparisons	s, masks and					
Boo	lean logics, i	indexing, sorting arrays, Num	Py's structured arrays.	1						
		Module			07 Hours					
Data	a Manipula	tion with Pandas: Introduct	ion to pandas objects – S	Series object	, DataFrame					
obje	ct, Index ob	ject, Data Indexing and selec	tion for series and DataF	rame, Operat	ting on Data					
in Pa	andas, Hand	ling missing data, Operating	on Null values, hierarch	ical Indexing	, combining					
datas	sets using Co	oncat and Append, Merge and	l Join.							
Agg	regation and	d Grouping, Pivot tables, V	ectorized string operation	ons, working	with Time					
serie	es- Dates and	d Times in python, indexing	by Time, time series da	ta structures,	frequencies					
and	offsets, resa	mpling, shifting and windowi	ng, High-performance Pa	ndas – eval()	and query()					
		Module 3	3		07 Hours					
Visu	alization u	sing Python: Importing ma	tplotlib, setting styles, s	imple line p	olots, simple					
scatt	er plots, vi	sualizing errors, density and	l contour plots, visualiz	ing a three	dimensional					
func	tion, Histog	rams, binning and density, cu	stomizing plot legends, cu	ustomizing tio	eks.					
Thr	ee-Dimensio	onal Plotting: Three-dimensi	ional points and lines, th	ree dimensio	onal contour					
plots	s, surface tria	angulation, geographic data w	ith basemap, visualizatio	n with Seabo	rn.					
		Module 4	4		07 Hours					
Stat	istics : Me	asures of Central Tenden	ey, Statistics with Pytho	on, Measurin	g Variance,					
Norr	mal Distrib	oution, Binomial Distributi	on, Poisson Discrete	Distribution	, Bernoulli					
Dist	ribution, P-	value, Exploring Correlatior	in Python, Create a c	correlation N	latrix using					
Pyth	on, Pearson	's Chi-Square Test	-		C C					
Text	t Books:									
	• Python	for Data Analysis, Wes Mck	Kinney, 2 <sup>nd</sup> edition, O'Re	illy Media, IS	SBN: 978-1-					

491-	491-95766-0, 2018. • Python Programming and SQL Mark Reed													
• Pyth	on Pr	ogran	nming	g and	SQL,	Mark	Reed	l						
• Intro	oducti	on to	Dat	a Sc	ience	Prac	ctical	App	roach	with	R an	d Pytl	10n, E	B Uma
Mah	eshw	ari, 1	R. Suj	atha										
Reference Bo	ooks:													
Intro	ductio	n to Py	ython f	for Dat	a Scie	nce: P	aul J. I	Deitel,	Harve	y M. D	eitel, H	arvey D	)eite	
Lab Compon	Lab Components													
Case studies of	dies on:													
AirBn	B dat	dataset												
• Fitbit	t dataset													
McKin	McKinsey dataset													
Netflix dataset														
Video Games dataset														
Yolo Dataset														
MOOCs:														
<u>https://onlinecourses.nptel.ac.in/noc23_cs99/preview</u>														
Course Artic	ulatio	on Ma	atrix											
Course						Drog	rom (	hitoor	nog [I	$0_{\mathrm{cl}}$				
Outcomes		Program Outcomes [POs]												
outcomes														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
003														
CO1	2													
	Z													
CO2		2											2	
<u> </u>						1	1	1	1	1	1	1	1	1
CO3			2										2	
CO3			2										2	
CO3			2		3				2	2			2	

<b>Course Title</b>	UNIVERSAL HUMAN VALUES										
Course Code	23UHV	L-T-P-C	(0-0-2)1								
Exam Hrs.	3	Hours / Week	2								
SEE	50 Marks	Total Hours	24 Hrs.								

**Course Objective:** The course aims at the development of the value education by the right understanding through the process of self-exploration (about themselves), family, society and nature/existence. Strengthening of self-reflection by development of commitment and courage to act are presented as the prime focus throughout the course towards qualitative transformation in the life of the student.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	Course Outcomes	Mapping to POs	Mapping to PSOs
1.	Start exploring themselves, get comfortable with each other and with the teacher and they start appreciating the need and relevance for the course. Also they are able to note that the natural acceptance (intention) is always for living in harmony.	6, 7, 8, 9, 12	-
2.	Differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them and need to take appropriate steps to ensure right participation (in terms of nurturing, protection and right utilization) in the nature.	6, 7, 8, 9, 12	_
3.	Present sustainable solutions to the problems in society and nature. They are also able to see that these solutions are practicable and draw roadmaps to achieve them	6, 7, 8, 9, 12	-
Course	e Contents:		

Module 107 HoursIntroduction to Value Education: Understanding Value Education, Self-exploration as the<br/>Process for Value Education, Continuous Happiness and Prosperity – the Basic Human<br/>Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity<br/>– Current Scenario, Method to Fulfill the Basic Human Aspirations

Module 207 HoursHarmony in the Human Being: Understanding Human being as the Co-existence of the Selfand the Body, Distinguishing between the Needs of the Self and the Body, The Body as anInstrument of the Self Lecture, Understanding Harmony in the Self Tutorial, Harmony of theSelf with the Body to ensure self-regulation and Health.

Module 307 HoursHarmony in the Family, Nature and Existence: Harmony in the Family – the Basic Unit of<br/>Human Interaction, Values in Human-to-Human Relationship, 'Trust'– the Foundational Value<br/>in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society,<br/>Vision for the Universal Human Order.

Whole existence as Coexistence: Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-

regulation in nature. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 407 HoursImplications of the Holistic Understanding – a Look at Professional Ethics: Natural<br/>Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct A Basis for<br/>Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in<br/>Professional Ethics, Holistic Technologies, Production Systems and Management Models,<br/>Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.

## Self-Learning Activities-

- 1. Sharing about One self and Exploring Natural Acceptance
- 2. Exploring Harmony of Self with the Body
- 3. Exploring the Feeling of Respect
- 4. Exploring the Four Orders of Nature Lecture and Exploring Co-existence in Existence

5. Exploring Humanistic Models in Education, Exploring Steps of Transition towards Universal Human Order

## **Text Books:**

- The Textbook: A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
- The Teacher's for a Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

## **Reference Books:**

- Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
- Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
- The Story of Stuff (Book).
- The Story of My Experiments with Truth-by Mohandas Karamchand Gandhi
- Small is Beautiful-E.F Schumacher.
- Slow is Beautiful-Cecile Andrews
- Economy of Permanence-JCKumarappa
- Bharat Mein Angreji Raj–Pandit Sunderlal.
- Redis covering India-by Dharampal
- Hind Swarajor Indian Home Rule-by Mohandas K. Gandhi.
- India Wins Freedom-Maulana Abdul Kalam Azad
- Vivekananda-Romain Rolland(English)
- Gandhi-Romain Rolland(English)

Course Outcomes		Program Outcomes [POs]												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01						2	2	2	2			2		
CO2						2	2	2	2			2		
CO3						2	2	2	2			2		

Cours	se Title		BIOLOGY FOR ENGIN	EERS		
Cours	se Code	23BOK409	(L-T-P)C	(0-0-	-2)1	
Exam	l	3 Hrs.	Hours/Week	2	,	
SEE		50 Marks	<b>Total Hours</b>	28		
Cours	se Object	tive: Realization of r	elation between Natural En	gineering	and man-ma	de
Engin	eering.					
Cours	se outcon	nes: At the end of co	urse, student will be able to	):		
No.		Cour	se Outcomes		Mapping to POs	Mapping to PSOs
1.	To far	niliarize engineering ts	g students with basic b	oiological	6	-
2.	Apply t	he interdisciplinary	vision of biology to enginee	ering	1,6,8	-
3.	Analyz enginee	e how biological cred to substitute natu	systems can be design ral system	ned and	2,6	-
4.	To deve	elop biological mode	ls using AI tools		2,6	-
Cours	e Conten	its:				
		MOD	ULE – 1		6	Hrs.
the hu systen lymph	man bod n, excreto natic syste	y- cardiovascular sys ory system, em, nervous system,	tem, endocrine system, dig	estive system.	tem, respirate	ory
		MOD	ULE - 2		8	Hrs.
Bioins pacem	<b>spired E</b> n naker, ster	ngineering based on nts), Nervous system	<b>human physiology</b> : Circu (Artificial neural network)	ılatory sys	tem (artificia	al heart,
		MOD	ULE -3		8 ]	Hrs.
Bioins Paralle Dynar Algori	spired Al el Geneti nic Upda ithms Ins	<b>Igorithms and Appl</b> c Programming: Met ting DNA Computin pired by Honey Bee	ications: Genetic algorithm hodology, History, and App g Algorithms. Beehive: Ne Behaviour.	n, Gene ex plication to w Ideas fo	pression mo o Real-Life I r Developin	delling. Problems. g Routing
		MOD	ULE -4		6	Hrs.
Artific engine	<b>cial Inte</b> leering, sy	ligence and Biology stems biology, micro	Applications of AI in metobolic and data mining.	dical imag	ing, neural	
Text I	Books: Bioinsp 978160 A Pract Springe	ired Engineering, N 66502259 ical Guide to Bio-ins r2019, ISBN 978-3-0	Y: Momentum press, Jenkir pired Design, Hashemi Far 662-57683-0	ns, C.H. 20 zaneh, He	)12 ISBN: lena, Linden	nann, Udo,

#### **Reference Books:**

- •Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
- •Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
- Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.

#### MOOCS

• <u>https://onlinecourses.nptel.ac.in/noc19\_ge31/preview</u>

Course Outcomes		Program Outcomes [POs]												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2								
CO2	2					2			1					
CO3		2				2								
CO4	2					2								

Course Title DATA VISUALIZATION USING TABLEAU AND POWER BI											
Course Code	23CB658B	L-T-P	(0-0-2)1								
Exam	3 Hrs.	Hours/Week	2 Hours								
SEE	50 Marks	Total Hours	28								

**Course Objective:** The course aims to provide a comprehensive introduction to R programming, focusing on data structures, control structures, package management, data manipulation, statistical analysis, and data visualization.

Course Outcomes (COs): Upon completion of the course, students shall be able to:

No.	Course Outcomes	Manning	Manning
1,00		t-DO	L DCO.
		topOs	topsus
1.	Develop skills for performing statistical analysis summarizing data, and	2.5.10	1
	proting various trage of visualizations including southan alots line alots	2,0,10	-
	creating various types of visualizations, including scatter plots, line plots,		
	bar charts, histograms, and box plots.		
-			
2.	Clean, transform, statistically analyze, and visualize dataeffectively,	2,5,10	-
	along with the capability to build interactive		
	applications and custom packages in R.		
List o	f Experiments:		
Table	au		

- Tableau Basics: Creating First Bar Chart
- Time series, Aggregation and filters
- Maps, Scatterplots, and creating first Dashboard
- Joining, Blending and Relationship
- Table Calculations, advanced Dashboards, Storytelling

#### **Power BI**

- Introducing Microsoft Power BI
- Connecting and Shaping data
- Creating Data Model
- Calculated Fields with DAX
- Visualizing Data with Reports

## **Text Books:**

- Learning Tableau 2020: Create effective data visualizations, build interactive visual analytics, and transform your organization by Joshua N. Milligan.
- Mastering Microsoft Power BI: Expert techniques for effective data analytics and business intelligence by Brett Powell.

## **Reference Books:**

- The Definitive Guide to DAX: Business intelligence with Microsoft Excel, SQL Server Analysis Services, and Power BI by Marco Russo and Alberto Ferrari.Lawrence, M., &Verzani, J. (2016).
- Tableau Your Data!: Fast and Easy Visual Analysis with Tableau Software by Daniel G. Murray.

## **MOOCs:**

- <u>https://www.coursera.org/specializations/data-visualization</u>
- https://www.coursera.org/professional-certificates/microsoft-power-bi-data-analyst

	Course		Program Outcomes [POs]													
	Outcomes															
ĺ	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	

CO1	2		2			2		2	
CO2	2		2			2			