D Y PATIL
DEEMED TO BE
UNIVERSITY

SCHOOL *of* ENGINEERING
& MANAGEMENT
KOLHAPUR

F.Y. B. Tech.
Data Sciences Engineering
Structure and Curriculum

Department of First Year Engineering

w. e. f. A.Y.: 2024-25

F.Y. B. Tech Data Sciences Engineering Structure 2024-25

SEMESTER – I												
			Teaching Scheme				Theory			Practical		
Course Category	Course Type	Course Name	Credits	Contact Hrs.			ISE	MSE	ESE	INT	OE/ PoE	Total Marks
				L	P	T						
Basic Sciences	BSC	Linear Algebra & Calculus	4	3	-	1	20	30	50	25	-	125
	BSC	Applied Physics	4	3	2	-	20	30	50	25	-	125
Engineering Science	ESC	Problem Solving through Programming	4	3	2	-	20	30	50	25	-	125
	ESC	Digital Logic Design	4	3	2	-	20	30	50	25	-	125
Vocational Skills Enhancement Course	VSEC	Design Thinking Through Innovation	2	1	2	-	25	-	-	25	-	50
Indian Knowledge System	IKS	Historical Places in and Around Kolhapur District	2	2	-	-	20	30	-	-	-	50
Co-Curricular Activities	CCA	Liberal Learning - I	2	-	4	-	-	-	-	50	-	50
Mandatory Course	MC	Finishing School Training - I	-	3	-	-	50	-	-	-	-	Grade
		Rural/Social Internship	-	-	-	-	-		-	50	-	Grade
		Total	**22**	**15**	**12**	**1**	**175**	**150**	**200**	**225**	-	**650**
SEMESTER – II												
Basic Sciences	BSC	Differential Equations & Numerical Techniques	4	3	-	1	20	30	50	25	-	125
	BSC	Applied Chemistry	4	3	2	-	20	30	50	25	-	125
Engineering Science	ESC	Generative AI	4	3	2	-	20	30	50	25	-	125
Ability Enhancement Course	AEC	Professional Communication	2	1	2	-	25	-	-	25	-	50
Co-Curricular Activities	CCA	Liberal Learning - II	2	-	4	-	50	-	-	-	-	50
Program Core Courses	PCC	Data Analytics with Spreadsheet	2	2	-	-	-	-	50	-	-	50
Vocational Skills Enhancement Cours	VSEC	Python Programming	2	1	2	-	25	-	-	25	-	50
Mandatory Course	MC	Capstone Project	-	-	-	-	-	-	-	50	-	Grade
		Finishing School Training - II	-	3	-	-	50	-	-	-	-	Grade
		Total	**20**	**13**	**12**	**1**	**210**	**90**	**200**	**175**	-	**575**

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School of Engineering & Management
Department of First-Year Engineering
Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

F. Y. B. Tech. Scheme of Teaching and Examination w. e. f. A. Y. 2024-2025

Semester-I

Sr. No	Course Code	Course Type	Name of the Course	Teaching Scheme Per Week			Credits	Total Marks	Evaluation Scheme		
				L	P	T			Type	Max. Marks	Minimum Marks For Passing
Students Induction Program as Per AICTE Guidelines											
1	241DSEBSCL101	BSC	Linear Algebra & Calculus	03	--	--	03	100	ISE MSE ESE	20 30 50	40
2	241DSEBSCL105	BSC	Applied Physics	03	--	--	03	100	ISE MSE ESE	20 30 50	40
3	241DSEESCL101	ESC	Problem Solving through Programming	03	--	--	03	100	ISE MSE ESE	20 30 50	40
4	241DSEESCL103	ESC	Digital Logic Design	03	--	--	03	100	ISE MSE ESE	20 30 50	40
5	241DSEVSECL101	VSEC	Design Thinking ThroughInnovation	01	--	--	01	25	ISE	25	10
6	241DSEIKSL101	IKS	Historical Places in and Around Kolhapur District	02	--	--	02	50	ISE MSE	20 30	20
7	241DSEBSCP102	BSC	Linear Algebra & Calculus Tutorial	--	--	01	01	25	ISE	25	10
8	241DSEBSCP106	BSC	Applied Physics Laboratory	--	02	--	01	25	ISE	25	10
9	241DSEESCP102	ESC	Problem Solving through Programming Laboratory	--	02	--	01	25	ISE	25	10
10	241DSEESCP104	ESC	Digital Logic Design Laboratory	--	02	--	01	25	ISE	25	10
11	241DSEVSECP102	VSEC	Design Thinking ThroughInnovation Laboratory	--	02	--	01	25	ISE	25	10
12	241DSECCAP101	CCA	Liberal Learning - I	--	04	--	2	50	ISE	50	20
Total				**15**	**12**	**01**	**22**	**650**	--	--	--	--
Mandatory Courses											
1	241DSEMC102	MC	Rural/Social Internship	--	--	--	--	50	ISE	Grade	--	--
2	241DSEMC101	MC	Finishing School Training - I	03	--	--	--	50	ISE	Grade	--	--

D. Y. Patil Education Society

(Deemed To Be University)

School of Engineering & Management

Department of First-Year Engineering

Data Sciences Engineering Curriculum

(As Per National Education Policy 2020)

F. Y. B. Tech. Scheme of Teaching and Examination w. e. f. A. Y. 2024-2025

Semester -II

Sr. No	Course Code	Course Type	Name of the Course	Teaching Scheme Per Week			Credits	Total Marks	Evaluation Scheme			
				L	P	T			Type	Max. Marks	Minimum Marks for Passing	
1	241DSEBCSL103	BSC	Differential Equations & Numerical Techniques	03	--	--	03	100	ISE MSE ESE	20 30 50	40	
2	241DSEBSCL107	BSC	Applied Chemistry	03	--	--	03	100	ISE MSE ESE	20 30 50	40	
3	241DSEESCL105	ESC	Generative AI	03	--	--	03	100	ISE MSE ESE	20 30 50	40	
4	241DSEAECL102	AEC	Professional Communication	01	--	--	01	25	ISE	25	10	
5	241DSEPCCL101	PCC	Data Analytics with Spreadsheet	02	--	--	02	50	ESE	50	20	
6	241DSEVSECL103	VSEC	Python Programming	01	--	--	01	25	ISE	25	10	
7	241DSEBSCP104	BSC	Differential Equations & Numerical Techniques Tutorial	--	--	01	01	25	ISE	25	10	
8	241DSEBSCP108	BSC	Applied Chemistry Laboratory	--	02	--	01	25	ISE	25	10	
9	241DSEESCP106	ESC	Generative AI Laboratory	--	02	--	01	25	ISE	25	10	
10	241DSEAECP103	AEC	Professional Communication Laboratory	--	02	--	01	25	ISE	25	10	
11	241DSEVSECP104	VSEC	Python Programming Laboratory	--	02	--	01	25	ISE	25	10	
12	241DSECCAL102	CCA	Liberal Learning - II	--	04	--	02	50	ISE	50	20	
			Total	**13**	**12**	**1**	**20**	**575**	--	--	--	--
Mandatory Courses												
1	241DSEMC104	MC	Capstone Project	--	--	--	--	50	ISE	Grade	--	--
2.	241DSEMC103	MC	Finishing School Training - II	03	--	--	--	50	ISE	Grade	--	--

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(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Linear Algebra & Calculus	
Course Code: 241DSEBSCL101	**Semester:** I
Teaching Scheme: L-T-P: 3-1-0	**Credits:** 3
Evaluation Scheme ISE-I/MSE/ISE-II**:** 10/30/10	**ESE Marks:** 50

Prior Knowledge of:	Matrices, Derivatives

Course Objectives:

1.	To teach mathematical methodology.
2.	To develop mathematical skills and enhance the logical thinking power of students.
3.	To provide students with skills in Linear Algebra and Calculus.
4.	To imbibe graduates with mathematical knowledge, computational skills, and the ability to deploy these skills effectively in solution of engineering problems.

Curriculum Details

Course Contents	Duration
Unit 1: Unit-I Linear Algebra –I • Introduction to matrices, types of matrices • Rank of matrix by normal form and echelon form • Solution of simultaneous linear non-homogenous equations • Solution of simultaneous linear homogenous equations	**07 Hrs**
Unit 2: Numerical Solutions of Linear Algebra • Introduction • Gauss–Elimination method • Gauss –Jordan method • Gauss –Seidel method • Jacobi's iterative method • Power method	**07 Hrs**
Unit 3: Linear Algebra –II • Definition of a linear combination of vectors • Dependence and independence of vectors • Eigenvalues and its properties • Eigenvectors and their properties • Cayley-Hamilton theorem	**07 Hrs**
Unit 4: Differential Calculus • Introduction. • Partial derivatives • Total derivatives • Euler's theorem on homogeneous functions • Jacobian and its properties	**07 Hrs**

Data Sciences Engineering Curriculum

(As Per National Education Policy 2020)

Unit 5: Multiple Integrals • Introduction of Double integrals • Method of evaluation of Double integrals • Change of order of integration • Area enclosed by plane curves • Mass of a plane lamina	**07 Hrs**
Unit 6: Vector Spaces • The Euclidean space and vector space, subspace • Linear combination, linear span, linear dependence and independence • Basis, dimensions of finite dimensional vector space • Subspace- Row and column spaces • Rank and nullity Theorem	**07 Hrs**

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements
101.1	**Reduce** matrices to echelon form and **apply** the concept of rank of matrices to solve a system of linear equations
101.2	**Solve** linear equations by numerical methods.
101.3	**Identify** Eigen values & **make use of** them for finding Eigenvectors.
101.4	**Apply** the knowledge of partial differentiation.
101.5	**Apply** multiple integrals to calculate the areas and mass of lamina.
101.6	**Recognize and use** basic properties of subspace and vector space.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs / COs	BTL	1	2	3	4	5	6	7	8	9	10	11	12
101.1	2, 3	3	2	--	--	1	---	--	--	--	--	--	1
101.2	3	3	2	--	--	1	--	--	--	--	--	--	1
101.3	2, 3	3	2	--	--	1	--	--	--	--	--	--	1
101.4	3	2	2	--	--	--	--	--	--	--	--	--	1
101.5	3	2	2	--	--	--	--	--	--	--	--	--	1
101.6	3	2	2	--	--	1	--	--	--	--	--	--	1

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(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Advanced Engineering Mathematics	7th	Peter V. O'Neil	Cengage Learning	2012
2	Advanced Engineering Mathematics	1st	H. K. Dass	S. Chand Publications, New Delhi	2011
3	A Text Book of Applied Mathematics	7th	P.N.Wartikar, J.N.Wartikar	Vidyarthi Griha Prakashan, Pune.	2006
4	Higher Engineering Mathematics	36th	B.S. Grewal	Khanna Publishers	2001
5	Linear Algebra		Jin Ho Kwak and Sungpyo Hong	Springer	2004
6	Numerical Methods in Engineering and Science		B.S. Grewal	Khanna Publishers	

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Advanced Engineering Mathematics	5th	Erwin Kreyszig	India Pvt, Ltd.	2014
2	Higher Engineering Mathematics	6th	B.V.Ramana	Tata M/c Graw-Hill Publication	2010
3	Numerical Methods for Scientific and Engineering Computation	5th	M.K.Jain	New Age International Pvt. Ltd New Delhi	2007
4	A Textbook of Engineering Mathematics	6th	N.P.Bali, Iyengar	Laxmi Publication	2004
5	Elementary Linear Algebra	5th	Stephen Andrilli and David Hecker	Academic Press	2016

Useful Link /Web Resources:

1. DELNET- http://www.delnet.in
2. NDL-http://ndl.iitkgp.ac.in
3. N-LIST- http://www.nlist.inflib.ac.in
4. https://www.youtube.com/results?search_query=Dr+Navneet+Sangle

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Linear Algebra & Calculus Tutorial	
Course Code: 241DSEBSCP102	**Semester:** I
Teaching Scheme: L-T-P: 0-1-0	**Credits:** 1
Evaluation Scheme ISE: 25	**ESE Marks: --**

Prior Knowledge of:	Matrices, Derivatives

Course Objectives:

1.	To teach mathematical methodology.
2.	To develop mathematical skills and enhance the logical thinking power of students.
3.	To provide students with skills in Linear Algebra and Calculus.
4.	To imbibe graduates with mathematical knowledge, computational skills, and the ability to deploy these skills effectively in solution of engineering problems.

List of Tutorials

Tut. No.	Title of Tutorials	Duration
01	**Linear Algebra–I:** Rank of Matrix, Solutions of Non-homogenous simultaneous linear equations	01Hr
02	**Linear Algebra–I:** Solutions of simultaneous linear homogeneous Equations	01Hr
03	**Numerical Solutions of Linear Equations:** Gauss–Elimination method, Gauss–Jordan method.	01Hr
04	**Numerical Solutions of Linear Equations:** Gauss–Seidel method, Jacobi's iterative method.	01Hr
05	**Linear Algebra:** Linear Algebra using *SCILAB* /MATLAB	01Hr
06	**Linear Algebra –II:** Dependence and Independence of vectors	01Hr
07	**Linear Algebra –II:** Eigen values and Eigen vectors of Matrix, Cayley-Hamilton Theorem	01Hr
08	**Differential Calculus:** Euler's theorem on homogeneous functions.	01Hr
09	**Differential Calculus:** Partial derivatives, Jacobian and its properties.	01Hr
10	**Multiple Integrals:** Double integrals, change of order of integration, evaluation of Double integrals, change variables to polar coordinates, area enclosed by plane curves, Mass of a plane lamina.	01Hr
11	**Vector Spaces: V**ector space, Span, Basis, dimensions, subspace- Row and column spaces, Rank and nullity Theorem	01Hr
12	**Vector Spaces:** Vector Spaces using *SCILAB* /MATLAB	01Hr

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Applied Physics	
Course Code: 241DSEBSCL105	**Semester: I & II**
Teaching Scheme: L-T-P:3-0-0	**Credits: 03**
Evaluation Scheme ISE-I/MSE/ISE-II: 10/30/10	**ESE Marks: 50**

Prior Knowledge of:	Fundamentals of optics, semiconductors, nature of radiation, quantum mechanics, electrochemistry.

Course Objectives:

1.	To provide basic concept of modern optics
2.	To make the students grasp the working principles of LASER and its applications
3.	To perceive the fundamentals of quantum mechanics and its applications
4.	To explain electronic properties of semiconductors materials from quantum mechanical point of view
5.	To elucidate the thermodynamic and kinetic properties of cell reactions in rechargeable batteries

Curriculum Details

Course Contents	Duration
Unit 1: Wave Optics • Introduction: interference, diffraction, review of geometric and optical path • Theory of plane diffraction grating and grating equation • Resolving power of plane diffraction grating • Newton's ring: Experimental arrangement • Diameter of bright and dark ring • Determination of wavelength of monochromatic light using Newton's ring	**07 Hrs**
Unit 2: LASER • Concept of LASER, • Principle and working of LASER: Absorption, Spontaneous emission, Stimulated emission, Population inversion • Einstein's coefficient • Properties of LASER • Types of LASERS - Ruby LASER, He-Ne LASER • Applications of LASER: Industrial, Medical	**07 Hrs**

Data Sciences Engineering Curriculum

(As Per National Education Policy 2020)

Unit 3: Quantum Mechanics • Introduction to quantum physics • de Broglie wavelength of matter waves and its different forms • Heisenberg's uncertainty principle • Wave function and probability interpretation • Schrödinger's time independent & dependent wave equation (1-D) • Energy of particle in 1-D potential well using Schrödinger equation • Numerical	**07 Hrs**
Unit 4: Semiconductor Physics • Fermi Dirac distribution • Formation of bands in solids • Fermi energy and Fermi level in intrinsic and extrinsic semiconductors • Dependence of Fermi energy on temperature • Hall effect: equation for Hall voltage and Hall coefficient and relation between them • Numerical	**07 Hrs**
Unit 5: Semiconductor Devices and Digital Electronics • Properties of a P-N junction • Diode equation and I-V characteristic • Construction, working and I-V characteristics of BJT, JFET and MOSFET • Introductory digital concepts: Logic levels, Digital waveform and characteristic. Time clock and timing diagram • Logic functions and logic gates: AND, OR, NOT, NAND, NOR, X-OR, and X-NOR • Numerical	**07 Hrs**
Unit 6: Supercapacitor and Battery • Introduction: Electrolytic and galvanic cells, • Electrochemical energy storage: Supercapacitors and Batteries • Types of supercapacitors and batteries • Cell reactions in rechargeable batteries • Thermodynamic and Kinetic parameters of cell reactions • Courses of the cell reactions in different rechargeable batteries • Heat effects and Battery parameters	**07 Hrs**

Self-learning topics: Fire Temperature sensor (TIR-based), NDT of materials, Optical fiber as sensors, CO_2 LASER

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Outcomes (COs): After completion of the course, students will be able to:

CO	Statements
105.1	**Apply** the principle of interference and **relate** concepts in various engineering applications
105.2	**Summarize** the working mechanism and applications of LASER
105.3	**Examine** 1-D potential well problems using principles of quantum mechanical phenomenon
105.4	**Interpret** the electronic properties of semiconductors
105.5	**Express** the output characteristics of P-N junction-based semiconductor devices
105.6	**Determine** the equilibrium cell voltage using thermodynamic parameters of rechargeable batteries

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs / Cos	BTL	1	2	3	4	5	6	7	8	9	10	11	12
105.1	3	3	2	-	-	-	-	-	-	-	-	-	1
105.2	2	3	2	-	-	-	-	-	-	-	-	-	1
105.3	3	3	2	-	-	-	-	-	-	-	-	-	1
105.4	2	3	2	-	-	-	-	-	-	-	-	-	1
105.5	2	3	2	-	-	-	-	-	-	1	-	-	1
105.6	3	3	2	-	-	-	-	-	-	1	-	-	1

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Engineering Physics	1st	H. K. Malik	Tata McGraw Hill Education	2019
2	A Text Book of Engineering Physics	Revised	M. N. Avadhanulu, P. G. Kshirasagar	S. Chand Publications	2018
3	Engineering Physics	Revised	L.N. Singh	Synergy Knowledge Ware	2016
4	Engineering Physics	Revised	V. Rajendran	Tata McGraw Hill Education	2010
5	Engineering Physics	1st	R.K. Gaur, S.L. Gupta	Dhanpat Rai Publications	1993

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Fundamentals of Physics	Revised	J. Walker, D. Halliday, R. Resnick	Wiley Publications	2018
2	Engineering Physics	1st	B.K. Pandey and Chaturvedi	Cengage learning Publications	2017
3	Battery Technology Handbook	2nd	H. A. Kiehne	Marcel Dekker, Inc., New York	2003
4	Introduction to Solid State Physics	8th	Charles Kittel	John Willey and Sons Inc.	2009
5	Solid State Physics	6th	S.O.Pillai	New edge Internationals	2009
6	Digital Fundamentals	8th	T. L. Floyd	Pearson Education Inc., New Delhi	2003

Useful Link /Web Resources:

1. http://hyperphysics.phy-astr.gsu.edu/hbase/index.html
2. https://en.wikipedia.org/wiki/Wave_interference
3. https://en.wikipedia.org/wiki/Introduction_to_quantum_mechanics

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(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Applied Physics Laboratory	
Course Code: 241DSEBSCP106	**Semester:** I/II
Teaching Scheme: L-T-P: 0-0-2	**Credits: 01**
Evaluation Scheme: ISE: 25	**ESE Marks:**

Prior Knowledge of:	Optics, magnetic materials, semiconductor basics, graph plotting, slope calculation

Course Objectives:

1	To make the students understand the concept of physics for the effective application in the field of engineering and technology.
2	To use the knowledge of electron transport in semiconductors.
3	To summarize the factors affecting the capacitance of the supercapacitors.

List of Experiments-

Exp. No	Title of Experiments	Duration
01	To compute diameter of cylindrical obstacle using mono chromatic Source	02 Hrs
02	To calculate radius of curvature of Plano convex lens using Newton's ring	02 Hrs
03	To determine the velocity of the ultrasonic wave in water using ultrasonic Interferometer	02 Hrs
04	To determine wavelength of LASER using diffraction grating	02 Hrs
05	To decide band gap energy of P-N junction diode	02 Hrs
06	To determine divergence of LASER beam	02 Hrs
07	To determine resolving power of diffraction grating	02 Hrs
08	To recognize carrier concentration of semiconductor using Hall effect	02 Hrs
09	To Determine wavelength of light using plane diffraction grating	02 Hrs
10	To study physical significance of wave function quantum mechanics	02 Hrs
11	To calculate the resolving power of telescope	02 Hrs
12	To prove De Morgan's theorem	
13	To calculate the performance parameters of a given supercapacitor device using the data recorded on an electrochemical work-station	02 Hrs

Minimum 10 Experiments should be conducted from above list.

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Outcomes (COs): After successful completion of the course, students will be able to

CO	Statements
106.1	**Implement** knowledge related to optics to use for suitable purposes in applied physics
106.2	**Examine** the properties of LASER for suitable applications in applied physics
106.3	**Apply** the theory of semiconductors to estimate band gap energy and carrier concentration
106.4	**Determine** the performance parameters of a supercapacitor device using a modern electrochemical workstation

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs / COs	BTL	1	2	3	4	5	6	7	8	9	10	11	12
106.1	3	3	-	-	-	-	-	-	-	-	-	-	1
106.2	3	3	-	-	-	-	-	-	-	-	-	-	1
106.3	3	3	-	-	-	-	-	-	-	-	-	-	1
106.4	3	3	-	-	-	1	-	-	-	-	-	-	1

Suggested Learning Resources: Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Engineering Physics	1st	H.K. Malik	Tata McGraw Hill Education	2019
2	A Text Book of EngineeringPhysics	Revised	M. N. Avadhanulu, P. G. Kshirasagar	S. Chand Publications	2018
3	Engineering Physics	Revised	L. N. Singh	Synergy Knowledge Ware	2016
4	Engineering Physics	Revised	V. Rajendran	Tata McGraw Hill Education	2010
5	Engineering Physics	1st	R.K. Gaur, S.L. Gupta	Dhanpat Rai Publications	1993

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Fundamentals of Physics	Revised	J.Walker, D.Halliday, R.Resnick	Wiley Publication	2018
2	Engineering Physics	1st	B.K. Pandey and Chaturvedi	Cengage Learning Publications	2017
3	Battery Technology Handbook	2nd	H. A. Kiehne	Marcel Dekker, Inc., New York	2003
4	Introduction to Solid State Physics	8th	C.Kittel	John Willey and Sons Inc.	2009
5	Solid State Physics	6th	S.O.Pillai	New edge Internationals,	2009
6	Digital Fundamentals	8th	T. L. Floyd	Pearson Education Inc., New Delhi	2003

Useful Link /Web Resources:

1. https://vlab.amrita.edu/?sub=1
2. http://vlabs.iitb.ac.in/vlab/labsps.html

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Problem-Solving Through Programming	
Course Code: 241DSEESCL101	**Semester:** I
Teaching Scheme: L-T-P: 3 – 0 – 0	**Credits:** 03
Evaluation Scheme ISE-I, MSE, ISE-II:10/30/10	**ESE Marks:** 50

Prior Knowledge of:	Basic knowledge of computers.

Course Objectives:

1.	Acquire basic principles of problem-solving using computers.
2.	Learn and use the syntax of C programming language to solve basic science and engineeringproblems.
3.	Select appropriate programming constructs, data structures, and functions to build solutionsto a variety of problems.

Curriculum Details:

Course Contents	Duration
Unit 1: Introduction to C programming: Fundamentals of algorithms, flowcharts. **Getting started with C**- Basic structure of C program, features of C language,Character set, C tokens, Keywords and Identifiers, Data types and Format Specifier. Managing Input and Output operations. **Variable**s-Local and Global variables, rules for defining a variable name, variable initialization-Run time and compile time, variable declaration. **Constants**-Defining Constant by using preprocessor directive and keyword const. **Operators:** Arithmetic operators, Relational operators, Logical Operators, Assignment operators, Increment and Decrement operators, Conditional operators, Bit-wiseoperators, Special operators. Operator precedence and Associativity.	**07Hrs**
Unit 2: Programming Constructs: **Need of Decision-making statements**- 'if' statement, Simple 'if' statement, the 'if…else' statement, nesting of 'if…else' statements, The 'else if' ladder, The 'switch' statement, break statement, The 'go to' statement. **Need of looping statements**: The 'for',' while', and' do-while statements with examples.	**08 Hrs**
Unit 3: Arrays& Strings: **Arrays**-Types of arrays, Declaration arrays, initializing dimensional arrays (One-Dimensional and Two-Dimensional Array)-Run time Initialization and Compile time Initialization with examples. **Character Arrays and Strings**: Declaration and Initialization- Run time Initialization and Compile time Initialization with examples, reading string from the terminal and writing strings to screen, String handling Functions - strcpy(), strcmp(), strlen(), strcat().	**07Hrs**

Data Sciences Engineering Curriculum

(As Per National Education Policy 2020)

Unit 4: Structures and Unions: **Structures**-Elements of Structure –Structure definition, declaring structure variables, Structure initialization. Accessing structure members by using '.' Operator, Arrays of structure, Arrays within structures. **Unions**: Elements of Union–Union definition, declaring union variables, Union initialization, Comparison of Structure and Unions.	**07Hrs**
Unit 5: Functions: Need for Functions, Types of functions (User Defined and Built–In). **User-defined Function**-Elements of UDF-Function Definition, Function declaration, Function call. Actual Parameters, Formal Parameters. **Categories of functions**- With Argument and with the return value, No Argument and with a return value, With Argument and No return value, No Argument, and No return value. Storage classes (Automatic, Static, Extern, and Register). Passing arrays to function, Structures, and Functions. **Recursion.**	**07Hrs**
Unit 6: Pointers: Introduction to Pointers, accessing a value of variable by using Pointers-Declaration of Pointer variable, Initialization of pointer variables, Dereference operator. Pointers as function arguments-Call by value and call by reference. Pointers Expression, Pointers and Arrays, Pointers and Strings, Pointers to Functions, Pointers and Structures.	**06Hrs**

Self-learning topics: Recent trends in IT.

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements
101.1	Describe the basic structure of C program and use of different data type.
101.2	Develop conditional and Loop statements to write C programs.
101.3	Explain the concept of arrays and strings to store homogeneous data.
101.4	Use functions to break programs into small module.
101.5	Explain the concept of structures and unions.
101.6	Use pointers to access memory location.

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes(POs)

POs / Cos	BTL	1	2	3	4	5	6	7	8	9	10	11	12
101.1	2	3	3	2	-	-	-	-	-	-	-	-	1
101.2	2	3	3	2	-	-	-	-	-	-	-	-	1
101.3	2	3	3	2	-	-	-	-	-	-	-	-	1
101.4	2	3	3	2	-	-	-	-	-	-	-	-	1
101.5	2	3	3	2	-	-	-	-	-	-	-	-	1
101.6	2	2	2	2	-	-	-	-	-	-	-	-	1

Text Books:

Sr.No	Title	Edition	Author(s)	Publisher	Year
1	Programming in ANSI C	8th	E. Balagurusamy	McGraw Hill Education	2019
2	Let Us C	16th	Yashwant Kanetkar	BPB Publication	2017

Reference Books:

Sr.No	Title	Edition	Author(s)	Publisher	Year
1	Programming with ANSI And Turbo C	-	Ashok Kamthane	Pearson Education	2002
2	Programming in C	2nd	J.B Dixit	Firewal Media	2011
3	The Complete Reference Edition	4th	Herbert Schildt	McGraw-Hill Education	2017

Useful Link /Web Resources:

https://nptel.ac.in/courses/1061041282.

https://www.udemy.com/courses

https://www.coursera.org

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Problem-Solving Through Programming Laboratory	
Course Code: 241DSEESCP102	**Semester:** I
Teaching Scheme: L-T-P: 0 – 0 – 2	**Credits:** 01
Evaluation Scheme ISE:25	**ESE Marks:** 25

Prior Knowledge of:	Basic understanding of computer operations and familiarity with mathematical concepts

Course Objectives:

1.	Acquire basic principles of problem-solving using computers.
2.	Learn and use the syntax of C programming language to solve basic science and engineeringproblems.
3.	Select appropriate programming constructs, data structures and functions to build solutions to variety of problems.

Details:

Exp. No	Title of Experiments	Duration
01	To Study basic Linux commands and different IDEs used for programming.	02 Hrs
02	Basic C Programming	02 Hrs
03	C Programs based on Data Types and Operators	02 Hrs
04	C Programs based on Control Structures-conditional statements	02 Hrs
05	C Programs based on Control Structures-loops	02 Hrs
06	C Programs based on Functions	02 Hrs
07	C Programs based on array and string manipulation.	02 Hrs
08	C Programs based on Structures	02 Hrs
09	C Programs based on Pointers	02 Hrs
10	C Programs based on File Handling	02 Hrs

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(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements
102.1	Develop problem-solving strategies and computational thinking.
102.2	Design and implement algorithms using the C programming language.
102.3	Write, test, and debug C programs effectively.
102.4	Apply problem-solving techniques to a variety of programming challenges.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes(POs)

POs / Cos	BTL	1	2	3	4	5	6	7	8	9	10	11	12
102.1	2	1				1							2
102.2	2		2					1		1			2
102.3	2	1	2		3			1		1			2
102.4	2	2	2		3	1		1		1	1	1	2

Text Books:

Sr.No	Title	Edition	Author(s)	Publisher	Year
1.	Let Us C	16th Edition	Yashavant Kanetkar	BPB Publication.	2017
2.	Computer Fundamentals	4th Edition	P. K. Sinha,	BPB Publications.	2011
3.	How to Solve it by Computer		R.G. Dromey	Pearson Education India	
4.	The Complete	4th Edition	Herbert Schildt	McGraw-Hill Education	

Reference Books:

Sr.No	Title	Edition	Author(s)	Publisher	Year
1.	The C Programming Language	2nd Edition	Brian W. Kernighan, Dennis Ritchie	Pearson Education India	2019
2.	C How to Program	7th Edition	Deitel	Pearson Education India	2017

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Digital Logic Design	
Course Code:241DSEESCL103	**Semester:** I
Teaching Scheme: L-T-P:3-0-0	**Credits:**3
Evaluation Scheme ISE-I, MSE, ISE-II**:**10/30/10	**ESE Marks:**50

Course Prerequisites:	Basic algebra and understanding of logic

Course Objectives:

1.	To understand the basic concepts of digital systems, including binary number systems, Boolean algebra, and logic gates.
2.	To apply and simplify Boolean expressions and logic circuits using Karnaugh maps and Boolean algebra.
3.	To construct digital circuits using basic components like multiplexers, decoders, encoders, and flip-flops.
4.	To artculate the concepts of Processing unit and memory subsystem.

Course Description:

Digital Logic Design focuses on essential concepts in digital systems, including Boolean algebra, logic gates, and both combinational and sequential circuits. The course emphasizes hands-on learning of Sequential and Combinational Circuit designs through hands-on practical's using simulators. By the end, students are equipped to apply digital logic design concepts in computer engineering and related fields.

Curriculum Details:

Course Contents	Duration
Unit 1: Introduction to Digital System and Number System Digital Systems, Number System, Number system conversions, Logic Gates, minimization: Representation of truth-table, SOP form, POS form, Simplification of logical functions, Minimization of SOP and POS forms, don't care conditions Reduction techniques: K-Maps up to 4 variables.	**05Hrs**
Unit 2: Combinational Logic Design BCD, Excess-3, Gray code, Binary Code. Half- Adder, Full Adder, Half Subtractor, Full Subtractor, Multiplexers (MUX), Demultiplexers (DEMUX)	**07 Hrs**
Unit 3: Sequential Logic Design & Synchronous and Asynchronous Circuits Latches and Flip-Flops, Flip-Flop: SR, J-K, D, T; Preset & Clear, Truth Tables, and Excitation tables, Conversion of Flop- Flop, Registers: SISO, SIPO, PISO, PIPO, Asynchronous Counter, Synchronous Counter, BCD Counter	**08Hrs**

Data Sciences Engineering Curriculum

(As Per National Education Policy 2020)

Unit 4: Introduction to Computer Organization Function and structure of a computer Functional components, interconnection of components, Bus Structures. Processing Unit: Organization of a processor - Registers, ALU and Control unit, Instruction cycle	**07Hrs**
Unit 5: Input/output Subsystem Access of I/O devices, I/O ports, I/O interfaces - Serial port, Parallel port, PCI bus, I/O peripherals - Input devices, Output devices, Secondary storage devices.	**07Hrs**
Unit 6: Memory Subsystem Memory Hierarchy, RAM (Random Access Memory), Read Only Memory (ROM), Types of ROM, Cache Memory.	**08 Hrs**

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements
103.1	Describe the working of basic digital components.
103.2	Solve Boolean expressions for designing digital circuits using K-Maps.
103.3	Design Combinational digital circuits & Sequential circuits.
103.4	Demonstrate basics of Computer organization and Memory

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes(POs)

POs / Cos	BTL	1	2	3	4	5	6	7	8	9	10	11	12
103.1	2	1	-	-	-	-	-	-	-	-	-	-	-
103.2	2	1	1	-	-	2	-	-	-	-	-	-	-
103.3	2	2	2	2	2	3	-	-	-	1	2	-	-
103.4	2	1	-	-	1		-	-	-	-	-	-	-

Text Books:

1. R.P.Jain, “Modern Digital Electronics”, Tata McGraw-Hill, 4th Edition,2010 ISBN 978-0-07-06691-16
2. Moris Mano, “Digital Logic and Computer Design”, 2017, Pearson, ISBN 978-93-325-4252-5
3. W. Stallings, “Computer Organization & Architecture: Designing for performance”, 10th Edition, 2016, Pearson Education/ Prentice Hall of India, ISBN-10: 0-13-410161-8 | ISBN-13: 978-0-13-410161-3

Reference Books:

1. John Yarbrough, “Digital Logic applications and Design”, Cengage Learning, 2006, ISBN 13:978-81-315-0058-3
2. Norman B & Bradley, “Digital Logic and Design Principles”, Wiley India Ltd, 2000, ISBN 978-81-265-1258-4.

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(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Digital Logic Design Lab	
Course Code: 241DSEESCP104	**Semester:** I / II
Teaching Scheme: L-T-P: 0-0-2	**Credit:** 01
Evaluation Scheme: ISE: 25	**ESE Marks:**

Course Description:
Digital Logic Design This subject covers practical details of the subject Digital Logic Design and Memory organization in computers.

Course Objectives	
1	To provide hands on experience on construction of basic digital logic circuits
2	To get practical experience on Demorgan's theorem, SOP and POS forms.
3	To demonstrate verification of Full Adders, Subtractors, Gray to binary converters and vice versa
4	To verify working of Flip-flops, Counters and Shift registers

Sr. No	**Experiment**
1	Realization of functions using basic and universal gates (SOP and POS forms).
2	Study of Boolean algebra & De Morgan's theorem.(Verification of Theorem with truth table)
3	Realization of 4/5 variable K-maps.
4	Design and Realization of half /full adder and subtractor using basic gates and universal gates.
5	Design and Realization of Multiplexers and Demultiplexers.
6	Study of Flip-Flops: J-K, D, T, S-R.
7	Study of Registers and Counters.
8	Study of Bus Structure and Instruction Cycle.
9	Interfacing counter circuit with seven segment display.
10	Hand- on -constructin of various combinational circuits using CircuitVerse Simulator.

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements
104.1	Construct the truth table of various Logic Gates and combination circuits using logic gates.
104.2	Design, test, and evaluate various combinational circuits such as adders, subtractors, multiplexers, demultiplexers, decoders, etc.
104.3	construct flip-flops, counters, and shift registers
104.4	Simulate various combinational circuits using Circuit Verse Simulator.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes(POs)

POs / Cos	BTL	1	2	3	4	5	6	7	8	9	10	11	12
104.1	2	1								2			
104.2	2	1	1			2				2			
104.3	2	2	2			3				2	2		1
104.4	2	1			1					2			

Text Books:

1. R.P.Jain, “Modern Digital Electronics”, Tata McGraw-Hill, 4th Edition,2010 ISBN 978-0-07-06691-16
2. Moris Mano, “Digital Logic and Computer Design”, 2017, Pearson, ISBN 978-93-325-4252-5
3. W. Stallings, “Computer Organization & Architecture: Designing for performance”, 10th Edition, 2016, Pearson Education/ Prentice Hall of India, ISBN-10: 0-13-410161-8 | ISBN-13: 978-0-13-410161-3

Reference Books:

1. John Yarbrough, “Digital Logic applications and Design”, Cengage Learning, 2006, ISBN 13:978-81-315-0058-3
2. Norman B & Bradley, “Digital Logic and Design Principles”, Wiley India Ltd, 2000, ISBN 978-81-265-1258-4.

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Design Thinking Through Innovation	
Course Code: 241DSEVSECL101	**Semester:** I/II
Teaching Scheme: L-T-P: 1-0-0	**Credits:** 01
Evaluation Scheme: ISE: 25	**ESE Marks:**

Prerequisites: Understanding, User-Centric Mindset, Collaboration and Teamwork, Curiosity and Open-Mindedness, Effective Communication Skills, Learning Orientation, and Risk Tolerance.

Course Description:

The Design Thinking & Innovations subject aims to provide students with the tools and exposure to address problems using the design thinking process. The curriculum for "Design Thinking through Innovations" structured in such a way students learn to acquire both knowledge of design and practice of skills required to develop an attitude towards design. Being of the exemplary kinds, it focuses more on hands-on knowledge, learned by doing and acting upon challenges discovered within the community and surroundings.

Course Objectives:

1.	To Familiarize with Engineering Design Process and The basics of Design Thinking
2.	To Bring Awareness on Idea Generation to Solve the Problems
3.	To Familiarize with the various types of prototype and the techniques used for prototyping.

Course Outcomes (COs): At the end of the course, the students should be able to:

CO	Statements	BTL
101.1	**Learn the** Structured Approach of Engineering Design and the Relevance of Design and Design Thinking in Engineering & **Understand** Idea Generation Techniques to find solutions to Problems.	**1**
101.2	**Understand** the various types of prototypes and **Inculcate** the techniques used for prototyping.	**2**

Course Content:

Content	Duration
Unit I: Engineering Design, Design Thinking and Idea Generation • Introduction, Key Concepts of Design, A Simplified Process of Engineering Design • What is Design Thinking? - Its Importance, Socio-Economical Relevance, Principles, Origin, Process of Design Thinking, Relevance of Design and Design Thinking in Engineering • Introduction to Idea Generation, Idea Generation Techniques, Processes, Define the Problem, Needs v/s Wants, Identify Philosophy, Problem Solving Tools, Case Studies • Critical thinking: Fundamentals, Characteristics, Critical v/s Ordinary Thinking. • Critical thinking skills- linking ideas, structuring arguments, five pillars of critical thinking.	**07 Hrs**

Data Sciences Engineering Curriculum

(As Per National Education Policy 2020)

Unit II: Prototyping and Tools for Design - Innovation • Prototyping: Introduction, Need, Process, Types, Fidelity for prototypes, Minimum Usable Prototype [MUP] – Concept, challenges, etc. • Prototyping for Digital & Physical products: Concept, What is unique in Digital and Physical Prototypes? • Digital & Physical prototypes: Preparation; testing prototypes with users. • Introduction to Different tools used for design and Innovation, such as Hand Saw (Wood, PVC, CPVC and Steel), Component cutter, Spanners, Allen key & Wrench (Flat, Ring, Adjustable), Solder Gun, Component cutter, Tweezer, Multi meter, Glue Gun, Hex saw, Cutter, Wire Stripper.	**07 Hrs**

Text Books:

Sr. No	Title	Author(s)	Publisher	Year
1.	Introduction to Design Thinking	S.Salivahanan, S.Suresh Kumar, D.Praveen Sam	Tata Mc Graw Hill, First Edition	2019
2.	The Design Thinking Playbook	Michael Lewrick	Wiley	2019
3.	Prototyping for Designers: Developing the best Digital and Physical Products	Kathryn McElroy	O'Reilly	2017

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1.	Design Thinking – New Product Essentials from PDMA	1st	Michael G. Luchs, Scott Swan , Abbie Griffin	Wiley	2015
2.	101 Design Methods: A Structured Approach for Driving Innovation in Your Organization	1st	Vijay Kumar	Wiley	2012

Online Resources:

Sr. No.	Online Resource Link	Source
1	Introduction to Design Thinking - Course (swayam2.ac.in) Design Thinking Full Course | Design Thinking Process | Design Thinking For Beginners | Simplilearn - YouTube	Swayam (NPTEL) &YouTube
2	Thinking at IDEO - Insight, innovation, & a healthy dose of play	IDEO
3	INTRO (youtube.com)	YouTube
4	The Power of an Entrepreneurial Mindset | Bill Roche | TEDxLangleyED (youtube.com)	YouTube
5	https://www.ideou.com/pages/design-thinking	IDEO U
6	https://dschool.stanford.edu/	Stanford D school
7	https://www.designthinkersacademy.com/usa/	Design Thinking Institute
8	https://www.ibm.com/design/thinking/page/toolkit	Design thinking ToolKit
9	https://hbr.org/2018/09/design-thinking-is-fundamentally-conservative-and-preserves-the-status-quo	

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Design Thinking Through Innovation Lab	
Course Code: 241DSEVSECP102	**Semester:** I / II
Teaching Scheme: L-T-P: 0-0-1	**Credit:** 01
Evaluation Scheme: ISE: 25	**ESE Marks:**

Prerequisites: Understanding, User-Centric Mindset, Collaboration and Teamwork, Curiosity and Open-Mindedness, Effective Communication Skills, Learning Orientation, and Risk Tolerance.

Course Description:

The Design Thinking & Innovations subject aim at providing students with the tools and exposure to be able to address problems using the design thinking process. Design Thinking & Innovations is designed in such a way students learn to acquire both knowledge of design and practice of skills required to develop an attitude towards design. Being of the exemplary kinds, it focuses more on hands-on knowledge, learned by doing and acting upon challenges discovered within the community and surroundings.

Course Objectives:

1.	To Discuss Various Techniques of Idea Generation.
2.	To Explain the Various Tools Used for Innovation.
3.	To Discuss the Methods of Implementing Design Thinking in The Real World.
4.	To Discuss the Implementation of Creativity and Innovation.

Course Outcomes (COs):

At the end of the course, the student should be able to:

CO	Statements	BTL
105.1	**Learn the** Structured Approach of Engineering Design and the Relevance of Design and Design Thinking in Engineering & **Understand** Idea Generation Techniques to find out solutions to Problems.	**1**
105.2	**Understand** the various types of prototypes and **Incorporate** the techniques used for prototyping.	**2**

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Content

Sr. No.	Title of Experiments/Assignment List	Duration
01	Overview of Design Thinking: Ethical Design and Critiques, Generation of "IDEA", Problem Identification and Exercises.	02 Hrs
02	Brainstorming Sessions to Find out Solution for Identified Problems	02 Hrs
03	Prototyping and Modelling Challenge, Various Tools and Methodology Used for the Prototyping.	02 Hrs
04	Hands-On Demonstration of Different Tools used for Design & Innovation.	02 Hrs
05	Hands-On Demonstration of Soldering Machine, Function and Purpose of Soldering Machine.	02 Hrs
06	Explanation and Usage of Joining & Insulation Tools and Technics.	04 Hrs
07	Assembly and Disassembly of Two Wheel Drive Robot Based Vehicle.	02 Hrs
08	Micro Project: Group Formation and Idea Generation.	02 Hrs
09	Creation of Prototype and Innovative Solution.	02 Hrs
10	Test and Evaluation of Prototype.	02 Hrs
11	Report Drafting - Instructions & Practices.	02 Hrs
12	Presentation & Exhibition.	02 Hrs

Suggested Learning Resources: --

Reference Books:

Sr. no.	Name of Book	Author	Year
1.	Design Thinking: Understand-Improve-Apply	S. G. Blank	2007
2.	Design Thinking for Innovation Research and Practice	Walter Brenner, Falk Uebernickel, Springer	2016
3.	Business Design Thinking and Doing: Frameworks, Strategies and Techniques for Sustainable Innovation	Angele M. Beausoleil	2022

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(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Historical Places in and Around Kolhapur District	
Course Code:241DSEIKSL101	**Semester:** I/II
Teaching Scheme L-T-P :2-0-0	**Credits:**02
Evaluation Scheme ISE-I, MSE, ISE-II:10/30/10	**ESE Marks:**

Curriculum Contents	Duration
Unit 01: Chhatrapati Shahu Maharaj: A King for Society • Introduction • Life History • Contribution of Rajarshi Shahu Maharaj in various fields as a modern Social Reformer as Women Empowerment in the 19th Century • Development in Education • Social Reservation and equality • Agriculture • Industry • Initiation for Radhanagari Village and Dam	07 Hrs
Unit 02: A Study of Khidrapur- Kopeshwar • Life History of Khidrapur Kopeshwar Temple • The Wonder of Khidrapur Kopeshwar Temple • Swarga Mandap in Kopeshwar Temple • Sabha Mandap, Antaral Kaksha of Kopeshwar Temple • Beauty of Exterior Architecture of Kopeshwar Temple • Mystery of Black stone • Measures Suggested to Development of Khidrapur	07 Hrs
Unit 03: A Study of Panhala Fort and Pawankhind • History of Panhala Fort • Major Features: Andhar Bawadi • Major Features: Kalavanticha Mahal, Ambarkhana • Major Features: Dharma Koti, Sajja Koti • Teen Darwaja, Raj Darwaja • Rajdindi Bastion • Journey from Panhalgad to Pawankhind by Chhatrapati Shivaji Raje	07 Hrs
Unit 04: A Study of Mahalaxmi Temple • History and construction of Temple • The Main Shrines Doorway • Darshan and Kurma Mandap • Ganapati Chowk, Garud Mandap • Boundary wall, Entrances and complex • Mahalaxmi Temple Timings • Kiranostav Celebrations	07 Hrs

References:

1. Social Movements in India: A Review of Literature – Ghanshy am ShahISBN 0761995145 New Delhi ; Thousand Oaks : Sage Publications, 2004
2. Rajarshi Shahu Maharaj – Jeevan Vakarya, editor – Ramesh Patnage.
3. Shahu Chhatrapati - Royal Revolutionary – DhananjayKeer
4. Samajik SanshodhanPadnativaTantre – Dr. Pradeep Aaglave.
5. Kalasekar. T. L : Khidrapur: Khojurao of Maharashtra.
6. Chothe R.G : Temples of Khidrapur, A heritage of India.
7. Kulkarni A. B : Kopeshwar temple of Khidrapur.
8. Gazetteer of Kolhapur District.
9. Eaton, Richard Maxwell (2005). The New Cambridge History of India
10. "Translations of Panhala inscriptions". Government of Maharashtra. Retrieved 19 March 2009.
11. "Mahalakshmi Temple - Jewel Among Kolhapur Temples
12. "Inside Temples". mahalaxmikolhapur.com.

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Differential Equations Numerical Technique	
Course Code: 241DSEBSCL103	**Semester: II**
Teaching Scheme: L-T-P: 3-0-0	**Credits:** 3
Evaluation Scheme ISE-I/MSE/ISE-II:10/30/10	**ESE Marks:** 50

Prior Knowledge of:	Formulae of Derivatives and Integration, Differential Equation, Statistics.

Course Objectives:

1.	To teach mathematical methodology.
2.	To develop mathematical skills and enhance logical thinking power of students.
3.	To provide students with skills in differential equations and numerical techniques.
4.	To imbibe graduates with mathematical knowledge, computational skills and the ability to deploy these skills effectively in solution of engineering problems.

Curriculum Details

Course Contents	Duration
Unit 1: Ordinary Differential Equations of First Order and First Degree • Definition of differential equation, order and degree of differential equation • Exact differential equations • Non - exact differential equations • Linear differential equations • Bernoulli's differential equations	**07 Hrs**
Unit 2: Applications of Ordinary Differential Equations • Introduction of variable separable form. • Orthogonal trajectories. (Cartesian form) • Applications to simple electrical circuits • Newton's law of cooling • Rate of decay and growth	**07 Hrs**
Unit 3 Numerical methods to solve Ordinary Differential Equations • Introduction • Picard's method • Taylor's series method • Euler's method • Runge - Kutta's method (Fourth order)	**07 Hrs**

Data Sciences Engineering Curriculum

(As Per National Education Policy 2020)

Unit 4: Numerical Solutions of Algebraic & Transcendental equations • Introduction of Algebraic and Transcendental equations • Bisection method • Newton-Raphson method • Regula-Falsi method • Secant method	**07 Hrs**
Unit 5: Correlation and Regression • Introduction, Types of correlation, Karl Pearson's coefficient of correlation • Interpretation of the coefficients of corrections • Computation of coefficient of correlation for ungroup data • Lines of regression • Calculations of equations of the lines of regression	**07 Hrs**
Unit 6: Frequency distribution and measure of central Tendency • Frequency distribution, Continuous frequency distribution • Graphical representation of a Frequency distribution- Histogram, frequency polygon • Measure of central tendency- Arithmetic mean, median and mode • Range, Quartile deviation • Mean deviation, Standard deviation	**07 Hrs**

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements
1	**Solve** ordinary differential equations of first order and first degree.
2	**Apply** the knowledge of ordinary differential equation of first order and first degree.
3	**Use** the numerical methods to solve ordinary differential equations.
4	**Apply** the numerical techniques to solve algebraic &transcendental equations.
5	**Describe** the statistical data numerically by using correlation, regression and curve fittings.
6	**Apply** the knowledge to study the data given with respect to dispersion and measure of central tendency.

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs / COs	BTL	1	2	3	4	5	6	7	8	9	10	11	12
1	2, 3	3	2	--	--	--	--	--	--	--	--	--	1
2	3	3	2	--	--	--	--	--	--	--	--	--	1
3	2,3	3	2	--	--	1	--	--	--	--	--	--	1
4	3	2	2	--	--	1	--	--	--	--	--	--	1
5	3	2	2	--	--	1	--	--	--	--	--	--	1
6	3	2	2	--	--	1	--	--	--	--	--	--	1

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Advanced Engineering Mathematics	7th	Peter V.O'Neil	Cengage Learning	2012
2	Advanced Engineering Mathematics	1st	H.K. Dass	S. Chand Publications, New Delhi	2011
3	A Text Book of Applied Mathematics	7th	P.N.Wartikar, J.N.Wartikar	Vidyarthi Griha Prakashan, Pune.	2006
4	Higher Engineering Mathematics	36th	B.S. Grewal	Khanna Publishers	2001

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Advanced Engineering Mathematics	5th	Erwin Kreyszig	India Pvt, Ltd.	2014
2	Higher Engineering Mathematics	6th	B.V.Ramana	Tata M/c Graw-Hill Publication	2010
3	Numerical Methods for Scientific and Engineering Computation	5th	M.K.Jain	New Age International Pvt. Ltd New Delhi	2007
4	A Textbook of Engineering Mathematics	6th	N.P.Bali, Iyengar	Laxmi Publication	2004

Useful Link /Web Resources:

1. DELNET- http://www.delnet.in
2. NDL-http://ndl.iitkgp.ac.in
3. N-LIST- http://www.nlist.inflib.ac.in
4. https://www.youtube.com/results?search_query=Dr+Navneet+Sangle

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Differential Equations Numerical Technique Tutorial	
Course Code: 241DSBSCP104	**Semester: II**
Teaching Scheme: L-T-P: 0-0-1	**Credits:** 1
Evaluation Scheme ISE: 25	**ESE Marks:** 50

Prior Knowledge of:	Formulae of Derivatives and Integration, Differential Equation, Statistics.

Course Objectives:

1.	To teach mathematical methodology.
2.	To develop mathematical skills and enhance logical thinking power of students.
3.	To provide students with skills in differential equations and numerical techniques.
4.	To imbibe graduates with mathematical knowledge, computational skills and the ability to deploy these skills effectively in solution of engineering problems.

List of Tutorials

Tut. No.	Title of Tutorial	Duration
01	**Ordinary Differential Equations:** Exact and non-exact differential equations.	01Hr
02	**Ordinary Differential Equations:** Linear and non-linear differential equations.	01Hr
03	**Applications of Ordinary Differential Equations:** Orthogonal Trajectories. (Cartesian curves), Applications to Simple Electrical Circuits.	01Hr
04	**Applications of Ordinary Differential Equations:** Newton's law of cooling, Rate of Decay, and growth	01Hr
05	**Numerical Solution of Ordinary Differentia Equations First Order and First Degree:** Picard's method, Taylor's series method.	01Hr
06	**Numerical Solution of Ordinary Differential Equations of First Order and First Degree:** Euler's method, Runge-Kutta's method.	01Hr
07	**Numerical Solutions of Algebraic & Transcendental Equations:** Bisection method, Newton-Raphson method.	01Hr
08	**Numerical Solutions of Algebraic & Transcendental Equations:** Regula-Falsi method, Secant method.	01Hr

09	**Numerical Solutions**: Numerical Solutions using SCILAB/MATLAB	01Hr
10	**Correlation and Regression:** Computation of Correlation, Lines of regression	01Hr
11	**Frequency distribution and measure of central Tendency:** Measure of central tendency- Arithmetic mean, median and mode, Range, Quartile deviation, Mean deviation, Standard deviation	01Hr
12	**Measure of central Tendency:** Measure of central Tendency using SCILAB/MATLAB	01Hr

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Advanced Engineering Mathematics	7^{th}	Peter V.O'Neil	Cengage Learning	2012
2	Advanced Engineering Mathematics	1^{st}	H.K. Dass	S. Chand Publications, New Delhi	2011
3	A Text Book of Applied Mathematics	7^{th}	P.N.Wartikar, J.N.Wartikar	Vidyarthi Griha Prakashan, Pune.	2006
4	Higher Engineering Mathematics	36^{th}	B.S. Grewal	Khanna Publishers	2001

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Advanced Engineering Mathematics	5^{th}	Erwin Kreyszig	India Pvt, Ltd.	2014
2	Higher Engineering Mathematics	6^{th}	B.V.Ramana	Tata M/c Graw-Hill Publication	2010
3	Numerical Methods for Scientific and Engineering Computation	5^{th}	M.K.Jain	New Age International Pvt. Ltd New Delhi	2007
4	A Textbook of Engineering Mathematics	6^{th}	N.P.Bali, Iyengar	Laxmi Publication	2004

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Applied Chemistry	
Course Code: 241DSEBSCL107	**Semesters:** I and II
Teaching Scheme: L-T-P: 3 – 0 - 0	**Credits: 3**
Evaluation Scheme ISE-I/MSE/ISE-II: 50	**ESE Marks: 50**

Prior Knowledge of:	Periodic properties of elements, Basics of organic, inorganic, physical, and analytical chemistry

Course Objectives:

1.	**Understand** the principles and applications of sensors.
2.	**Discuss** the Basic concepts of electronic memory and display Systems
3.	**Illustrate** general synthesis and mechanisms of some advanced polymeric Materials and nanomaterials
4.	**Evaluate** the electrochemical energy storage systems such as lithium batteries and design for usage in electrical and electronic applications
5.	**Interpret** of extraction of metal from e-waste.
6.	**Apply** the theoretical aspects for understanding the water chemistry

Curriculum Details

Course Contents	Duration
Unit 1: Water Chemistry • Introduction, Types of impurities in natural water. • Water quality parameters total solids, acidity, alkalinity, chlorides, COD and BOD. (definition, causes, significance) • Hardness of water, types of hardness, units of hardness, numerical on hardness. • Ill effects of hard water in steam generation in boilers (scale & sludge formation, caustic embrittlement and boiler corrosion) • Treatment of hard water (Ion exchange and reverse osmosis process) • Biosensors for glucose detection.	**07 Hrs**
Unit 2: Sensors • Introduction, working, principle and applications of conductometric sensors, electrochemical sensors, thermometric sensors (Flame photometry) and optical sensors (colorimetry). • Hydrated gel sensor (P^H meter). • Sensors for the measurement of dissolved oxygen (DO). • Electrochemical gas sensors for SOx and NOx. • Disposable sensors (DS): Introduction, principle, characteristics of disposable sensors, Advantages of DS over Classical sensors.	**07 Hrs**

Unit 3: Materials for Memory and Display Systems **Memory Devices**: • Introduction, basic concepts of electronic memory, Classification of electronic memory devices (organic, polymeric and hybrid material). • Manufacturing of semiconducting chips. • Green computing: Bio-composite based memory devices **Display Systems**: • Nanomaterials and organic materials for display technology (Light absorbing and emitting materials) used in optoelectronic devices. • Liquid crystals display (LC's) –Introduction, classification, properties and application in Liquid Crystal Displays (LCD's). • Properties and application of Organic Light Emitting Diodes (OLED's) and light-emitting electrochemical cells	**07 Hrs**
Unit 4: Energy System and Battery Technology • Introduction, Classification of batteries (primary and secondary batteries). • Construction, working, advantages, and applications of the carbon-zinc cell, Ni-Cd, and Li-ion battery as an electrochemical cell. • Principle, Properties, and applications of Quantum dots sensitized solar cells (QDSSC's). • Fuel cells**:** Concept, types of fuel cells and merits. • Construction, working and applications of phosphoric acid fuel cells and Hydrogen-oxygen fuel cell	**07 Hrs**
Unit 5: **Sustainable Chemistry and E-waste management:** • Introduction, sources of e-waste, Composition, Characteristics, and Need of e-waste management. • Toxic materials used in manufacturing electronic and electrical products, health hazards due to exposure to e-waste. • Recycling and Recovery: Different approaches of recycling (separation, thermal treatments, hydrometallurgical extraction, direct recycling). • Extraction of Metal from E-waste. Role of stakeholders in environmental management of e-waste (producers, consumers, recyclers, and statutory bodies).	**07 Hrs**
Unit 6: Engineering Advanced materials and Green Chemistry • Introduction, and classifications of polymer. • Introduction, synthesis, properties & applications of Bakelite and Urea-formaldehyde resin. • Conducting Polymers: Introduction, Synthesis & Mechanism of conduction in polyaniline. • Biodegradable polymers: Introduction and their requirements. Synthesis, properties and applications of Polylactic acid. **Green Chemistry:** • Introduction, Aims, goals and applications. • Twelve principle of green chemistry. • Green Fuels: Introduction, construction and working of solar photovoltaic cell, advantages, and disadvantages.	**07 Hrs**

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements
107.1	**Understand** the principles and applications of sensors.
107.2	**Discuss and assess** the Basic concepts of electronic memory and display Systems
107.3	**Illustrate** general synthesis and mechanisms of some advanced polymeric Materials and nanomaterials
107.4	**Evaluate** the electrochemical energy storage systems such as lithium batteries and design for usage in electrical and electronic applications
107.5	**Interpret** the extraction of metal from e-waste and the role of stakeholders in the environmental management of e-waste.
107.6	**Apply** the theoretical aspects for understanding water chemistry

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs / Cos	BTL	1	2	3	4	5	6	7	8	9	10	11	12
107.1	3	3	-	-	-	-	-	-	-	-	-	-	1
107.2	2	3	-	-	-	-	-	-	-	-	-	-	1
107.3	2	3	-	-	-	-	-	-	-	-	-	-	1
107.4	2	3	-	-	-	-	-	-	-	-	-	-	1
107.5	3	3	-	-	-	-	-	-	-	-	-	-	1
107.6	3	3	-	-	-	-	-	-	-	-	-	-	1

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Functional and smart materials,	--	Chander Prakash, Sunpreet Singh, J. Paulo Davim	CRC Press, ISBN: 978-036-727-510	2020,
2	A Textbook of Engineering Chemistry	12th	S. S. Dara, S. S. Umare	S. Chand & Company Ltd., New Delhi.	2011
3	A Text Book of Engineering Chemistry	--	Shashi Chawla	Dhanpat Rai & Co.	2017
4	A textbook of Engineering Chemistry	--	Jain and Jain,	Dhanpatrai Publication.	2015

Data Sciences Engineering Curriculum

(As Per National Education Policy 2020)

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Energy storage and conversion devices: Supercapacitors, batteries, and hydroelectric cells,	1st edition, I	Anurag Gaur, A. L. Sharma, Anil Arya.	CRC Press, SBN: 978-1-003-14176-1	2021
2	E-waste recycling and management: present scenarios and environmental issues	Vol. 33.	Khan, Anish, and Abdullah M. Asiri.	Springer, ISBN: 978-3-030-14186-8.	2019
3	Functional and smart materials,	--	Chander Prakash, Sunpreet Singh, J. Paulo Davim	CRC Press, ISBN: 978-036-727-510	2020,
4	A Textbook of Engineering Chemistry	12th	S. S. Dara, S. S. Umare	S. Chand & Company Ltd., New Delhi.	2011

Useful Link /Web Resources:

1. https://ndl.iitkgp.ac.in/
2. https://www.youtube.com/watch?v=faESCxAWR9k

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Applied Chemistry Laboratory	
Course Code:241DSEBSCP108	**Semesters:** I & II
Teaching Scheme: L-T-P: 0-0-2	**Credit:** 1
Evaluation Scheme: ISE: 25	**ESE Marks:**

Prior Knowledge of:	Experiments based on titration, Handling of Glassware & Chemicals, and Preparation of Solutions.

Course Objectives:

1.	To test water quality parameters using various titration analysis methods
2.	To synthesize simple advanced materials and estimate concentration of elements in material's
3.	To know handling of glassware's and simple equipment's for chemical analysis.

List of Experiments-

Exp. No	Title of Experiments	Duration
01	Determination of total hardness of water sample by EDTA method (Complex metric Titration).	02Hrs
02	To determine the normality of given strong acid by titrating against strong alkali solution by conduct meter	02Hrs
03	To determine the normality of given weak acid by titrating against strong alkali solution by conductometer.	02Hrs
04	Determination pH of given solutions by pH meter.	02Hrs
05	Estimation of Iron from a solution by calorimetry.	02Hrs
06	Estimation of Nickel from a solution by calorimetry	02Hrs
07	To determine the approximate analysis of coal.	02Hrs
08	To study the Construction and working of Galvanic cell	02Hrs
09	To estimate amount of calcium from waste chalk.	02Hrs
10	Estimation of zinc metal from brass solution.	02Hrs
11	Preparation of urea-formaldehyde resin.	02Hrs
12	Preparation of phenol formaldehyde resin.	02Hrs

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(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements
108.1	**Analyse** hardness, acidity, alkalinity, and chloride content of water and percentage of elements in some alloys.
108.2	**Produce** various advanced materials and analyse aqueous solutions using instruments.
108.3	**Perform** various experiments by following written instructions.
108.4	**Express** involvement by understanding concepts in applied chemistry.

Course Articulation Matrix: Mapping of Course Outcomes (Cos) with Program Outcomes (PO's)

PO's / Cos	BTL	1	2	3	4	5	6	7	8	9	10	11	12
108.1	3	3	-	-	-	-	-	-	-	-	-	-	1
108.2	3	3	-	-	-	-	-	-	-	-	-	-	1
108.3	3	3	-	-	-	-	-	-	-	-	-	-	1
108.4	3	3	-	-	-	-	-	-	-	-	-	-	1

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Laboratory manual on engineering chemistry	1st	S. K. Bashin, Dr.Sudha Rani	Dhanpat Rai Publishingcompany Ltd.,New Delhi	2012
2	Engineering Chemistry	15th	P. C. Jain,	Dhanpat Rai Publishing Company Ltd., New Delhi	2014

Useful Link /Web Resources:

1. https://www.vlab.co.in/broad-area-chemical-science

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School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Generative AI	
Course Code: 241DSEESCL105	**Semester:** II
Teaching Scheme: L-T-P: 3 – 0 - 0	**Credits:** 3
Evaluation Scheme: ISE-MSE Marks: 50	**ESE Marks:** 50

Course Description: Students will explore the basic principles of machine learning and neural networks, gaining insights into how AI systems learn from data to generate novel outputs. The course covers key areas of AI application, including natural language processing and computer vision, providing students with a broad perspective on the field's capabilities and potential.

Course Objectives:

1. To Explain the basic principles of Machine Learning.
2. To Describe the core concepts of neural networks and deep learning
3. To Distinguish between different generative models (e.g., GANs, VAEs)

Course Outcomes (COs):

Upon successful completion of this course, the students will be able to:

C105.1	Understand and explain the fundamentals of AI and generative AI
C105.2	Develop proficiency in prompt engineering and apply effective techniques for text generation
C105.3	Analyze and compare different types of generative models, including their capabilities.
C105.4	Evaluate the ethical implications, societal impact, and future potential of generative AI

Content	Hours
Unit 1: Introduction to AI and Generative AI Definitions of AI and generative AI. Brief history and types of AI.	5
Unit 2: Fundamentals of Generative AI "Neural networks, machine learning, deep learning. How generative AI ""learns""?"	7
Unit 3: Prompt Engineering and Text Generation "What is prompt engineering? Importance of prompts in generative AI. Techniques for effective prompt writing. How do text generation models work? Applications in writing, chatbots, and education."	7
Unit 4: Introduction to Generative Models What are generative models? Overview of different types (GANs, VAEs, etc.) Simple examples of content generation Generating simple images or melodies	7

Unit 5: Image and Art Generation Image generation techniques. Role of prompts in image generation	6
Unit 6: Ethical Considerations and Future of Generative AI Potential applications and impact on society Ethical considerations (bias, misinformation, etc.) Privacy and security concerns Discussing the future of AI	8

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	Pos											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
C205.1	1				1							1
C205.2	1		2		1							
C205.3	1	2		1	1							
C205.4						3	2	3				1

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Generative AI Laboratory	
Course Code: 241DSEESCP106	**Semester:** II
Teaching Scheme: L-T-P: 0 – 0 - 2	**Credits:** 1
Evaluation Scheme: ISE Marks: 25	**ESE-**

Course Description: This course provides an introduction to generative artificial intelligence (AI), covering fundamental concepts, Models, AI tools and applications. Students will learn about various generative models and tools used in creating content such as images, text, music, prompt engineering concepts and ethics.

Course Objectives:

1. To study basic principles of generative AI.
2. To study different types of generative models and their applications.
3. To give hands-on experiences with existing generative models and tools.
4. To explore ethical considerations and societal implifications of generative AI technologies.

Course Outcomes (COs):

Upon successful completion of this course, the students will be able to:

C205.1	Understand and explain the fundamentals of AI and generative AI
C205.2	Develop proficiency in prompt engineering and apply effective techniques for text generation
C205.3	Analyze and compare different types of generative models, including their capabilities.
C205.4	Evaluate the ethical implications, societal impact, and future potential of generative AI

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	**Pos**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
C205.1	1				1							1
C205.2	1		2		1							
C205.3	1	2		1	1							
C205.4						3	2	3				1

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

List of Assignments		
Ass. No.	**Name of Assignment**	**Hours**
1	Use AIweirdness.com to explore simple text generation. (https://www.aiweirdness.com/)	2
2	Use Teachable Machine by Google to create a simple image classifier. (https://teachablemachine.withgoogle.com)	2
3	Use Neural Network playground to visualize how neural networks make decisions. (https://playground.tensorflow.org/)	2
4	Use GPT-3 playground or a similar tool to generate text. (https://studio.ai21.com/)	2
5	Create a simple chatbot using Dialogflow or Botpress.	2
6	Use DALL-E mini or Midjourney to create AI-generated art	2
7	Experiment with DeepArt.io to apply artistic styles to photos	2
8	Use Mubert to generate AI music .	2
9	Experiment with Google's Magenta studio for music creation	2
10	Use the What-If Tool by Google to explore machine learning models and dataset bias	2

Online Resources:

1. https://www.deeplearning.ai/courses/generative-ai-for-everyone/
2. https://www.coursera.org/learn/introduction-to-generative-ai
3. https://www.w3schools.com/gen_ai/gen_ai_prompt_intro.php
4. https://www.tutorialspoint.com/prompt_engineering/prompt_engineering_introduction.htm
5. https://www.youtube.com/@AI.Overpowered

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Professional Communication	
Course Code: 241DSEACEL102	**Semester:** I/II
Teaching Scheme L-T-P: 1-0-0	**Credits:** 01
Evaluation Scheme: - ISE: 25	**ESE: --**

Prior knowledge of:	Basic English grammar, Basics of communication

Course Objectives:

1.	To **make** students learn important communicative situations, the basics of communication, and its significance in the corporate sector
2.	To **sharpen** listening, speaking, reading, and writing skills
3.	To **facilitate** them to draft office documents effectively
4.	To **enhance** career skills to make students industry-ready

Curriculum Details

Course Contents	Duration
Unit 1 Language and Communication • Need for effective communication • The process and levels of communication • Professional communication • Communication networks/ flows • Forms and methods (verbal and non-verbal) of communication • Barriers to communication and solutions	**04 Hrs**
Unit 2 Introduction to LSRW • **Listening Skills:** Hearing and listening, Listening as an active skill; Types of Listening; Barriers to effective listening skills • **Speaking Skills**: Importance, Various oral business contexts/situations, Group communication, Preparing effective public speeches (Impromptu and Prepared) • **Reading Skills**: Benefits of effective reading, Types of reading (Skimming; Scanning, Intensive reading, Extensive reading) Overcoming common obstacles, Reading comprehension • **Writing Skills:** Importance, Paragraph writing techniques	**03Hrs**
Unit 3 Professional Correspondence • **Official correspondence** Principles, structure (elements) Layout (complete block, modified block, semi-block), Types (enquiry and reply, claim and adjustment) • **Office drafting** Writing notice, agenda, and minutes of the meeting • **Email writing** Advantages and limitations Style, structure, and content Email etiquette	**04 Hrs**

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Unit 4 Career Skills and Ethics	**03 Hrs**
• **Resume and cover letter writing** Types of resume Important features of selling resume Cover letter writing • **Job Interviews** Interview preparation FAQs (Frequently Asked Questions) • **Guidance for IELTS, TOFEL and GRE** • **Corporate etiquette and ethics**	

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements
102.1	**Implement** verbal and non-verbal codes for effective communication
102.2	**Demonstrate** language learning skills- LSRW (Listening, Speaking, Reading, and Writing)
102.3	**Compose** business documents competently
102.4	**Enhance** employability and readiness for industry demand and career advancement

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs / COs	BTL	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	-	-	-	-	-	-	-	2	3	3	-	1
CO2	3	-	-	-	-	-	-	-	2	3	3	-	1
CO3	3	-	-	-	-	-	-	-	2	3	3	-	1
CO4	3	-	-	-	-	-	-	-	2	3	3	-	1

Suggested Learning Resources:
Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Technical Communication: Principles and Practice	4th	Meenakshi Raman & Sangita Sharma	Oxford University Press	2022
2	Personality Development and Soft- Skills	2nd	Barun K. Mitra	Oxford University Press	2016
3	Communication Skills	2nd	Sanjay Kumar & Pushp Lata	Oxford University Press	2015
4	Communication Skills	3rd	Meenakshi Raman & Sangeeta Sharma	Oxford University Press	2013

Data Sciences Engineering Curriculum

(As Per National Education Policy 2020)

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Business Communication	2nd	Urmila Rai and S.M. Rai	Himalaya Publishing House Pvt. Ltd.	2014
2	A University Grammar of English	1st	Randolph Quirk and S Greenbaum	Pearson	2007
3	Effective Technical Communication	2nd	B. K.Mitra	Oxford University Press	2006
4	Effective Technical Communication	2nd	M.Ashraf Rizvi	McGraw Hill Education	2005

Useful Links/Web Resources:

1. **https://www.skillsyouneed.com**
2. **https://www.psychologytoday.com**
3. **https://www.britishcouncil.in**
4. **https://www.udemy.com**
5. **https://www.englishclub.com**

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Professional Communication Laboratory	
Course Code: 241DSEVSECP103	**Semester:** I/II
Teaching Scheme L-T-P: 0-0-2	**Credit:**01
Evaluation Scheme: ISE Marks: 25	**ESE Marks: --**

Prior knowledge of:	Basic language learning and people skills

Course Objectives:

1.	To **familiarize** students with English phonology and improve their pronunciation
2.	To **improve** language learning skills (LSRW) by providing ample practice
3.	To **develop** students' verbal and non-verbal communication
4.	To **cultivate** creative thinking and workplace skills

List of Lab Sessions

Session No	Title of Activities	Duration
01	**Icebreaking: Introducing self and others** Different ways of introducing self and others: demonstration	02Hrs
02	**Phonetics** Introduction to phonetics - consonants, vowels and diphthongs, stress, intonation in English with video samples	02Hrs
03	**Remedial English** Vocabulary-building games and identifying errors revising rules of English grammar	02Hrs
04	**Listening Practice** Listening comprehension, strategies for effective listening with audio/video samples	02Hrs
05	**Reading Practice** Improving Comprehension Skills, Techniques for good comprehension	02Hrs
06	**Technical Writing Practice** Paragraph writing, writing notices, agenda minutes of the meeting, email writing	02Hrs
07	**Public Speaking** Practicing extempore and prepared speeches	02Hrs
08	**Group discussion** Group discussions on current topics	02Hrs
09	**Mock Meetings** Purposes, preparation, and procedure for conducting effective meetings	02Hrs
10	**Mock Interviews** Preparing for FAQs and facing mock interviews	02Hrs
11	**Creative Writing** Blog Writing	02Hrs
12	**Film/Book Appreciation** Showing short films and appreciation of them. Reading novels or short stories and critical analysis of them.	02Hrs

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements
103.1	**Demonstrate** effective LSRW skills
103.2	**Articulate** words accurately and create grammatically correct sentences
103.3	**Deliver** speeches and participate in GDs, business meetings, and mock interviews effectively
103.4	**Draft** business documents and blogs by following writing ethics

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs / COs	BTL	1	`2	3	4	5	6	7	8	9	10	11	12
103.1	**3**	-	-	-	-	-	-	-	**2**	**3**	**3**	-	**1**
103.2	**3**	-	-	-	-	-	-	-	**2**	**3**	**3**	-	**1**
103.3	**3**	-	-	-	-	-	-	-	**2**	**3**	**3**	-	**1**
103.4	**3**	-	-	-	-	-	-	-	**2**	**3**	**3**	-	**1**

Suggested Learning Resources:

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	A Practical Course in Spoken English	1st	J.K. Gangaj	PHI Learning Pvt. Ltd	2014
2	English Language Laboratories	2nd	Nira Konar	PHI Learning Pvt. Ltd	2014
3	Better English Pronunciation	2nd	J.D.O Connor	Cambridge University Press,	1980

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Communication Skills	2nd	Sanjay Kumar & Pushp Lata	Oxford University Press	2015
2	Technical Communication: Principles and Practice	2nd	Meenakshi Raman & Sangita Sharma	Oxford University Press	2011

Useful Links /Web Resources:

1. **https://www.indiabix.com**
2. **https://www.skillsyouneed.com**
3. **https://interviewbuddy.in**
4. **https://learnenglish.britishcouncil.org**
5. **https://www.fluentu.com**

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Data Analytics with Spreadsheet	
Course Code: 241DSEPCCL101	**Semester:** II
Teaching Scheme L-T-P: 2 – 0 - 0	**Credits:** 02
Evaluation Scheme: - ISE:	**ESE: - 50**

Prior knowledge of:	Fundamental knowledge of mathematics and computers.

Course Objectives:

1	Understand the fundamental concepts of data organization within a spreadsheet, including the use of tables and ranges.
2	Learn to apply statistical functions within a spreadsheet to calculate means, medians, modes, standard deviations, and other relevant statistics.
3	Learn to create various types of charts (e.g., bar charts, line charts, pie charts) within a spreadsheet to represent data visually.

Curriculum Details

Course Contents	Duration
Unit 1 Introduction to Spreadsheet and Data Analytics Introduction to the user interface, Basic operations: entering data, formatting cells, and basic arithmetic operations, understanding rows, columns, and worksheets, what is Data Analytics. Importance of Data Analytics in various fields, Role of Spreadsheet in Data Analytics	**04 Hrs**
Unit 2 Data Management Data types: Text, numbers, dates, etc., Data validation and cleaning, Sorting and filtering data, removing duplicates, Creating and formatting Spreadsheet tables, Using structured references, Introduction to formulas and functions, Basic functions: SUM, AVERAGE, COUNT, MIN, MAX, Using logical functions: IF, AND, OR	**05Hrs**
Unit 3 Data Analysis Techniques Basic statistical concepts: mean, median, mode; Using Spreadsheet functions for statistical analysis, Descriptive statistics using Spreadsheets; Introduction to data visualization, creating basic charts: Line, Bars, Column, Pie, Customizing charts: Titles, labels, colors, and styles Creating combo charts, Sparklines and data bars, Introduction to Pivot Charts, Introduction to PivotTables, Creating and customizing PivotTables, Analysing data with PivotTables	**06 Hrs**
Unit 4 Advanced Spreadsheet Functions for Data Analysis VLOOKUP, HLOOKUP, and XLOOKUP functions, INDEX and MATCH functions, Nested functions and their applications, Installing and using the Analysis Tool pack, Performing regression analysis, Using the Histogram and Descriptive Statistics tools, Using conditional formatting to highlight data trends, Setting up custom data validation rules, creating dynamic data visualizations using conditional formatting.	**06 Hrs**

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements
101.1	Efficiently manage and manipulate datasets in spreadsheet, utilizing tables, formulas, and functions to organize and clean data.
101.2	Perform basic statistical analysis of real-world dataset and draw meaningful insight.
1013	Apply data visualization techniques using spreadsheets' charting and PivotTable features.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs / COs	BTL	1	2	3	4	5	6	7	8	9	10	11	12
101.1	2	1		1	2				1			1	2
101.2	2	1	1	2	3				1				2
1013	2	1	1	1	2				1	2		1	2

Books:

1. "Mastering Google Sheets: A Beginner to Advanced Guide" by Mark Dascano
2. "Data Analysis with Microsoft Excel: Updated for Office 2007" by Kenneth N. Berk and Patrick Carey
3. "Microsoft Excel Data Analysis and Business Modeling" by Wayne L. Winston
4. "Google Sheets: The Complete Beginner to Expert Guide" by William S. Bauer

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(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Python Programming	
Course Code: 241DSEVSECL103	**Semester:** I/II
Teaching Scheme L-T-P: 1 – 2 - 0	**Credits:** 02
Evaluation Scheme: - ISE: -25	**POE: -** 25

Prior knowledge of:	Basic Knowledge of computers

Course Description:
This subject covers basic principles of programming and programming ethics through the python programming language.

Course Objectives:

1.	
2.	
3.	

Curriculum Details

Course Contents	Duration
Unit 1 Introduction to Python and Decision Structures Input, Processing, and Output: Introduction to programming and Python, Basic syntax, Displaying Output with the print Function, Comments, Variables, Operators, Reading Input from the Keyboard, Performing Calculations Decision Structures: The if Statement, The if-else Statement, Comparing Strings, Nested Decision Structures and the if-elif-else Statement	**04 Hrs**
Unit 2 Repetition Structures and Functions Repetition Structures: Introduction to Repetition Structures, The while Loop: A Condition Controlled Loop, The for Loop: A Count-Controlled Loop, Calculating a Running Total, Sentinels, Input Validation Loops, Nested Loops Functions: Introduction to Functions, Defining and Calling a Void Function, Designing a Program to Use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Introduction to Value-Returning Functions.	**03Hrs**
Unit 3 Python Data structures and String **Lists and Tuples:** Sequences, Introduction to Lists, List Slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two Dimensional Lists, Tuples, **Dictionaries and Sets**: Operations and use. **Strings:** Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings.	**04 Hrs**
Unit 4 Modules and File Handling **Modules:** Writing Your Own Value-Returning Functions, The math Module, Storing Functions in Modules **Files:** Introduction to File Input and Output Using Loops to Process Files, Processing Records, Exceptions.	**03 Hrs**

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(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements
103.1	Demonstrate use of decision and repetition structure in order to solve specific problem
103.2	Model a given big problem statement in to smaller parts to provide modular approach.
103.3	Choose proper data structure like list, touples, dictionaries etc. for solving given problem

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs / COs	BTL	1	2	3	4	5	6	7	8	9	10	11	12
103.1	1	-	-	-	2	-	-	1	-	-	-	-	1
103.2	1	-	-	-	2			1	-	-	-	-	1
103.3	1	-	-	-	2			1	-	-	-	-	1

Text Books:
1. Ethics for the Information Age 6th edition Michael J. Quinn
2. Starting Out with Python 5th Tony Gaddis Pearson March 17th 2021
Core Python Programming 3rd R. Nageswara Rao Dreamtech Press 1 Jan 2018

Reference Books:
1. Python: The Complete Reference Indian Edition Martin C. Brown MGH March 2018

D. Y. Patil Education Society
(Deemed To Be University)
School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Python Programming Laboratory	
Course Code: 241DSEVSEC104	**Semester:** I/II
Teaching Scheme L-T-P: 0 – 0 - 2	**Credits:** 01
Evaluation Scheme: - ISE: -25	

Prior knowledge of:	Basic Knowledge of computers

Course Description:
This subject covers basic principles of programming and programming ethics through the python programming language.

Course Objectives:

1.	
2.	
3.	

List of Experiment

Session No	Title of Activities	Duration
01	Program based on the decision structures (if, If else, nested if else, if elif else)	02Hrs
02	Program to demonstrate use of different types of looping statements.	02Hrs
03	1. Program to write and use different types of user defined function	02Hrs
04	Programs to demonstrate the use of various built-in functions in Python,	02Hrs
05	Program demonstrating operations and use of List and Touple	02Hrs
06	Program demonstrating operations and use of Dictionary and set.	02Hrs
07	Program to demonstrate modules	02Hrs
08	Program to perform CURD operations in a file using file handling.	02Hrs
09	Implement stack operations	02Hrs
10	Implement Queue operations	02Hrs

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School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Outcomes (COs): After successful completion of the course, students will be able to:

CO	Statements
104.1	Demonstrate use of decision and repetition structure in order to solve specific problem
104.2	Model a given big problem statement in to smaller parts to provide modular approach.
104.3	Choose proper data structure like list, touples, dictionaries etc. for solving given problem

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

POs / COs	BTL	1	2	3	4	5	6	7	8	9	10	11	12
104.1	1				2			1					1
104.2	1				2			1					1
104.3	1				2			1					1

Text Books:
1. Ethics for the Information Age 6th edition Michael J. Quinn
2. Starting Out with Python 5th Tony Gaddis Pearson March 17th 2021

Core Python Programming 3rd R. Nageswara Rao Dreamtech Press 1 Jan 2018

Reference Books:
2. Python: The Complete Reference Indian Edition Martin C. Brown MGH March 2018

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School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Liberal Learning Course (LLC)	
Course Code: 241DSECCA101	**Semester:** I/II
Teaching Scheme: L-T-P :0 – 0 – 4	**Credits:** 02
Evaluation Scheme ISE-50	**ISE Marks:** 50

Syllabus Contents (All Clubs)	Duration
1. PAINTING • Memory Drawing - Human sketching, Object Drawing Perspective Memory • 2D Drawing - Basic Drawing Elements Principles, Compositions, Colour Scheme/Texture • 3D Drawing - 3D Basic Forms,3D Sketching, Light effect (shade/shadow)	**30 Hrs**
2. DANCE • Hip-Hop. • Information about elements. • Old School- New School steps. • Variations in old school new school steps. • How to use old-school steps in dance. • Choreography on 2 songs	**30 Hrs**
3. YOGA & MEDITATION • Breathing practices and pranayama • Sectional Breathing • Yoga deep Breathing • Concept of bandha and mudra • Rictation of pranava mantra • Anter Maun • Breath Mediation • Om dhayna	**30 Hrs**
4. Music • Introduction of Music • Taal • Practical Raag (Harmonium Swar) • Group Song • Presentation	**30 Hrs**
5. GUITAR • Introduction of Guitar • Guitar Tuning • Open strings Exercise • Finger Exercise • Scales and Intervals • Major Scale • Minor Scale • Strumming Pattern • Lead	**30 Hrs**

Data Sciences Engineering Curriculum

(As Per National Education Policy 2020)

6. INTERIOR DESIGN **6.1 Primary elements in Architecture** • Elements of design such as point, line, shape, form, mass, space, color and texture patterns, light and shade; understanding the relations between them. **6.2 Principles in Architectural Design** • Principles of design such as harmony (unity), proportions, contrast, scale, balance (symmetric & asymmetric), rhythm (pattern), emphasis, scale proportion Finger Exercise **6.3 Color Theory** • Properties of color, color schemes, color value, intensity, Color texture, psychological effect of color. • Apply the knowledge of color theory and rendering techniques for Interior design assignments and portfolio Scales and Intervals • Introduction to Architectural lettering, size, and notation of drawing, symbolic representation of building elements and material, and other features as per standard practice. • Assignments included for Sketch plan measure drawing lettering and architectural symbols.	**30 Hrs**
7. ADVENTURE **7.1 Introduction to Adventure Activities** • Introduction • Benefits of adventure activities. • how to plan an adventure activity and prepare for safety.	
7.2 Safety Protocols, Risk Management and Basic First Aid for Adventure Activities • Equipment safety check • Emergency response procedure • Risk assessment and mitigation strategies. • Common injuries and ailments in adventure settings • Wound care and basic treatments • Heat and cold-related illnesses	
7.3 Adventure Cycling and Trekking Equipment Safety Check • Basic cycle/bike maintenance and repair • Cycling activity • Long-distance trekking and camping (One Day in Nature) • Route planning and logistics	**08 Hrs**
7.4 Environmental Stewardship and study of Wildlife • Leave No Trace principles • Environmental impact of adventure activities • Sustainability practices and conservation efforts • Habitat requirements and preferences of different species. • Interactions between wildlife and their environment. • Conservation strategies for maintaining viable populations. • Visit to Sanctuary -Dajipur, Radhanagari, Kolhapur,Jungle safari.	**08 Hrs**

7.5 Adventure Sports: Self-defense and Personal Development, Leadership. • Benefits of Self-Defense Sports • Physical fitness and conditioning • Improved self-confidence and self-esteem • Enhanced coordination, agility, and reflexes • Stress relief and mental discipline • Practical self-defense skills and situational awareness • Example:- Wrestling, boxing, Karate, Martial arts, taekwondo, lathikati • Building resilience and mental toughness • Teamwork and collaboration in challenging environments • Leadership skills and decision-making under pressure	**4Hrs**
7.6 Study of Historical Monuments • Historical background and evolution of Indian Culture. • History of Maratha Empire. • Visit Forts, temples, Palace, etc • **VISIT TO VERTICAL ADVENTURE PARK, MASAI PATHAR-JEUR** • Zipline • Zorbing ball • Bungee Ejection • High rope course • Rappelling • Parasailing • Sports Climbing • Slack Line • Rock climbing	**4Hrs**
8. Foreign Language-German • Introducing self and others • Grammar: WH questions, personal pronouns, simple sentences, verb conjugation • Themes: hobbies, the week, numbers, the alphabet, months, seasons • Grammar: articles, plural, the verbs to have and to be basic directions / • Grammar: definite and indefinite articles; negation - kein and nicht; • Form Filling Can understand and use familiar, everyday expressions and very simple sentences, which relate to the satisfying of concrete needs. Can introduce him/herself and others as well as ask others about themselves – e.g. where they live, who they know and what they own – and can respond to questions of this nature. Can communicate in a simple manner if the person they are speaking to speaks slowly and clearly and is willing to help.	**28 Hrs**
9. Photography. **9.1 Introduction to Digital Photography** • Understanding film and paper photography. • Learning about the digital revolution. • How photos are used today.	**30 Hrs**

9.2 Digital Basics • Digital image method of storing and processing digital image: Raster and Vector method Doodling. • Representation of digital image: Resolution – Pixel Depth **9.3 Digital Basics** • Windows Operating System • Concept of Internet • Image transportation through floppy, CD, zip and Internet. **9.4 Image Editing** • Image editing through image editing • Software like Adobe Photoshop – Adjustment of Brightness, Contrast, Tonal and Colour Values – • Experimenting with Level and Curve.	
10. Art & Craft **10.1 Craft Skills** • Cutting and Pasting Techniques - collage. • Paper folding Techniques -Origami.	**4 Hrs**
10.2 D.I.Y Project • Craft project using recycled material • Doodling.	**4 Hrs**
10.3 Field Trip • Cultural visit • Outdoor sketching • Visit to the exhibition and museum	**8 Hrs**
10.4 Workshop • Pottery Making • Lantern Making	**6 Hrs**
10.5 Cultural Activities • Drama, • skit, • Open Mic, • Singing, Dancing, etc.	**6 Hrs**
11. Film Making • Introduction of filmmaking • Short videos, Reels • Visit to Film Industry Kolhapur, • Information regarding instrument used in film industry	**30 Hrs**
12.Coding Club • Basics of C programming • Introduction • Datatypes • Operators • Keywords	**6 Hrs**

Data Sciences Engineering Curriculum

(As Per National Education Policy 2020)

Control Structure • If • If Else • Else If • For • While • Switch	**6 Hrs**
Functions • Types of Functions • Overloading & Overriding • Examples	**4 Hrs**
Arrays • Basics of Arrays • One Dimensional Array • Two-Dimensional Array	**4 Hrs** **4 Hrs**
Practice Problems	**4 Hrs**

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Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Capstone Project	
Course Code: 241DSEMC104	**Semester:** II
Teaching Scheme: L-T-P:0-0-0	**Credits:** Grade (Mandatory Course)
Evaluation Scheme ISE: 50	**ESE Marks:** --

Course Objectives:

1	To inculcate independent learning by problem-solving in a social context.
2	To engage students in rich and authentic learning experiences.
3	To emphasize learning activities that are long-term, interdisciplinary, and student-centric.
4	To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.

Curriculum Details
As per the approved structure of the curriculum, students will be allowed to do capstone projects during the second semester of B. Tech. program.

Topics:

A Capstone Project may be a theoretical analysis, modeling & simulation, experimentation & analysis, prototype design, new equipment fabrication, correlation and analysis of data, software development, or a combination of these.

Group Structure:

Working in supervisor/mentor-monitored groups; the students plan, manage, and complete a task/project/activity which addresses the stated problem.

1. There should be a team/group of 4 -5 students
2. A supervisor/mentor teacher assigned to individual groups

Selection of Project:

The project demo model for learning is recommended. The model begins with the identifying of a problem, often growing out of a question or “wondering”. This formulated problem then stands as the starting point for learning. Students design and analyze the problem within an articulated interdisciplinary or subject frame or based on Rural/Social internship.

A problem can be theoretical, practical, social, technical, symbolic, cultural, and/or scientific and grows out of students’ wondering within different disciplines and professional environments. A chosen problem has to be exemplary. The problem may involve an interdisciplinary approach in both the analysis and solving phases.

By exemplarity, a problem needs to refer back to a particular practical, scientific, social and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry.

There are no commonly shared criteria for what constitutes an acceptable project. Projects vary greatly in the depth of the questions explored, the clarity of the learning goals, the content, and structure of the activity.

1. A few hands-on activities that may or may not be multidisciplinary.

2. Use of technology in meaningful ways to help them investigate, collaborate, analyze, synthesize, and present their learning.

3. Activities may include- Solving real life problem, investigation, /study and Writing reports of in-depth study, fieldwork.

Recommended Guidelines and phases:

Capstone project is learning through activity. One of the teachers can be appointed as guide for capstone project group. Following are the recommended guidelines that will work as an initiator and facilitator in process of completion of Capstone project.

1. In first week of commencement of 2nd semester, let the guide create awareness about capstone project (what, why, and how) among the students. Convey students expected outcomes, assessment process and evaluation criteria.
2. Get groups of students registered preferably 4-5 students per group.
3. Assign guide to each group.
4. Provide guidelines for title identification (Problem can be some real-life situation that needs technology solutions. This situation can be identified by rural/social internship, by meeting people around, visiting various industries, society, and institutes. The solution can be prototype, model, convertible solutions, survey and analysis, simulation, and similar).

5. Let students submit the problem identified in prescribed format (Problem Statement, Initial Survey for topic finalization, Abstract, Software, Hardware required, Title)

6. Guide can approve the problem statements based on feasibility and learning outcomes expected for first year engineering students
7. Guide is to monitor progress of the task during phases of project work. Broadly phases may include- requirements gathering, preparing a solution, technology design for the solution.
8. Weekly monitoring and continuous assessment record are to be maintained by guide.
9. Get the report submitted at the end of semester.

Student is required to prepare a capstone project and file containing documentary proofs of the activities done by him. The evaluation will be done by expert committee constituted by HoD/Departmental capstone project In-charge/ faculty mentor.

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School of Engineering & Management
Department of First-Year Engineering

Data Sciences Engineering Curriculum
(As Per National Education Policy 2020)

Course Title: Rural/Social Internship	
Course Code: 241DSEMC102	**Semester:** I
Teaching Scheme: L-T-P :0-0-0	**Credits:** Grade (Mandatory Course)
Evaluation Scheme ISE: 50	**ESE Marks:** --

Course Objectives:

1	To provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job.
2	To exposure to the current technological developments relevant to the subject area of training.
3	To expose students to the engineer's responsibilities and ethics.
4	To understand the social, economic and administrative considerations that influence the working environment of industrial organizations
5	To gain experience in writing technical reports/projects.
6	To understand the social, economic, and administrative considerations that influence the working environment of industrial organizations

Curriculum Details

As per the approved structure of curriculum, students will be allowed to do internship during the first semester of B. Tech. program. During the internship, students are required to visit villages/wards/small industries/organizations etc

For following activities

1. Prepare and implement a plan to create local job opportunities.
2. Prepare and implement a plan to improve education quality in the village.
3. Preparing an actionable DPR for Doubling the village Income.
4. Developing a Sustainable Water Management system.
5. Prepare and improve a plan to improve the health parameters of villagers.
6. Developing and implementing Low-Cost Sanitation facilities
7. Prepare and implement a plan to promote Local Tourism through Innovative Approaches
8. Implement/Develop Technology solutions that will improve quality of life.
9. Prepare and implement solutions for energy conservation.
10. Prepare and implement a plan to Skill village youth and provide employment.
11. Develop localized techniques for Reduction in construction Costs.
12. Prepare and implement a plan for sustainable growth of the village.
13. Setting of Information imparting club for women leading to contribution to social and economic issues.
14. Developing and managing an Efficient garbage disposable system.
15. Contribution to any national-level initiative of the Government of India. For eg. Digital India/ Skill India/ Swachh Bharat Internship etc

Every student is required to prepare a file containing documentary proofs of the activities done by him. The evaluation will be done by an expert committee constituted by the HoD/Departmental Internship In-charge/ faculty mentor.

D. Y. PATIL DEEMED TO BE UNIVERSITY
SCHOOL OF ENGINEERING AND MANAGEMNET
Teaching and Evaluation Scheme from Year 2024-25 (as per NEP-2020)
B. Tech. Data Science Engineering (SEMESTER- III)

Sr. No.	Course Code	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	Contact Hrs			ISE	MSE	ESE	INT	OE/ PoE	
					L	P	T						
1	24DSEU3P01	PCC	Probability & Statistics	**3**	3	-	-	20	30	50	-	-	100
2	24DSEU3P02	PCC	Data Structures	**3**	3	-	-	20	30	50	-	-	100
3	24DSEU3P03	PCC	Data Structures Laboratory	**1**	-	2	-	-	-	-	25	25	50
4	24DSEU3P04	PCC	Programming Lab - I	**3**	2	2	-	-	-	-	50	50	100
5	24DSEU3M05	MDM-I	Fundamentals of Data Science	**2**	2	-	-	-	-	50	-	-	50
6	24DSEU3O06	OEC-I $	Data Science for Engineers	**3**	3	-	-	20	30	50	-	-	100
7	24DSEU3O07	OEC-I $	Data Science for Engineers Lab	**1**	-	2	-	-	-	-	25	-	25
8	24DSEU3F08	CEP/FP	Domain Specific Mini Project	**2**	-	4	-	-	-	-	25	25	50
9	24DSEU3V09	VEC	Environmental Studies-I	**2**	2	-	-	-	-	50	-	-	50
10	24DSEU3H10	HSSM	Economics and Management for IT	**2**	2	-	-	-	-	50	-	-	50
11	24DSEU3D11	AC	Liberal Learning	-	2*	-	-	-	-	-	50*	-	
12	24DSEU3D12	AC	Finishing School Training - III	-	2*	-	-	-	-	-	50*	-	
			Total	**22**	**17**	**10**	**0**						**675**

Note:
$ - Open & Distance Learning
* - Values are not included in total marks
Min. Marks for Passing: 40% of total marks of individual course

Course Code:	24DSEU3P01
Course Name:	**Probability and Statistics**

L	T	P	Credit
3	0	0	3

Course Prerequsites:

Basic Probability Theory

Course Description:

This course plays important role in Data Science. This course provides fundamentals of probability and statistics which required for Data Science. This course focuses on probability theory, probability distribution, testing hypothesis, curve fitting , linear programming and
Optimization techniques and recurrence relation.

Course Outcomes: After the completion of the course the student will be able to -

CO1	**apply** the fundamental concepts of probability theory.
CO2	**solve** basic problems in probability theory, including problems involving the binomial, Poisson and normal distributions.
CO3	**understand** tests for hypothesis and its significance.
CO4	**apply** the recurrence relation to solve the counting problems and program analysis problems.
CO5	**make** use of method of least squares to fit the curves for bivariate data.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			1									
CO2	3	2			1									
CO3	2	2			1									
CO4	2	2			1									
CO5	2	2			1									

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit 1	**Probability Theory**	**6 Hours**
Introduction to Probability Set Theory and Events Axioms and Properties of Probability Conditional Probability Bayes' Theorem		
Unit 2	**Probability Distribution Functions**	**6 Hours**
Introduction, Elementary theory of probability, Random variable Discrete probability distribution, Continuous probability distribution Binomial distribution Poisson distribution Normal distribution		
Unit 3	**Testing of hypothesis**	**6 Hours**
Introduction, Statistical hypothesis (Simple and Composite), Null hypothesis, Alternative hypothesis Critical region, Type I and Type II errors Level of significance Test for Goodness of fit of chi square distribution t- distribution		
Unit 4	**Recurrence Relation**	**6 Hours**
Introduction, Definition of recurrence relation, Linear recurrence relation with constant coefficients Construction of recurrence relation Solution of Homogeneous recurrence relation Solution of non-homogeneous recurrence relation		
Unit 5	**Curve Fitting**	**6 Hours**
Fitting of curve by method of lest squares Fitting of straight lines Fitting of exponential curve Fitting of second degree parabolic curve		
Unit 6	**Linear Programming and Optimization Techniques**	**6 Hours**
Introduction to Linear Programming Problems, Formulations of LPP Basic Concepts and Terminology Graphical Solution Method (for two variables) Simplex Method Big M-Method Duality in Linear Programming, Dual Simplex Method Solving the Primal using the Dual		

Text Books:

1. Probability and Statistics for Engineers and Scientists– 8th Edition – Walpole, Myers, Myers, Ye (Pearson Education Inc.)
2. Numerical Methods in Engineering and Science – 11th Edition- Dr. B. S. Grewal – Khanna Publishers, Delhi
3. Advanced Engineering Mathematics- 7th Edition- H. K. Dass, S Chand – S. Chand ublishing
4. Operations Research - 11th Edition – S. D. Sharma – Kedar Nath & Ram Nath

Reference Books:

1. Applied statistics and Probability for Engineers - 4th Edition – Douglas C Montgomery, George C Runger, Wiley Asia Student Edition
2. Statistics for Management - 6th Edition – Richard I Levin, David S Rubin – Prentice Hall India
3. Probability and Statistics - 5th Edition – Purna Chandra Biswal – PHI Learning Private Limited, Eastern Economy Edition
4. Operations Research - 9th Edition – H. A. Taba – Pearson

Course Code:	24DSEU3P02
Course Name:	Data Structures

L	T	P	Credit
3	0	0	3

Course Prerequsites:

1. Basic Knowledge of C
2. Basic mathematical Approach

Course Description:

The course is designed to develop skills to design and analyze simple linear and non linear data structures. It strengthen the ability to the students to identify and apply the suitable data structure for the given real world problem. It enables them to gain knowledge in practical applications of data structures

Course Outcomes: After the completion of the course the student will be able to -

CO1	Illustrate the concepts of Data Structures
CO2	Identify the appropriate data structure for specific application
CO3	Choose appropriate sorting and searching algorithms.
CO4	Outline the solution to the given software problem with appropriate data structure
CO5	

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1													
CO2	2	3	2	2	2				1					1
CO3	1	1	2	2	2				1					1
CO4	1	3	1	2	1				1					3
CO5														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Course Contents:

Unit 1	**Basic of Data Structures**	**4 Hours**
Data structure- Definition, Types of data structures, Data Structure Operations, Algorithms: Complexity, Time and Space complexity.		
Unit 2	**Stacks and Queues**	**7 Hours**
Stack: Definition, operations, Array representation of stack, applications Queue: Definition, operations, Array representation of queue, applications, Circular queue, Priority queue,		
Unit 3	**Linked Lists**	**8 Hours**
Definition, representation, operations, implementation and applications of singly, doubly and circular linked lists. Linked representation of stack and Queue.		
Unit 4	**Trees**	**7 Hours**
Terminology, representation, binary tree, traversal methods, binary search tree, AVL tree (Introduction), Heaps-Operations and their applications		
Unit 5	**Graphs**	**6 Hours**
Basic concept of graph theory, storage representation, graph traversal techniques- BFS and DFS		
Unit 6	**Searching and Sorting Techniques**	**7Hours**
Searching: Linear search, Binary search Sorting: Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort, Heap Sort Complexity and analysis of Searching and Sorting Algorithms		

Text Books:

1. Schaum's Outlines Data Structures – Seymour Lipschutz (MGH)
2. Data Structures- A Pseudo code Approach with C – Richard F. Gilberg and Behrouz A. Forouzon 2nd Edition

Reference Books:

1. Data Structure using C- A. M. Tanenbaum, Y. Langsam, M. J. Augenstein (PHI)
2. Fundamentals of Data Structures - Horowitz, Sahani (CBS India)

Course Code:	24DSEU3P03
Course Name:	Data Structures Lab

L	T	P	Credit
		2	1

Course Prerequsites:

1. Basic Knowledge of C
2. Basic mathematical Approach

Course Description:

The course is designed to develop skills to design and analyze simple linear and non linear data structures. It strengthen the ability to the students to identify and apply the suitable data structure for the given real world problem. It enables them to gain knowledge in practical applications of data structures

Course Outcomes: After the completion of the course the student will be able to -

CO1	Implement the Various Data Structures
CO2	Implement the various sorting and searching algorithms.
CO3	Compare the complexities of various algorithms
CO4	

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1		1	1							1	2
CO2	3	1	1		1	1								1
CO3	3	3	2	3	3				1	1	1		1	3
CO4														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation (ISE)	50%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	End Semester Examination (ESE)	50%	Practical Oral Exam

List of Experiments:

1. Write a C program to implement operations on Stack using array
2. Write a C program to implement operations on Linear Queue using array
3. Write a C program to implement operations on Circular Queue using array
4. Write a C program to implement operations on Singly Linked list
5. Write a C program to implement operations on Doubly Linked list
6. Write a C program to implement operations on Circular Linked list
7. Write a C program to implement Searching Techniques
8. Write a C program to implement Bubble sorting Techniques
9. Write a C program to implement Selection Sort Technique
10. Write a C program to implement Insertion Sort Technique
11. Write a C program to implement BST and its traversal
12. Write a C program to implement BFS and DFS

Course Code:	24DSEU3P04
Course Name:	Programming Lab - I

L	T	P	Credit
2	0	2	3

Course Prerequsites:

Procedural Programming Language (C Language)

Course Description:

This course introduces students to the principles of object-oriented programming using C++. Students will develop practical skills through hands-on coding exercises and projects, learning to design and implement efficient, reusable, and maintainable code using OOP concepts.

Course Outcomes: After the completion of the course the student will be able to -

CO-1:	explain object oriented concepts, principles and techniques.
CO-2:	create well-structured classes with appropriate data members and member functions, demonstrating proper encapsulation principles.
CO-3:	apply various object-oriented features to solve real-life problems using C++ language.
CO-4:	demonstrate an understanding of generic programming concepts.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									1	1		3		
CO2	1	1	2		3			2	1	2			3	3
CO3	1	2	2		3			2	1	1		3	3	3
CO4	1				3				1				2	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation	50%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	End Semester Examination (ESE)	50%	100% course contents
3			
4			

Course Contents:

Unit 1	**Pointers & Structures in C**	**6 Hours**
Pointers: What Are Pointers?, Pointer Variables, The Pointer Operators, Pointer Expressions, Pointers and Arrays, Array of Pointers, Initializing Pointers, Pointers to Functions and structures, C's Dynamic Allocation Functions. Structures: Structures, Arrays of Structures, Passing Structures to Functions, Structure Pointers, Unions, Macro		
Unit 2	**Fundamentals of C++ Programming**	**8 Hours**
C++ Program Structure, variables, operators, Input/output – I/O streams and standard I/O devices, cin and associated functions, cout and formatted output. User Defined function - declaration, definition & calling function, storage classes, scope rules, function - default arguments. Reference and reference arguments to the function. Pointer variables, new and delete operator, dynamic arrays. Class & Objects: Object Oriented fundamentals, Class and object - concept and need, Class declaration, Class members - member variables and functions, access specifiers, implementation of member functions. Object Declaration, Accessing class members, class scope, . Constructors, invoking a constructor, constructors and default		
Unit 3	**Inheritance**	**4 Hours**
Inheritance: concept, implementation, base classes and derived classes, members in base classes and derived classes, overriding base class members, UML notations for inheritance, constructors of derived and base classes, destructor in derived class, Inheritance as public, protected and private Composition (Aggregation) and association – concept, implementation and UML Notation		
Unit 4	**Polymorphism**	**4 Hours**
Polymorphism: Need, concept, implementation using function overloading, Multiple Inheritance, function overriding, virtual function, pure virtual function, abstract classes, Friend function and friend classes, accessing base class functions from derived class objects, accessing derived class functions from base class objects. Operator overloading: fundamentals of operator overloading, overloading binary operators, overloading unary operator		
Unit 5	**Generic Programming with Templates**	**4 Hours**
Introduction to Generic Programming, Concept and benefits, Type-independent code Function Templates: Syntax and basic usage, Multiple template parameters, Explicit instantiation and specialization Class Template: Syntax and implementation		

Text Books:

1. Object oriented Programming in C++ 3rd Edition-R.Lafore (Galgotia Publications)
2. C++programming – John Thomas Berry(PHI)
3. Object –Oriented Analysis & Design: Understanding System Development with UML 2.0 , Docherty, Wiley India Ltd.

Reference Books:

1. C++ Programming with language - Bjarne Stroustrup, AT & T

Course Code:	24DSEU3M05
Course Name:	Fundamentals of Data Science

L	T	P	Credit
2			2

Course Prerequsites:

Basic knowledge of computer, Basic knowledge of Mathematics

Course Description:

The aim of the course is to get basic knowledge about data science and its processes. This course also aims to visualize the complex data using different data visualization tools. It also provides different statistical methods to perform data analysis.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Summarize the basic concepts in data science.
CO2	Identify the data science process for the problem solving.
CO3	Choose the appropriate data visualization technique for the given problem.
CO4	Use different statistical methods for data analysis.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1													
CO2	2	1		1									2	
CO3	1	2			2								3	
CO4	2			1										

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	End Semester Examination (ESE)	50%	100% course contents

D Y PATIL EDUCATION SOCIETY Deemed to be University Kasba Bawada, Kolhapur School of Engineering & Management KOLHAPUR

Unit 1	**Data Science and its scope**	**4 Hours**
What is Data Science, A Brief History, Difference between Data Science and Data Analytics, Knowledge and Skills for Data Science Professionals, Some Technologies used in Data Science, Benefits and uses of Data Science, Facets of Data.		
Unit 2	**Data Science Process**	**6 Hours**
Overview, Defining research goals and creating a project charter, Retrieving data, Cleansing, integrating, and transforming data, Exploratory data analysis, Build the models, Presenting findings and building applications on top of them.		
Unit 3	**Data Visualization**	**5 Hours**
Introduction to data visualization, Visual encoding, Data visualization software, Data visualization libraries, Basic data visualization tools, Specialized data visualization tools, Advanced data visualization tools, Visualization of geospatial data, Data visualization types		
Unit 4	**Statistical Data Analysis**	**6 Hours**
Role of statistics in data science, Kinds of statistics - Descriptive statistics, Inferential statistics, Probability theory - Random variables, Independence, Sample space, Odds and risks, Expected values, Standard errors, Bayesian probability, Probability distribution		

Text Books:

1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, “Introducing Data Science”, Manning Publications.
2. DR. Gypsi Nandi, DR. Rupam Kumar Sharma, “Data Science Fundamentals and Practical Approaches”, BPB Publications, India , ISBN 978-93-89845-662

Reference Books:

1. DR. Amar Sahay, “Essentials of Data Science and Analytics”, O’REILLY Publication.
2. https://onlinecourses.nptel.ac.in/noc21_cs23/preview

Course Code:	24DSEU3O06
Course Name:	Data Science for Engineers

L	T	P	Credit
3			3

Course Prerequsites:

1. Fundamentals of Data Science

Course Description:

This course introduces students to data analysis and visualization in the field of exploratory data science.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Describe a flow process for data science problems and classify them into standard typology .
CO2	Use R codes for data science solutions and correlate results to the solution approach followed .
CO3	Construct use cases to validate approach and identify modifications required.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	3	3								2
CO2	1	2	2	3	3	1							3	3
CO3	1	1	1	2	2								2	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:		
Unit 1	**Introduction to R**	**6 Hours**
R Studio, Variables and datatypes in R, Data frames, Arithmetic,Logical and Matrix operations in R, Advanced programming in R _ Functions, Control structures, Data visualization in R Basic graphics.		
Unit 2	**Linear algebra for data science**	**8 Hours**
Algebraic view - vectors, matrices, product of matrix & vector, rank, null space, solution of over-determined set of equations and pseudo-inverse) Geometric view - vectors, distance, projections, eigenvalue decomposition.		
Unit 3	**Statistics**	**8 Hours**
Descriptive statistics, notion of probability, distributions, mean, variance, covariance, covariance matrix, understanding univariate and multivariate normal distributions, introduction to hypothesis testing, confidence interval for estimates.		
Unit 4	**Optimization**	**6 Hours**
Optimization, Typology of data science problems and a solution framework.		
Unit 5	**Logsitic Regression**	**6 Hours**
Classification using logistic regression.		
Unit 6	**Classification and clustering**	**6 Hours**
Classification using kNN and k-means clustering		

Text Books:

1. R for Data Science - Hadley Wickham & Garrett Grolemund (O'Reilly Media) - Units 1, 3
2. Linear Algebra and Its Applications - Gilbert Strang (Wellesley-Cambridge Press) - Unit 2
3. Introduction to Statistical Learning with R - James, Witten, Hastie, Tibshirani (Springer) - Units 4, 5, 6

Reference Books:

1. The Art of R Programming - Norman Matloff (No Starch Press) - Unit 1
2. Matrix Computations - Gene H. Golub & Charles F. Van Loan (Johns Hopkins University Press) - Unit 2
3. All of Statistics - Larry Wasserman (Springer) - Unit 3
4. Numerical Optimization - Jorge Nocedal & Stephen J. Wright (Springer) - Unit 4
5. Applied Logistic Regression - David W. Hosmer Jr. & Stanley Lemeshow (Wiley) - Unit 5
6. Pattern Recognition and Machine Learning - Christopher M. Bishop (Springer) - Unit 6

Course Code:	24DSEU3O07
Course Name:	Data Science for Engineers Lab

L	T	P	Credit
0	0	2	1

Course Prerequsites:

1. Fundamentals of Data Science

Course Description:

This course introduces students to practical data analysis and visualization techniques in the field of exploratory data science through hands-on laboratory experiments using R programming language.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Implement data science workflows in R environment and demonstrate proficiency in data manipulation, visualization, and basic statistical operations.
CO2	Apply linear algebra concepts, statistical methods, and optimization techniques to solve data science problems using R programming.
CO3	Design and execute classification and clustering algorithms, evaluate their performance, and validate results through comprehensive case studies.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	3								3	3
CO2	3	2	2	3	3								3	3
CO3	3	3	3	3	3	3							3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal	50%	Practical performance and internal POE
2	ESE	50%	POE

Course Contents:

Experiment 1:	**Introduction to R and RStudio Environment**	**2 Hours**
Experiment 2	**Data Structures and Data Frames in R**	**2 Hours**
Experiment 3:	**Functions and Control Structures**	**2 Hours**
Experiment 4:	**Data Visualization using R Graphics**	**2 Hours**
Experiment 5:	**Linear Algebra Operations for Data Science**	**2 Hours**
Experiment 6:	**Descriptive Statistics and Probability Distributions**	**4 Hours**
Experiment 7:	**Logistic Regression for Classification**	**4 Hours**
Experiment 8:	**Implement k-NN classification**	**2 Hours**
Experiment 9:	**Implement k-means clustering**	**2 Hours**

Text Books:

1. R for Data Science - Hadley Wickham & Garrett Grolemund (O'Reilly Media)
2. The Art of R Programming - Norman Matloff (No Starch Press)
3. Introduction to Statistical Learning with R - James, Witten, Hastie, Tibshirani (Springer)

Reference Books:

1. R in Action - Robert Kabacoff (Manning Publications)
2. Data Mining with R - Luis Torgo (Chapman & Hall/CRC)

Course Code:	24DSEU3F08	L	T	P	Credit
Course Name:	Domain Specific Mini Project			4	2

Course Prerequsites:

1. Data Structures
2. Problem Solving Using C
3. Software Engineering

Course Description:

This course emphasis on a problem-based learning approach. It is a group activity where students have to present an idea / solution for the problem chosen. Then requirement analysis and design specification of the system is to be developed by the students. This is followed by software design, implementation, testing and finally demonstrate the results obtained. This course helps the students to learn how to analyze the demands of a customer and represent them in the form of software requirements specification (SRS) document including quality requirements. Ultimately this course enhances students programming skills and enable them to learn how to perform requirement analysis, system designing, coding, testing and report writing.

Course Outcomes:	After the completion of the course the student will be able to -
CO1	Define appropriate problem statement for real world problems.
CO2	Organize an effective project plan with clear objectives and prepare a synopsis.
CO3	Design the various modules of the project to provide a solution to the problem with the help of various design tools.
CO4	Develop the proposed system using suitable development platform.Able to present their work and prepare technical project report.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		1				1	1		3			
CO2	3	3		1	1	1	1	1	3	3	2	2	2	
CO3		1	2		2			1	3	2	3	3	3	3
CO4		1	2		2			1	3	3	2	3	3	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation (ISE)	50%	Problem identification and Design
2	End Semester Examination (ESE)	50%	Coding, Testing and Creating Repository

Course Contents:

1. The Project should be undertaken preferably by a group of 3-4 students.
2. These students will jointly work and implement the project.
3. The group will select a project with the approval from the domain expert panel and submit the name of the project with a synopsis.
4. The Project should consist of defining the problem and analyzing it, designing the solution and implementing it using a suitable programming language.
5. Presentation and demonstration based on the above work is to be given by the group for ISE.
6. The work will be jointly assessed twice in a semester by an internal domain expert panel. No externally implemented projects work will be allowed. Student has to follow every project phase himself in a group.
7. Hard copy of project report of the work done is to be submitted along with the softcopy of the project during ESE.

Project topics may be selected from following domains:

a. Real world applications in Data Analytics
b. Probability and Statistics
c. Data Preprocessing
d. Web Page design
e. Web Scrapping
f. Healthcare Analytics
g. Analytics using modern tools & techniques.

Course Code:	24DSEU3V09
Course Name:	Environmental Studies - I

L	T	P	Credit
2			2

Course Prerequsites:

1. Understanding of Environmental Education course

Course Description:

The main objective of course is to create awareness among students regarding environmental issues and its impact on society. Knowledge regarding environmental components, its degradation and protection of environment is need for sustainable future ahead.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Understand the scope and importance of Environmental awareness and Sustainable development
CO2	Understand various Environmental issues due to development.
CO3	Understand various modes of Environmental management through techno and legislation
CO4	Acquire problem solving attitude through actual field experience and report it in the form of a field report.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1						2							
CO2							2							
CO3							2							
CO4							2							

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation (ISE)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
	Mid Semester Exam	30%	50%ofcourse contents
	In Semester Evaluation (ISE)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	End Semester Examination (ESE)	50%	100%course contents

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Course Contents:

Unit 1	**Our Environment**	**5 Hours**
Introduction to Environment, Scope of Environmental Studies, Importance of Environmental Awareness, Concept of Sustainability, Sustainable development : History and Goals, Environmental Ethics and Sustainability Ethics, Population Growth and its Impact on Environmental Health		
Unit 2	**Development and Environmental Health**	**8 Hours**
Natural resources: Natural Resources: Types (Renewable and Non-renewable), Developmental Benefits, Forest: Benefits and Problems (Deforestation), Biodiversity: Importance, Threats, Conservation, Ecosystems: Importance, Problems, Ecological Restoration, Air: Benefits and Problems (Pollution, Climate Change), Water: Benefits and Problems (Depletion, Pollution), Soil/Land: Benefits and Problems (Degradation, Fertility Loss, Desertification), Minerals: Benefits and Problems (Mining, Overexploitation, Pollution), Energy Resources: Benefits and Problems (Depletion, Energy Crisis), Urbanization and Environmental Health, Urban Problems and Solid Waste: MSW Effects, Plastic, Hazardous Waste, E-Waste		
Unit 3	**Environmental Management**	**8 Hours**
Renewable Energy Technologies (Biogas, Biofuel, Hydrogen, etc.), Pollution Abatement: 5R, ZLD, Carbon Credit, Bio Remedies, Soil/Land Reclamation and Sustainable Agriculture, Environmental Impact Assessment (EIA), Environmental Audit, ISO 14001 Certification, Role of CPCB and MPCB in Environmental Protection, Emerging Environmental Technologies: GIS, Remote Sensing, IoT, Smart Bins, Waste-to-Energy, Recycling Automation, Circular Economy Practices, Sustainable Packaging, Community Engagement, Decentralized Waste Treatment, Zero-Waste Initiatives, Environmental Legislation: Environmental Protection Act, Air Act, Water Act, Solid Waste Management Act, Hazardous Waste Management Rules, E-Waste (Management) Rules, 2022.		
Unit 4	**Field Project Work**	**5 Hours**
Case studies based on field visit (Each student must complete a project on an environmental issue and propose solutions)		

Text Books:

1. Erach Bharucha – Textbook of Environmental Studies for Undergraduate Courses
   Publisher: University Grants Commission / Orient Blackswan
   ISBN: 9788173715402
2. Benny Joseph – Environmental Science and Engineering
   Publisher: McGraw Hill Education
   ISBN: 9789339221266
3. Anubha Kaushik & C.P. Kaushik – Perspectives in Environmental Studies
   Publisher: New Age International Publishers
   ISBN: 9788122439802

Reference Books:

1. Rajagopalan – Environmental Studies: From Crisis to Cure
   Publisher: Oxford University Press
   ISBN: 9780198067691
2. S.K. Dhameja – Environmental Studies
   Publisher: S.K. Kataria & Sons
   ISBN: 9789350141014
3. A.K. De – Environmental Chemistry
   Publisher: New Age International Publishers
   ISBN: 9788122419460
4. P.D. Sharma – Ecology and Environment
   Publisher: Rastogi Publications
   ISBN: 9788171337033
5. S.C. Santra – Environmental Science
   Publisher: New Central Book Agency
   ISBN: 9788173810732
6. N. Basak – Environmental Engineering
   Publisher: McGraw Hill Education
   ISBN: 9789339205181
7. Ministry of Environment, Forest and Climate Change (MoEFCC) – Reports and Surveys
   (Available at: https://moef.gov.in)

Course Code:	24DSEU3H10
Course Name:	Economics and Management for IT

L	T	P	Credit
2			2

Course Prerequsites:

Basic knowledge of computer

Course Description:

The course is intended to provide basic understanding of Economics and Management to engineering students with following aspects –
1. To impart knowledge, with respect to concepts of management information system.
2. To expose the students to the characteristic and applications of Decision Support Systems.
3. To help the students to understand different trends in current information system technology and also IT Tools & Techniques for Business operations.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Explain the concepts of system development management life cycle.
CO2	Describe scope and objective of management information system.
CO3	Develop the decision making skills and practices.
CO4	Elaborate the different corporate case studies.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2										2	1	1	
CO2	2										2	1	1	
CO3	2										2	1	1	
CO4	2										2	1	1	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	ESE	50 Marks	
2			

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Course Contents:

Unit 1	**Management Information System**	**4 Hours**
Conceptual foundations of information systems; Information theory; Information resource management; Types of information systems; Systems development - Overview of systems and design; System development management life-cycle, designing for online and distributed environments; Implementation and control of project.		
Unit 2	**Scope and Objectives of MIS**	**6 Hours**
MIS meaning and role, MIS concepts, Management science structure, Information flow in management, MIS, for management support, Planning with MIS, control with MIS. Problem solving & decision making, Development of MIS, strategic & project planning for MIS.		
Unit 3	**Enhancing Management Decision Making**	**5 Hours**
Decision support systems (DSS) – understanding DSS, characteristics components, major DSS applications. Group decision support systems (GDSS), - elements, characteristics, how GDSS can enhance group decision - making? Executive support systems (ESS) – role of ESS in the organization, developing ESS, benefits of ESS.		
Unit 4	**Case Studies**	**6 Hours**
Web Publishing: types of websites, Web surfing, E- commerce, B2B, B2C, C2C, E-commerce security issues, Ethical issues.		

Text Books:

1. Management of Information systems, Gordon B. Davis & Margreth H. Olson, Pearson Edition

Reference Books:

1. MIS Concepts & Design by Robert C. Murdik. PHI 2nd Edition
2. Information system by H.F. & Abraham, S., Database System Concepts, McGraw Hill
3. Engineering Economics, R.Paneerselvam, PHI publication
4. Modern Economic Theory, By Dr. K. K. Dewett& M. H. Navalur, S. Chand Publications

D. Y. PATIL DEEMED TO BE UNIVERSITY
SCHOOL OF ENGINEERING AND MANAGEMNET
Teaching and Evaluation Scheme from Year 2024-25 (as per NEP-2020)
B. Tech. Data Science Engineering (SEMESTER- IV)

Sr. No.	Course Code	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	Contact Hrs			ISE	MSE	ESE	INT	OE/ PoE	
					L	P	T						
1	24DSEU4P01	PCC	Discrete Mathematical Structure	**3**	3	-	-	20	30	50	-	-	100
2	24DSEU4P02	PCC	Design and Analysis of Algorithm	**3**	3	-	-	20	30	50	-	-	100
3	24DSEU4P03	PCC	Programming Lab - II	**4**	2	4	-	-	-	-	50	50	100
4	24DSEU4M04	MDM-II	Data Analysis and Visualization	**2**	2	-	-	-	-	50	-	-	50
5	24DSEU4O05	OEC-II	Introduction to Data Engineering	**2**	2	-	-	-	-	50	-	-	50
6	24DSEU4A06	AEC	Soft Skill	**2**	-	4	-	-	-	-	25	25	50
7	24DSEU4N07	VSEC	Web Application Development - I	**2**	1	2	-	-	-	-	25	25	50
8	24DSEU4V08	VEC	Environmental Studies-II	**2**	2	-	-	-	-	50	-	-	50
9	24DSEU4H09	HSSM	Leveraging Technologies for Project Management and Startup Ventures	**2**	1	2	-	-	-	-	50	-	50
10	24DSEU4D10	AC	Liberal Learning	-	2*	-	-	-	-	-	50*	-	
11	24DSEU4D11	AC	Finishing School Training - IV	-	2*	-	-	-	-	-	50*	-	
			Total	**22**	**16**	**12**	**0**						600

HONORS

Sr. No.	Course Code	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	L	P	T	ISE	MSE	ESE	INT	OE/	
3	23DSEU4Z01	Honors	Fundamentals of Cyber Security	3	3	-	-	20	30	50	-	-	100
4	23DSEU4Z02	Honors	Fundamentals of Cyber Security	1	-	2	-	-	-	-	25	-	25

Note:
$ - Open & Distance Learning
* - Values are not included in total marks
Min. Marks for Passing: 40% of total marks of individual course

Course Code:	24DSEU4P01		L	T	P	Credit
Course Name:	Discrete Mathematical Structures		3			3

Course Prerequsites:

1. Mathematics - Probability theory, Set theory, functions

Course Description:

This Course consists of concepts of Discrete mathematical structures such as mathematical logic, Sets, relations, functions, lattices and Boolean algebra, combinatorics and graph theory.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Explain the basic concepts of discrete mathematical structures
CO2	Demonstrate the applications of discrete structures in different fields of computer science.
CO3	Solve problems using the concepts of Discrete structures.
CO4	Apply the mathematical proofs and techniques to prove the theorems in computer science.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2				1									
CO2	2			1	2	1						1	1	
CO3	2	2	2	1	1									
CO4	2	1	1	1	1	1								
CO5														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

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Course Contents:		
Unit 1	**Mathematical logic**	**8 Hours**
1.1 Statements and Notations 1.2 Connectives , Statement formulas and truth tables, well formed formulas, Tautologies, Equivalence of formulas, Duality law, Tautological implications, functionally complete sets of connectives, other connectives 1.3 Normal and principal normal forms, completely parenthesized infix and polish notations 1.4 Theory of Inference for statement calculus – validity using truth table, rules of inference, consistency of Premises and indirect method of proof, Predicate calculus		
Unit 2	**Set theory**	**8 Hours**
2.1 Basic concepts of set theory, Operations on sets, Ordered pairs, Cartesian Products 2.2 Representation of discrete structures 2.3 Relation and ordering - properties of binary relations in a set, Relation matrix and the graph of a relation, Partition and Covering of set, Equivalence relations, Recurrence relations, Composition of Binary relations,Partial ordering , POSET and Hasse diagram. 2.4 Functions – types, composition of functions, Inverse functions.		
Unit 3	**Algebraic systems**	**5 Hours**
3.1 Algebraic systems, properties and examples 3.2 Semigroups and Monoids, properties and examples, Homomorphism of Semigroups and Monoids 3.3 Groups: Definition and examples, Subgroups and homomorphism		
Unit 4		**5 Hours**
4.1 Lattice as POSETs , definition , examples and properties 4.2 Lattice as algebraic systems, Special lattices 4.3 Boolean algebra definition and examples 4.4 Boolean functions		
Unit 5	**Permutations, Combinations and Probability theory**	**7 Hours**
5.1 The Basics of Counting 5.2 The Pigeonhole Principle 5.3 Permutations and Combinations 5.4 Generalized Permutations and Combinations 5.5 Discrete Probability 5.6 Conditional probability 5.7 Bayes' Theorem		
Unit 6	**Graphs**	**7 Hours**
6.1 Introduction to Graphs 6.2 Graph Terminology 6.3 Representing Graphs and Graph Isomorphism 6.4 Connectivity 6.5 Euler and Hamilton Paths 6.6 Planar Graphs 6.7 Introduction to Trees		

Text Books:	
1. Discrete Mathematical Structures with Application to Computer Science - J. P. Tremblay & R. Manohar (MGH International) 2. Discrete Mathematics and its Applications - Kenneth H. Rosen (AT&T Bell Labs) (mhhe.com/rosen)	

Reference Books:	

1. Discrete Mathematics - SemyourLipschutz, MarcLipson (MGH), Schaum's outlines.
2. C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", SiE Edition, TataMcGrawHill, 2008,ISBN 10:0-07-066913-9
3. Schaums Solved Problem Series – Lipschutz.
4. Discrete Mathematical Structures – Bernard Kolman, Robert Busby, S.C.Ross and NadeemurRehman (Pearson Education)

Course Code:	24DSEU4P02
Course Name:	Design and Analysis of Algorithms

L	T	P	Credits
3			3

Course Prerequsites:

1. Problem Solving Approch
2. Data Structures

Course Description:

This course introduces basic methods for the design and analysis of efficient algorithms. Different algorithms for a given computational task are presented and their relative merits evaluated based on performance measures. It introduces the fundamental techniques for designing and analyzing algorithms, including asymptotic analysis, divide-and-conquer algorithms, greedy algorithms, dynamic programming, traversal methods and even backtracking approach. It also provides introduction to NP-completeness.

Course Outcomes: After the completion of the course the student will be able to -

CO1	demonstrate an understanding of algorithms, their properties, and design techniques.
CO2	evaluate algorithm performance using asymptotic notations.
CO3	select the most appropriate algorithmic strategy for solving complex computational problems.
CO4	classify problems into polynomial, NP-Hard, and NP-Complete categories.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1				1			1					1	
CO2	2	1		1				1		1	1			
CO3		2	2	1	1					1		2	1	1
CO4	1	1		1						1	1	2		

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

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Course Contents:		
Unit 1	**Introduction to Algorithms**	**7 Hours**
Definition, Properties of Algorithms, Expressing Algorithm- Pseudocode; Flowchart, Algorithm Design Techniques, Performance Analysis of Algorithms, Types of Algorithm's Analysis, Order of Growth, Asymptotic Notations, Recursion		
Unit 2	**Divide and Conquer**	**7 Hours**
The general method, Binary search, Finding the maximum and minimum, Merge sort, Quick sort, Analysis of Divide and Conquer algorithms.		
Unit 3	**Greedy Algorithms**	**7 Hours**
Introduction to Greedy Technique, General Greedy Method, Knapsack Problem, Job Sequencing with Deadline, Optimal Merge Patterns, Minimum Spanning Tree - Prim's Algorithm, Kruskal's algorithm, Single-Source Shortest Path Algorithm		
Unit 4	**Dynamic Programming**	**7 Hours**
The general method, Longest Common Sub-sequence, Bellman Ford, All pair shortest paths, 0/1 knapsack, Traveling Salesperson problem.		
Unit 5	**Backtracking**	**7 Hours**
Backtracking Concept, N–Queens Problem, Sum of Subsets Problem, Graph Coloring Problem, Hamiltonian Cycle		
Unit 6	**NP Hard and NP Complete Problems**	**6 Hours**
Introduction, Polynomial Complexity Class, Non Polynomial Complexity Class- NP-Hard, NP-Complete		

Text Books:

1. Ellis Horowitz, Satraj Sahani, Saguthevar Rajasejaran, Fundamentals of Computer Algorithms Universities Press, Second Edition (All Units)

Reference Books:

1. Gilles Brassard, Paul Bratley, Fundamentals of Algorithmics, Pearson Education
2. Kyle Loudon, Mastering Algorithms with C, SPD O'Reilly
3. Allen Van Gelder , Sara Baase, Computer Algorithms- Introduction to Design and Analysis, Pearson Education

Course Code:	24DSEU4P03
Course Name:	Programming Lab - II

L	T	P	Credit
2	0	2	3

Course Prerequsites:

1. Procedural Programming Language

Course Description:

This course introduces students to the principles of object-oriented programming using Java. Students will develop practical skills through hands-on coding exercises and projects, learning to design and implement efficient, reusable, and maintainable code using OOP concepts.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Understand the fundamentals of Object-Oriented Programming (OOP) and Java language constructs.
CO2	Apply various object-oriented features to solve real-life problems using Java Programming language.
CO3	Make use of file I/O operations and exceptions in Java to create robust and error-resilient programs.
CO4	Utilize appropriate collection classes to solve real-world programming problems.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1								1	1		3	1	
CO2	1	1	2		3			2	1	2			3	2
CO3	1	1	2		3			2	1	1		3	3	2
CO4					3				1				2	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal Assessment	50%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	POE	50%	Practical/Oral Examination

Course Contents:

Unit 1	**Introduction to OOPs concepts and Java Programming**	**3 Hours**
Introduction to procedural & object-oriented programming, Limitations of procedural programming, Need of object-oriented programming, **Fundamentals of object-oriented programming:** objects, classes, data members, methods, messages, data encapsulation, data abstraction and information hiding, inheritance, polymorphism. **Introduction to Java Programming:** The Java Buzzwords, The Java Programming Environment- JVM, JIT Compiler, Byte Code Concept, A Simple Java Program, Source File Declaration Rules, Comments, Data Types, Variables, Operators, Strings, Input and Output, Control Flow, Big Numbers, ArraysJagged Array.		
Unit 2	**Classes and Objects**	**5 Hours**
Object-Oriented Programming Concepts, Declaring Classes, Declaring Member Variables, Defining Methods, Constructor, Passing Information to a Method or a Constructor, Creating and using objects, Controlling Access to Class Members(Access specifiers – public, private, protected,), Static Fields and Methods, this keyword, Object Cloning, use of the new keyword, Method overloading, array of objects, passing objects to functions, returning object.		
Unit 4	**Inheritance, Interface and Packaging**	**6 Hours**
Inheritance: Definition, Superclasses, and Subclasses, Overriding and Hiding Methods, Polymorphism, Inheritance Hierarchies, Super keyword, Final Classes and Methods, Abstract Classes and Methods, casting, Design Hints for Inheritance, Nested classes & Inner Classes. **Interfaces:** Defining an Interface, Implementing an Interface, Using an Interface as a Type, Evolving Interfaces, Default Methods. **Packages:** Class importing, Creating a Package, Naming a Package, Using Package Members, Managing Source and Class Files		
Unit 5	**Exception Handling and File I/O**	**6 Hours**
I/O Streams: Byte Stream – InputStream, OutputStream, DataInputStream, DataOutputStream, FileInputStream, FileOutputStream, Character Streams, BufferedStream, Scanner, File, RandomAccesFile. **Exception:** Definition, Dealing with Errors, The Classification of Exceptions, Declaring Checked Exceptions, Throw an Exception, Creating Exception Classes, Catching Exceptions, Catching Multiple Exceptions, Re-throwing and Chaining Exceptions, finally clause, Advantages of Exceptions, Tips for Using Exceptions.		
Unit 5	**Multithreading and Collections**	**6 Hours**
Multithreading: Processes and Threads, Runnable Interface and Thread Class , Thread Objects, Defining and Starting a Thread, Pausing Execution with Sleep, Interrupts, Thread States, Thread Properties, Joins, Synchronization **Collections:** Collection Interfaces, Concrete Collections- List, Queue, Set, Map, the Collections Framework.		

Text Books:

1. "Core Java Volume I – Fundamentals" by Cay S. Horstmann and Gary Cornell
2. "Java: The Complete Reference" by Herbert Schildt

Reference Books:

1. "Head First Java" by Kathy Sierra and Bert Bates

List of Experiments:

1. Write a Java program to implement data types, operators
2. Write a Java program to implement simple class and objects
3. Write a Java program to implement Contructor overloading
4. Write a Java program to implement Method overloading
5. Write a Java program to implement different types of inheritance
6. Write a Java program to implement abstract class
7. Write a Java program to implement interface
8. Write a Java program to implement package
9. Write a Java program to implement File Handling
10. Write a Java program to implement Exception Handling
11. Write a Java program to implement Multithreading
12. Write a Java program to implement different collection

Course Code:	24DSEU4M04
Course Name:	Data Analysis and Visualization

L	T	P	Credit
2			2

Course Prerequsites:

1. Fundamentals of Data Science

Course Description:

This course introduces students to data analysis and visualization in the field of exploratory data science.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Demonstrate proficiency in Python libraries for exploratory data analysis.
CO2	Implement comprehensive data preprocessing workflows
CO3	Apply data manipulation techniques and create effective visualizations to solve real-world data analysis problems.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	3	1							3	3
CO2	2	3	2	3	2	1							3	3
CO3	2	3	3	3	1	1							3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	End Semester Examination (ESE) [50 marks]	100%	100% course contents

Course Contents:

Unit 1	**Introduction**	**6 Hours**
Introduction to Data Science, Exploratory Data Analysis and Data Science Process. Motivation for using Python for Data Analysis, Introduction of Python shell iPython and Jupyter Notebook. Essential Python Libraries: NumPy, pandas, matplotlib, SciPy, scikit-learn, statsmodels.		
Unit 2	**Getting Started with Pandas**	**8 Hours**
Arrays and vectorized conputation, Introduction to pandas Data Structures, Essential Functionality, Summarizing and Computing Descriptive Statistics. Data Loading, Storage and File Formats. Reading and Writing Data in Text Format, Web Scraping, Binary Data Formats, Interacting with Web APIs, Interacting with Databases Data Cleaning and Preparation. Handling Missing Data, Data Transformation, String Manipulation		
Unit 3	**Data Wrangling and Data Visualization**	**8 Hours**
Data Wrangling: Hierarchical Indexing, Combining and Merging Data Sets Reshaping and Pivoting. Data Visualization matplotlib: Basics of matplotlib, plotting with pandas and seaborn, other python visualization tools.		
Unit 4	**Data Aggregation and Group operations**	**6 Hours**
Group by Mechanics, Data aggregation, General split-apply-combine, Pivot tables and cross tabulation, Categorical Data, Advanced GroupBy Use, Techniques for Method Chaining.		

Text Books:

1.McKinney, W.(2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython. 2nd edition. O'Reilly Media

Reference Books:

1. O'Neil, C., & Schutt, R. (2013). Doing Data Science: Straight Talk from the Frontline O'Reilly Media

Course Code:	24DSEU4O05
Course Name:	Introduction to Data Engineering

L	T	P	Credit
2			2

Course Prerequsites:

Fundamental of Data Science

Course Description:

This course is about the understanding of fundamental techniques involved in the data engineering and will provide understanding of data engineering life cycle. Also, includes topics which focus on source systems of data engineering, storage, ingestion, Security, data Management, Data modelling and Design. They are used in a variety of applications today including Business Intelligence and Analytics, smart cities, healthcare, fraud detection

Course Outcomes: After the completion of the course the student will be able to -

CO1	Describe the basic principles, foundation and building blocks of Data Engineering.
CO2	Define the data engineering lifecycle and ETL model.
CO3	Explain the need of basic architecture in data engineering.
CO4	Summarize the technologies used for implementation of data engineering lifecycle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	1								2	1
CO2	1	2	1	1	1								2	2
CO3	1	2	2	2	2	1							3	3
CO4	1	1	2	3	2	1							3	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	End Semester Examination (ESE) [50 marks]	100%	100% course contents

Course Contents:

Unit 1	**Foundation and Building Blocks of Data Engineering**	**6 Hours**
What is Data Engineering - Data Engineering Defined, Data Engineering Lifecycle, Evolution of the Data Engineer, Data Engineering and Data Science. Data Engineering Skills and Activities - Data Maturity and the Data Engineer, The Background and Skills of a Data Engineer, Business Responsibilities, Technical Responsibilities. Data Engineers Inside an Organization - Internal-Facing Versus External-Facing Data Engineers, Data Engineers and Other Technical Roles, Data Engineers and Business Leadership.		
Unit 2	**The Data Engineering Life Cycle**	**6 Hours**
What is data engineering life cycle - The data lifecycle vs the data engineering lifecycle, source systems,storage, ingestion, Batch vs streaming, push vs pull, Transformation, serving Data, Analytics, Machine Learning, Reverse ETL.Major undercurrents across the Data Engineering Lifecycle - Security, data Management, Data modelling and Design, Data Lineage, Data Integration and interoperability, Data Lifecycle management, DataOps		
Unit 3	**Designing good data architecture**	**6 Hours**
What is data architecture, enterprise architecture, Good data architecture, principles of good data architecture,Major architecture concepts, tight vs loose coupling, examples and types of Data architecture		
Unit 4	**Choosing technologies across Data Engineering Lifecycle**	**6 Hours**
Team size and capabilities, Speed to market, Interoperability, Cost optimization and business value, Today versus the future: immutable versus transitory technologies, Location (cloud, on premises, hybrid cloud, multi cloud), Build versus buy, Monolith versus modular, Serverless versus servers, Optimization, performance and the benchmark wars, The undercurrents of the data engineering lifecycle		

Text Books:

1. Fundamentals of Data Engineering, Joe Reis &Matt Housley, O'REILLY

Reference Books:

1. Designing Data-Intensive Applications, Martin Kleppmann, O'REILLY

Useful Links:

1.https://elearn.nptel.ac.in/shop/iit-workshops/completed/introduction-to-data-engineering-usingazure/?v=c86ee0d9d7ed

Course Code:	24DSEU4A06
Course Name:	Soft Skill

L	T	P	Credit
		4	2

Course Prerequsites:

Basic English Knowledge

Course Description:

1. Soft skills are character traits and interpersonal skills that characterize a person's relationships with other people. This course includes Communication skills, Writing skills, Techniques for self- development, Teamwork and group discussions, Time and stress management, Professional skills for overalldevelopment of an Engineer.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Effectively use the principles of communication.
CO2	Make appropriate use of interviews techniques.
CO3	Develop skills to conduct meetings & conferences.
CO4	Make effective presentations & technical report writing.
CO5	Actively participate in group discussion by following its etiquettes.
CO6	Effectively manage time and stress.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						1			3	3		3		
CO2									1	1		3		
CO3						1			3	1		3	2	
CO4	1				2	1			3	2		3	3	
CO5						1			2	2		3		
CO6						1			3	1		3	2	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	INT [25 Marks]	50.00%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	End Semester Examination (ESE) [25 Marks]	50.00%	Oral Examination

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Course Contents:	
Unit 1	**Communication Skills**
Process of communication, Flows of Communication in organization, Barriers to communication (Formal Flow – Upward, Downward, lateral and diagonal, Strategies to improve Organizational Communication,Effectiveness in Managerial Communication, and importance of technical communication, Nonverbal communication.	
Unit 2	**Interviews Skills**
Types of interview, General preparation for interview, gathering information about the company, knowing about the role/job position, Types of interviewing questions, Non-verbal communication to win the interview	
Unit 3	**Meeting & Conferences**
Planning a meeting (Agenda and notice), Conducting a meeting, Post meeting actions (Minutes), Planning & Conducting a Conference (anchoring and Report writing), and Video/web conferences, Identifying Strengths and Weakness.	
Unit 4	**Presentation Skills**
Effective Presentation strategies: Purpose, analyzing the audience and locale, organizing the content Oral presentation, Graphic presentation, Presentation aids, Personality Development. Newsletters, technical article and business letters. Technical Reports, characteristics, Importance, objectives, categories of report, format structure of reports, types of reports	
Unit 5	**Group Discussion**
Qualities needed for effective group discussion. Email etiquettes, Telephone Etiquettes, Role and responsibility of engineer, Work culture in jobs. Work place, rights and responsibilities.	
Unit 6	**Time and Stress Management**
Concept & Importance of Time Management, Techniques of Time Management, and Concept & Importance of Stress Management, Techniques of Stress Management, and Overcoming Stage fear and Interpersonal Relationships	

Text Books:

1. G.S.B.K Babu Rao, “Business Communication and Soft Skill”, Himalaya Publishing house (1st Edition)
2. Diane Hacker, “Pocket Style Manual”, Bedford Publication, New York, 2003. (ISBN 0312406843)
3. Shiv Khera, “You Can Win”, Macmillan Books, New York, 2003.

Reference Books:

1. Raman Sharma, “Technical Communications”, Oxford Publication, London, 2004.
2. “Ethics in Engineering practice and research” (2nd Edition) by Caroline Whit beck Cambridge
3. Sharma, R. and Mohan, K. “Business Correspondence and Report Writing”, TMH New Delhi 2002.

Course Code:	24DSEU4N07
Course Name:	Web Application Development – I

L	T	P	Credit
1		2	2

Course Prerequsites:

1. Basic Knowledge of Computer

Course Description:

This course is about the understanding and application development using the front end technologies. This aims to equip the students with different front end technologies needed to design and develop the applications of different problems related to UI interface

Course Outcomes: After the completion of the course the student will be able to -

CO1	Develop structured and styled web pages using HTML and CSS
CO2	Design responsive and user-friendly websites using Responsive Web Design principles
CO3	Implement dynamic and interactive web functionalities using JavaScript and jQuery

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1		2	1		1				1	2	
CO2	1	1	1		2	1		1				1	2	
CO3	1	1	2		2	1		1				1	2	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation	50%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	POE	50%	100% course contents

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Course Contents:

Unit 1	**HTML & CSS**	**3 Hours**

HTML: HTML Structure, Block Elements, Inline Elements, Class and ID Attributes, HTML Whitespaces.
CSS SELECTOR: Type, Class and ID Selector, Position and Group Selectors, Attribute Selectors, Pseudo-element Selectors, Pseudoclass Selectors.
Box Model: Display, Box Model, Inline Box, Inline-Block Box.

Unit 2	**Responsive Web Designing**	**3 Hours**

Responsive Web Designing: Introduction, Viewport, Grid View, Image, Video, Media Queries, RWD frameworks.
Twitter Bootstrap : Grid Basics, Typography, Tables, Images, Alerts, Button, Button Group, Borders, Labels, Progress bar, Pagination, Tabs, Navbar, Forms, Inputs, Input sizing, Carousel, Scrollspy.

Unit 3	**JavaScript**	**4 Hours**

Introduction, Data types and Variables, Operators, Expressions and Statements, Functions and Scope, Document Object Model, Event Handling, Form handling and validations.

Unit 4	**jQuery**	**3 Hours**

Introducing jQuery, jQuery selector, Animation effects, Event handling, DOM, jQuery DOM traversing, DOM manipulation.

Text Books:

1. Pro HTML5 and CSS3 Design Patterns by Michael Bowers, Dionysios Synodinos and Victor Sumner, Apress edition
2. Twitter Bootstrap Development How to by David Cochran, Packt Publication
3. JavaScript: The Definitive Guide by David Flanagan, O'Reilly Media
4. jQuery in Action by Bear Bibeault, Manning Publication

Reference Books:

1. Beginning with HTML5 and CSS3 The Web Evolved by Murphy, Apress
2. JavaScript: The Complete Reference by Thomas A Powell, Fritz Schneider, Tata McGraw Hill
3. Head First jQuery by Ryan Benedetti, O’reilly Publication

Experiment List:

1. Create Web Page structure using HTML5.

2. Create Web Pages with Class and ID attributes using HTML5.

3. Apply CSS to web pages created after developing the HTML5 pages.

4.Apply different CSS selectors to HTML5 web pages.

5. Create a responsive web page using media queries.

6. Create a responsive web page using bootstrap.

7. Write a JavaScript to compute mathematical operations on client side.

8. Write a JavaScript to handle event generated by client.

9. Write a JavaScript to perform form validation.

10. Write a jQuery script to provide animations effects in web pages.

11. Write a jQuery script to handle event generated by client.

12. Write a jQuery script to manipulate DOM

Course Code:	23DSEU4V08
Course Name:	Environmental Studies - II

L	T	P	Credit
2			2

Course Prerequsites:

1. Understanding of Environmental Education course

Course Description:

The main objective of course is to create awareness among students regarding environmental issues and its impact on society. Knowledge regarding environmental components, its degradation and protection of environment is need for sustainable future ahead.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Understand the fundamentals of environmental chemistry and assess the impacts of toxic pollutants on ecosystems and human health.
CO2	Identify and evaluate green technologies and sustainable innovations for solving environmental problems.
CO3	Analyze global environmental challenges and climate change mitigation strategies, including national and international policy frameworks.
CO4	Acquire problem solving attitude through actual field experience and report it in the form of a field report.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1						2							
CO2							2							
CO3							2							
CO4							2							

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation (ISE)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
	Mid Semester Exam	30%	50%ofcourse contents
	In Semester Evaluation (ISE)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	End Semester Examination (ESE)	50%	100%course contents

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Course Contents:

Unit 1	**Environmental Chemistry & Toxicology**	**5 Hours**
Basics of environmental chemistry (air, water, soil interactions), Chemical composition of the atmosphere, photochemical smog, Water chemistry: pH, DO, alkalinity, hardness, Soil chemistry: nutrients, contamination, pH ,Toxic pollutants: Pesticides, Heavy Metals (Hg, Pb, Cd, As), POPs, Industrial pollution sources and pathways, Health impacts of toxic substances on humans and ecosystems, Environmental standards by WHO, CPCB, BIS		
Unit 2	**Green Technologies & Innovations**	**8 Hours**
Introduction to Green Technologies: definitions, scope, principles, Green Buildings: features, LEED/IGBC ratings, case studies in India, Sustainable construction materials: fly ash bricks, bamboo, recycled concrete, Electric mobility: EVs, battery technologies, government policies (FAME), Renewable Energy Innovations: Solar PV, Wind, Bioenergy, LED systems, Smart energy solutions: energy metering, demand-side management, Energy-efficient appliances: BEE labeling, star ratings		
Unit 3	**Global Environmental Issues & Climate Action**	**8 Hours**
Climate change science: greenhouse gases , Major impacts of climate change: sea level rise, extreme events, biodiversity loss, International environmental treaties and protocols: Kyoto Protocol, Montreal Protocol, Paris Agreement: India's INDC goals, India’s National Action Plan on Climate Change (NAPCC), Carbon footprint: measurement, tools, reduction strategies, Net-zero emissions :pathways and technologies, Role of youth and civil society in climate action.ISO 14001:2015 – standards, implementation process, audits, Effluent Treatment Plant (ETP) and Sewage Treatment Plant (STP) processes, Corporate Social Responsibility (CSR) :legal framework, case studies.		
Unit 4	**Field Project Work**	**5 Hours**
Case studies based on field visit (Each student must complete a project on an environmental issue and propose solutions)		

Text Books:

1 Benny Joseph – Environmental Science and Engineering
Publisher: McGraw Hill Education,ISBN: 9789339221266.

2.Anubha Kaushik & C.P. Kaushik – Environmental Management, Publisher: New Age International Publishers, ISBN: 9788122419477.

3. S.M. Khopkar – Environmental Pollution Monitoring and Contro.
Publisher: New Age International Publishers, ISBN: 9788122404282

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Reference Books:

4. Rajagopalan – Environmental Studies: From Crisis to Cure
   Publisher: Oxford University Press
   ISBN: 9780198067691
5. S.K. Dhameja – Environmental Studies
   Publisher: S.K. Kataria & Sons
   ISBN: 9789350141014
6. A.K. De – Environmental Chemistry
   Publisher: New Age International Publishers
   ISBN: 9788122419460
7. ISO 14001:2015 – Environmental Management Systems :Requirements with Guidance for Use
   Publisher: International Organization for Standardization (ISO), ISBN: 9789267102970.
8. David T. Allen & David R. Shonnard: Green Engineering: Environmentally Conscious Design of Chemical Processes,Publisher: Pearson Education, ISBN: 9789332550479.
9. N. Basak – Environmental Engineering
   Publisher: McGraw Hill Education
   ISBN: 9789339205181
10. MoEFCC & NAPCC Policy Documents : Government of India, Available at: https://moef.gov.in

Course Code:	24DSEU4H09	L	T	P	Credit
Course Name:	Leveraging Technology in project Management and Start-up ventures	1		2	2

Course Prerequsites:

Software Engineering, project Management Basic Concepts

Course Description:

This course explores the integration of technology with project management principles, emphasizing how computer engineering students can leverage advanced tools and strategies in managing projects and launching start-up ventures. The course covers project management methodologies, software tools, and real-world applications .

Course Outcomes:	After the completion of the course the student will be able to -
CO1	Apply technology to optimize project planning, execution, and monitoring.
CO2	Dmonstrate practical skills in using project management tools and technologies
CO3	Learn the use of technology in start-up ventures and entrepreneurial projects

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			1		1						2			
CO2			1		3		3		2	2	2	2	3	
CO3			1		3		3		2	3	2	2	3	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation [50 Marks]	100%	Assignment, Test, Quiz, Seminar, Presentation, etc.

Course Contents:

Unit 1	**Introduction**	**3 Hours**
Project Management (PM) Fundamentals, People, Process, and Product, Technology Classic mistakes, PMI Processes, Software project phases, Organizational structures, Project charter, Statement of Work **(SOW)**		
Unit 2	**Project Management Methodologies**	**3 Hours**
Development lifecycle models, Project plans Work Breakdown Structures (WBS), Agile and Scrum: Principles and Practices,Comparing Methodologies: When to Use Which.		
Unit 3	**Project Planning and Scheduling Tools**	**3 Hours**
Introduction to Project Planning Software (e.g., MS Project, Jira, Asana), Creating Project Plans and Gantt Charts, Resource Allocation and Budgeting.		
Unit 4	**Vision and the Business Model & Innovation Strategies**	**4 Hours**
The Vision, The Mission Statement,The Value Proposition, The Business Model, Business Model Innovation in Challenging Markets, Core Competencies, Sustainable Competitive Advantage.First Movers Versus Followers, Imitation,Creativity and Invention, Types and Sources of Innovation, Technology and Innovation Strategy, New Technology Ventures.		

Text Books:

1. “Information Technology Project Management”, Kathy Schwalbe, Cengage Learning, 7/e, 2013.
2. "Technology Ventures From Idea to Enterprise",Thomas H. Byers, Richard C. Dorf, Andrew J., Nelson

Reference Books:

1. "Software Project Management", M. Cottrell and B. Hughes, McGraw-Hill, 5/e, 2009.
2. "Project Management Software Tools: A Guide to Choosing the Right Tools" by Michael S. Dobson
3. "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" by Eric Ries

D. Y. PATIL DEEMED TO BE UNIVERSITY
SCHOOL OF ENGINEERING AND MANAGEMENT
Teaching and Evaluation Scheme from Year 2023-24 (as per NEP-2020)
B. Tech. Data Science Engineering (SEMESTER- V)

Sr. No.	Course Code	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	Contact Hrs			ISE	MSE	ESE	INT	OE/ PoE	
					L	P	T						
1	23DSEU5P01	PCC	Operating Systems	**3**	3	-	-	20	30	50	-	-	100
2	23DSEU5P02	PCC	Computer Network	**2**	1	2	-	-	-	-	25	25	50
3	23DSEU5P03	PCC	Database Engineering	**3**	3	-	-	20	30	50	-	-	100
4	23DSEU5P04	PCC	Database Engineering Laboratory	**1**	-	2	-	-	-	-	25	25	50
5	23DSEU5P05	PCC	Programming Lab - III	**3**	2	2	-	-	-	-	50	50	100
6	23DSEU5M06	MDM-III	Data Mining and Warehousing	**3**	3	-	-	20	30	50	-	-	100
7	23DSEU5M07	MDM-III	Data Mining and Warehousing Laboratory	**1**	-	2	-	-	-	-	25	-	25
8	23DSEU5E08	PEC-I	Information Security	**3**	**3**	**-**	**-**	**20**	**30**	**50**	**-**	**-**	**100**
9	23DSEU5E09		Theory of Computation										
10	23DSEU5E10		Generative AI										
11	23DSEU5E11	PEC-I	Information Security Lab	**1**	-	**2**	-	-	-	-	**25**	-	**25**
12	23DSEU5E12		Theory of Computation Lab										
13	23DSEU5E13		Generative AI Lab										
14	23DSEU5O14	OEC-III	Business Analytics using Python	**2**	2	-	-	-	-	50	-	-	50
15	23DSEU5D15	AC	Liberal Learning	-	2*	-	-	-	-	-	50*	-	
16	23DSEU5D16	AC	Finishing School Training - V	-	2*	-	-	-	-	-	50*	-	
			Total	**22**	**17**	**10**	**-**						**700**

HONORS

Sr. No.	Course Code	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	L	P	T	ISE	MSE	ESE	INT	OE/	
1	23DSEU5Z01	Honors	Data Security Systems	3	3	-	-	20	30	50	-	-	100
2	23DSEU5Z02	Honors	Data Security Systems Lab	1	-	2	-	-	-	-	25	-	25

Note:
$ - Open & Distance Learning
* - Values are not included in total marks
Min. Marks for Passing: 40% of total marks of individual course

Course Code:	23DSEU5P01
Course Name:	Operating Systems

L	T	P	Credit
3			3

Course Prerequsites:

Fundamentals of Electronics and Computer

Course Description:

This is one of the core course of Data Science Engineering Programme. In this course you will become familiar with the core concepts of OS - how OS work, how a **processes & threads** are created, **inter-process communication & synchronisation**, the various **scheduling** algorithms, **memory management** & memory allocation strategies, etc. This course will be also helpful for exams like GATE.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Describe the basic concepts of operating systems.
CO2	Evaluate the performance of various scheduling & page replacement algorithms.
CO3	Distinguish techniques of inter process communication and synchronization.
CO4	Identify potential deadlock situations and propose appropriate strategies to handle or avoid deadlocks.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2									1	2	1	
CO2	2	2			2					1	2			
CO3	1	1	2	1	3							1		2
CO4	2	2		1	1								1	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:		
Unit 1	**Introduction**	**6 Hours**
Introduction to OS, OS Structure, Types of OS, OS Kernel, OS Services, Users Prespective of OS, System Boot Process, Architecture of UNIX OS		
Unit 2	**Process, Threads & Scheduling**	**8 Hours**
Process: Concept, States and Transitions, Context, Creation (fork), Termination (exit), Signals (signal, kill), Awaiting Process Termination(wait, waitpid), Invoking other programs (exec), Threads (pthreads) Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms.		
Unit 3	**Interprocess Communication**	**6 Hours**
Inter-Process Communication - Pipe, Shared Memory, Message Passing		
Unit 4	**Process Synchronization**	**7 Hours**
Inter-Process Synchronization: The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Problems of Synchronization		
Unit 5	**Deadlocks**	**6 Hours**
Deadlock: System Model; Deadlock Characterization; Methods for Handling Deadlocks; Deadlock Prevention; Deadlock Avoidance; Deadlock Detection and Recovery from Deadlock		
Unit 6	**Memory Management**	**8 Hours**
Memory background, Hierarchy, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Virtual Memory, Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing.		

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley India, 2009.
2. Operating Systems –Concepts and design –Milan Milenkovic (TMGH)

Reference Books:

1. The Design of Unix Operating System - Maurice J. Bach (PHI)
2. Operating Systems: Internals and Design Principles (8th Edition)- by William Stallings (Pearson Education)
3. Modern Operating Systems by Andrew S. Tanenbaum (Pearson Education International)
4. Unix concepts and administration – 3rd Edition – Sumitabha Das (TMGH).

Course Code:	23DSEU5P02
Course Name:	Computer Networks

L	T	P	Credit
1		2	2

Course Prerequsites:

Nil

Course Description:

This course explains how computers communicate in a network using different devices, protocols, and models like OSI and TCP/IP. It covers important topics such as IP addressing, routing, data transfer methods, and internet services like HTTP, DNS, and email.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Explain fundamental networking concepts and the layered architecture of the OSI and TCP/IP models
CO2	Analyze and apply IP addressing schemes, including subnetting and supernetting for IPv4.
CO3	Describe the functionalities and characteristics of key network layer and transport layer protocols.
CO4	Illustrate the role and operation of common application layer protocols and services.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2								1		2	1	
CO2	2	2			2				1	2				
CO3	1	1	2	1	3							1		2
CO4	2	2		1	1								1	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal	50%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (OE/POE	50%	100% course contents

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Course Contents:		
Unit 1	**Introduction to Network**	**3 Hours**
Data Communication, Networks Devices & Topologies, Network Types, Internet, Layered Tasks, OSI Reference Model and Layers, TCP/IP Protocol Suite		
Unit 2	**Network Layer**	**4 Hours**
Logical Addressing: IPv4 and IPv6 Addresses, Address Space, Special Addresses, Notations. Subnetting and Supernetting (IPv4). Network Layer Protocols: Internet Protocol (IP): Datagram Format, Fragmentation. Internet Control Message Protocol (ICMP). Address Resolution Protocol (ARP). Reverse Address Resolution Protocol (RARP). Routing: Routing Algorithms: Shortest Path, Flooding, Distance Vector Routing, Link State Routing.		
Unit 3	**Transport Layer**	**4 Hours**
Process-to-Process Delivery. Transport Layer Protocols: User Datagram Protocol (UDP): Characteristics and Applications. Transmission Control Protocol (TCP): Connection Establishment, Connection Termination, Flow Control, Congestion Control. Ports and Sockets.		
Unit 4	**Application Layer**	**4 Hours**
DHCP. HTTP and WWW. DNS. Email (SMTP, POP3, IMAP). FTP.		

Text Books:
1. Data Communications and Networking – Behrouz A Forouzan (The McGraw Hill) 2. TCP/IP Protocol Suite- Behrouz Forouzan-(The McGraw Hill)

Reference Books:
1. Computer Networks – Andrew S. Tanenbaum- (Prentice Hall) 5th Edition 2. Computer Networking with Internet Protocols and Technology, William Stallings (Prentice Hall)

Lab Assignments	
Experiment 1: Demonstration of networking commands	2 Hours
Experiment 2: Design and simulation of sample network	2 Hours
Experiment 3: Studying IPv4 and IPv6 addressess	2 Hours
Experiment 4: Design and simulate working of Virtual LAN	2 Hours
Experiment 5: Implementing TCP/UDP client for standard service using socket programming	2 Hours
Experiment 6: Implementing TCP/UDP Server using socket programming	2 Hours
Experiment 7: Installation and Configuration of FOSS server 1 (DHCP/DNS)	2 Hours
Experiment 8: Installation and Configuration of FOSS server 2 (Web, EMail, FTP)	2 Hours

Course Code:	23DSEU5P03
Course Name:	Database Engineering

L	T	P	Credit
3	0	0	3

Course Prerequsites:

Set Theory, Operating System, Data Structures, Basic Software Engineering Concept (SDLC)

Course Description:

The Database Engineering course provides a comprehensive understanding of database systems and their role in the design, development, and management of information systems. It introduces students to database theory, architecture, design methodologies, query languages, and data modeling techniques.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Understand fundamentals of Database Mmanagement Systems
CO2	Analyze the problem & construct good database design
CO3	Apply SQL queries to design & manage the database
CO4	Understand Transactions Model and the Recovery Schemes in Database Management Systems

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2		1	3	1	1			1		2	2	1
CO2	2	2	2	2	2	3	2	3	2	3	3	2	3	3
CO3	2	2	2	2	2	3		1	1	1	1	1	3	3
CO4	1	3	2	3	3	3	1	1		1	2	1	3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

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Course Contents:

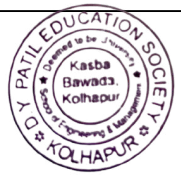
Unit 1	**INTRODUCTION TO DATABASES**	**6 Hours**
Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Specialty Databases, Database Users & Administrators, Structure of Relational Databases, Database Schema, Keys, Relational Query Languages, Relational Operations.		
Unit 2	**E-R MODEL AND DATABASE DESIGN**	**8 Hours**
E-R Model: The Entity-Relationship Model, Constraints, Entity-Relationship Diagrams, Reduction to Relational Schemas **Normalization**: Data Redundancies & Update Anomalies, Functional Dependencies, The Process of Normalization, First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form.		
Unit 3	**STRUCTURED QUERY LANGUAGE (SQL)**	**7 Hours**
Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Aggregate Functions, Nested sub Queries, Modification of Databases.		
Unit 4	**DATA STORAGE & INDEXING**	**7 Hours**
File Organization, Organization of records in File, Data Dictionary Storage, Database Buffer, Basic Concepts indexing & hashing, Ordered Indices, B+ Tree Index files, Multiple-Key Access, Static Hashing.		
Unit 5	**TRANSACTION MANAGEMENT**	**7 Hours**
Transaction Concept, A Simple Transaction Model, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Lock-Based Protocols, Deadlock Handling, Timestamp-Based Protocols, Validation-Based Protocols		
Unit 6	**RECOVERY SYSTEM**	**6 Hours**
Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Failure with Loss of Nonvolatile Storage, Remote Backup Systems		

Text Books:

1. Database System Concepts, A. Silberschatz, H.F. Korth, S. Sudarshan, 6th Edition, Mc Graw Hill Education.
2. Database Systems - A practical approach to Design, Implementation and Management Thomos Connolly, Carolyn Begg, 3rd Edition, Pearson Education

Reference Books:

1. Database Systems – Design, Implementation and Management, Rob & Coronel 5th Edition, Thomson Course Technology
2. Fundamentals of Database Systems, Ramez Elmasri, Shamkant B. Navathe, 4th Edition,Pearson Education



Course Code:	23DSEU5P04
Course Name:	Database Engineering Lab

L	T	P	Credit
0	0	2	1

Course Prerequsites:

Set Theory, Fundamental of Software Engineering (SDLC)

Course Description:

The Database Engineering course provides a comprehensive understanding of database systems and their role in the design, development, and management of information systems. It introduces students to database theory, architecture, design methodologies, query languages, and data modeling techniques.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Understand fundamentals of database management systems
CO2	Analyze & construct good database design
CO3	Apply SQL queries to design & manage the database

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1		3	1	1			1	1	1		
CO2	1	3	2	3	2	3	1	3	1	1	3	2		
CO3	2	3	2	2	3	3	1	3	1	1	3	2		
CO4														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal Assessment	50%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	POE	50%	Practical/Oral Examination

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Course Contents:	
Assessment No. 1 : Draw an E-R Diagram of any organization	
Assessment No. 2 : Reduce above mentioned E-R Diagram into Relational Model	
Assessment No. 3 : Normalize any database from first normal form to Boyce-Codd Normal Form (BCNF)	
Assessment No. 4 :Use DDL Queries to create, alter (add, modify, rename, drop) & drop Tables	
Assessment No. 5 : Use DML Queries to insert, delete, update & display records of the tables	
Assessment No. 6 : Create table with integrity constraints like primary key, check, not null and unique	
Assessment No. 7 : Create table with referential integrity constraints with foreign key, on delete cascade and on delete set null	
Assessment No. 8 : Display the results of set operations like union, intersections & set difference	
Assessment No. 9 : Display the results of Join Operations like cross join, self join, inner join, natural join, left outer join, right outer join and full outer join	
Assessment No. 10 : Display the records using Aggregate functions like min, max, avg, sum & count. Also use group by, having clauses	
Assessment No. 11 : Display the results using String operations	
Assessment No. 12 : Create & Update views for any created table	
Assessment No. 13 : Study of B+ tree indexing	
Assessment No. 14 : Implement static hashing (Simulation)	
Text Book:	
Williams Stallings – Cryptography and Network Security Principles and Practices (Unit 1 to 5) Pearson Education (LPE), 7th Edition	

Course Code:	23DSEU5P05
Course Name:	Programming Lab - III

L	T	P	Credit
2	0	2	3

Course Prerequsites:

1. Procedural Programming Language

Course Description:

This course introduces students to the principles of object-oriented programming using Java. Students will develop practical skills through hands-on coding exercises and projects, learning to design and implement efficient, reusable, and maintainable code using OOP concepts.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Understand the fundamentals of Object-Oriented Programming (OOP) and Java language constructs.
CO2	Apply various object-oriented features to solve real-life problems using Java Programming language.
CO3	Make use of file I/O operations and exceptions in Java to create robust and error-resilient programs.
CO4	Utilize appropriate collection classes to solve real-world programming problems.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1								1	1		3	1	
CO2	1	1	2		3			2	1	2			3	2
CO3	1	1	2		3			2	1	1		3	3	2
CO4					3				1				2	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal Assessment	50%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	POE	50%	Practical/Oral Examination

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Course Contents:

Unit 1	Introduction to OOPs concepts and Java Programming	3 Hours

Introduction to procedural & object-oriented programming, Limitations of procedural programming, Need of object-oriented programming,
Fundamentals of object-oriented programming: objects, classes, data members, methods, messages, data encapsulation, data abstraction and information hiding, inheritance, polymorphism.
Introduction to Java Programming: The Java Buzzwords, The Java Programming Environment- JVM, JIT Compiler, Byte Code Concept, A Simple Java Program, Source File Declaration Rules, Comments, Data Types, Variables, Operators, Strings, Input and Output, Control Flow, Big Numbers, ArraysJagged Array.

Unit 2	Classes and Objects	5 Hours

Object-Oriented Programming Concepts, Declaring Classes, Declaring Member Variables, Defining Methods, Constructor, Passing Information to a Method or a Constructor, Creating and using objects, Controlling Access to Class Members(Access specifiers – public, private, protected,), Static Fields and Methods, this keyword, Object Cloning, use of the new keyword, Method overloading, array of objects, passing objects to functions, returning object.

Unit 4	Inheritance, Interface and Packaging	6 Hours

Inheritance: Definition, Superclasses, and Subclasses, Overriding and Hiding Methods, Polymorphism, Inheritance Hierarchies, Super keyword, Final Classes and Methods, Abstract Classes and Methods, casting, Design Hints for Inheritance, Nested classes & Inner Classes.
Interfaces: Defining an Interface, Implementing an Interface, Using an Interface as a Type, Evolving Interfaces, Default Methods.
Packages: Class importing, Creating a Package, Naming a Package, Using Package Members, Managing Source and Class Files

Unit 5	Exception Handling and File I/O	6 Hours

I/O Streams: Byte Stream – InputStream, OutputStream, DataInputStream, DataOutputStream, FileInputStream, FileOutputStream, Character Streams, BufferedStream, Scanner, File, RandomAccesFile.
Exception: Definition, Dealing with Errors, The Classification of Exceptions, Declaring Checked Exceptions, Throw an Exception, Creating Exception Classes, Catching Exceptions, Catching Multiple Exceptions, Re-throwing and Chaining Exceptions, finally clause, Advantages of Exceptions, Tips for Using Exceptions.

Unit 5	Multithreading and Collections	6 Hours

Multithreading: Processes and Threads, Runnable Interface and Thread Class , Thread Objects, Defining and Starting a Thread, Pausing Execution with Sleep, Interrupts, Thread States, Thread Properties, Joins, Synchronization
Collections: Collection Interfaces, Concrete Collections- List, Queue, Set, Map, the Collections Framework.

Text Books:

1. "Core Java Volume I – Fundamentals" by Cay S. Horstmann and Gary Cornell
2. "Java: The Complete Reference" by Herbert Schildt

Reference Books:

1. "Head First Java" by Kathy Sierra and Bert Bates

List of Experiments:

1. Write a Java program to implement data types, operators
2. Write a Java program to implement simple class and objects
3. Write a Java program to implement Contructor overloading
4. Write a Java program to implement Method overloading
5. Write a Java program to implement different types of inheritance
6. Write a Java program to implement abstract class
7. Write a Java program to implement interface
8. Write a Java program to implement package
9. Write a Java program to implement File Handling
10. Write a Java program to implement Exception Handling
11. Write a Java program to implement Multithreading
12. Write a Java program to implement different collection

Course Code:	23DSEU5M06	L	T	P	Credit
Course Name:	Data Mining and Warehousing	3	0	0	3

Course Prerequsites:

Foundational knowledge of Database Systems,Data Structures, Statistics and Probability

Course Description:

This course introduces the fundamental concepts and techniques of data mining and data warehousing. It equips students with the skills to design and implement data warehouses and extract meaningful insights from large datasets through data mining. Students will explore various data mining algorithms and learn how to preprocess data effectively. The course also covers data warehouse architecture, OLAP operations, schema modeling, and real-world applications in business and industry. Emphasis is placed on both theoretical understanding and practical implementation using industry-standard tools.

Course Outcomes:	After the completion of the course the student will be able to -
CO1	Implement and evaluate data mining algorithms such as classification, clustering, and association rule mining.
CO2	Understand the concepts and architecture of data warehousing, including schema design and OLAP operations.
CO3	Apply data preprocessing techniques to prepare real-world datasets for analysis.
CO4	Utilize data mining and warehousing tools to analyze large datasets and generate actionable insights for business applications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	3						1			
CO2	1	3	2	3	3					1	1			
CO3	3	2	2	3	3	1	3		1	1	1		3	3
CO4	3	3	2	3	3	1	3		3	1	1	1	3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation1 [10 Mark	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination [30 M	30%	50% Course Contents
3	In Semester Evaluation2 [10 Mark	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	nd Semester Examination [50 Mark	50%	100% Course Contents

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Course Contents:

Unit 1	**Introduction to Data Mining**	**6 Hours**
Definition, Importance, and Applications of Data Mining, Knowledge Discovery in Databases (KDD) Process, Types of Data: Structured, Semi-structured, and Unstructured, Data Preprocessing: Cleaning, Integration, Reduction, and Transformation, Data Mining Architecture		
Unit 2	**Data Mining Techniques**	**9 Hours**
Association Rule Mining: Apriori Algorithm, FP-Growth algorithms Clustering: K-Means, Hierarchical Clustering, Outlier Detection Classification: Decision Trees, Bayesian Classification, Rule-based classification, Model evaluation and cross-validation		
Unit 3	**Advanced Topics in Data Mining**	**6 Hours**
Mining data streams, Web and text mining, Temporal and spatial data mining, Social network mining		
Unit 4	**Introduction to Data Warehousing**	**6 Hours**
Data Warehousing concepts, Differences between OLTP and OLAP, Data warehouse architecture, Data Marts, ETL Process (Extract, Transform, Load), Metadata		
Unit 5	**Data Warehouse Design and Implementation**	**9 Hours**
Dimensional modeling: Star, Snowflake, Fact Constellation Fact tables and Dimension tables Data Cube and OLAP operations (Roll-up, Drill-down, Slice, Dice, Pivot)		
Unit 6	**Data Warehousing and Mining Applications**	**6 Hours**
Real-world applications, Trends in data warehousing (cloud DW, real-time DW), Data privacy and ethical issues in data mining, Case studies from industry		

Text Books:

1.“Data Mining Concepts and Techniques”, Jiawei Han, Micheline Kamber and Jian Pei , Third Edition, Elsevier, 2012.
2. "Data Warehousing: Concepts, Techniques, Products, and Applications",P. P. Chen,Pearson Education,First Edition, 2003 3.Building the Data Warehouse by William H. Inmon, Wiley India, 4th Edition, 2005

Reference Books:

1. The Data Warehouse Toolkit by Ralph Kimball and Margy Ross, Wiley, 3rd Edition, 2013
2. Data Mining: Practical Machine Learning Tools and Techniques by Ian H. Witten, Eibe Frank, and Mark A. Hall, Morgan Kaufmann, 3rd Edition, 2011
3. Data Mining Techniques by Arun K. Pujari, Universities Press, 4th Edition, 2013

Course Code:	23DSEU5M07	L	T	P	Credit
Course Name:	Data Mining and Warehousing Laboratory			2	1

Course Prerequsites:

Basic knowledge of programming, SQL, database concepts, and foundational statistics

Course Description:

This course provides a practical introduction to Data Mining and Data Warehousing, focusing on core concepts like data preprocessing, classification, clustering, and schema design. Through simplified hands-on assignments, students learn to apply techniques such as association rule mining and ETL processes. Real-world case studies help bridge theory and practice, preparing students for analytical roles and projects.

Course Outcomes	After the completion of the course the student will be able to -
CO1	Apply data preprocessing techniques and identify appropriate types of data for mining tasks
CO2	Demonstrate practical skills in using Data mining and Warehousing tools and technologies
CO3	Learn the use of technology in real-world analytical scenarios

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	2	1			1			1	3	3
CO2	3	2	2	3	3	1			1			1	3	3
CO3	3	2	3	3	3	3			1	1	3	1	3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation [25 Mar	100%	Experiment, Practical Performance and Oral Exam etc.

List of Experimen	
1	Data Preprocessing on a Sample Dataset
2	Identify Data Types and Create a KDD Process Flow
3	Implement Association algorithms on market basket data.
4	Implement Clustering Techniques on real-world dataset.
5	Build models using Decision Trees and Naive Bayes. Evaluate using cross-validation.
6	Text Mining from Online Reviews
7	Draw a Social Network Graph
8	Design a basic ETL process using a dataset
9	Create a Data Warehouse Schema
10	Case Study Analysis

Text Books:

1.“Data Mining Concepts and Techniques”, Jiawei Han, Micheline Kamber and Jian Pei , Third Edition, Elsevier, 2012.
2. "Data Warehousing: Concepts, Techniques, Products, and Applications",P. P. Chen,Pearson Education,First Edition, 2003
3.Building the Data Warehouse by William H. Inmon, Wiley India, 4th Edition, 2005

Reference Books:

1. The Data Warehouse Toolkit by Ralph Kimball and Margy Ross, Wiley, 3rd Edition, 2013
2. Data Mining: Practical Machine Learning Tools and Techniques by Ian H. Witten, Eibe Frank, and Mark A. Hall, Morgan Kaufmann, 3rd Edition, 2011
3. Data Mining Techniques by Arun K. Pujari, Universities Press, 4th Edition, 2013

Course Code:	23DSEU5E08
Course Name:	Information Security

L	T	P	Credit
3			3

Course Prerequsites:

Computer Network, Data Communication, Engg. Mathematics

Course Description:

This course gives you practical survey of both the principles and practice of cryptography and network security. In the first part of course, the basic issues to be addressed by a network security capability are explored by providing a tutorial and survey of cryptography and network security technology. The later part of course deals with the practice of network security.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Explain the use of Cryptographic algorithms to ensure data protection and integrity.
CO2	Apply the knowledge of cryptographic techniques to solve the problems on security.
CO3	Illustrate the different Network and Internet security protocols in TCP/IP stack.
CO4	Analyze the security facilities designed to provide system security.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2					1						2	2	2
CO2	2	3	3	2	2	2		2				2	2	2
CO3	1				2	2						2	2	2
CO4		2	2		3	3		2				2	2	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	ISE	20%	
2	MSE	30%	
3	ESE	50%	

Course Contents:

Unit 1	Introduction to Information Security	5 Hours

Overview:
Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security

Classical Encryption Techniques:
Symmetric Cipher Model,Substitution Techniques, Transposition Techniques, Rotor machines, Steganography.

Case Study 1.1: Perform Encryption and Decryption using crypt tool.

Unit 2	Symmetric and Asymmetric Key Cryptography	8 Hours

Block Ciphers and the Data Encryption Standard:
Block Cipher Structure, Data Encryption Standard (DES), A DES Example, Strength of DES, Block Cipher Design Principles, AES Structure, Multiple Encryption and Triple-DES

Public Key Cryptography:
Principles of Public-Key Cryptosystems, RSA Algorithm, Other Public key Cryptosystems - Diffie-Hellman Key Exchange, ElGamal Cryptographic system

Unit 3	Cryptographic Authentication Functions	8 Hours

Cryptographic Hash Functions:
Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA)

Message Authentication Codes:
Message Authentication Requirements, Message Authentication Functions, Requirements for MAC and Security of MACs, MACs Based on Hash Functions: MAC, MACs Based on Block Ciphers: DAA and CMAC

Digital Signatures:
Digital Signatures, ElGamal Digital Signature Scheme, Schnorr Digital Signature Scheme, Digital Signature Standard (DSS)

Case Study 3.1: Working of Digital signature software tool Sign server

Unit 4	Key Management and User Authentication	8 Hours

Key management:
Symmetric Key Distribution Using Symmetric Encryption,Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public Key Infrastructure

User Authentication Protocol:
Remote User-Authentication Principles, Remote User-Authentication UsingSymmetric Encryption, Kerberos, Remote User Authentication Using Asymmetric Encryption.

Unit 5	Internet security Protocols	6 Hours

Transport-Level Security:
Web Security Issues, Secure Sockets Layer (SSL), Transport Layer Security (TLS), HTTPS, SSH

Electronic Mail Security:
Pretty Good Privacy (PGP), S/MIME, SET

IP Security:
IP Security Overview, IP Security Policy, Encapsulating Security Payload

Case Study 5.1: Perform surveillance through packet sniffer tool like Wireshark &TCP Dump.

Unit 6	Firewall and Intrusion detection system	8 Hours

Firewalls:
Introduction, Types of firewall, Firewall configuration, VPN, Types of VPN
IDS:
Overview of IDS, IDS Components, Approaches of IDS
SIEM:
Introduction to SIEM,SIEM Scenario and process flow, SIEM architecture, SIEM features
Case study 6.1: Run Online Scanners like Virus Total, Jotti and No VirusThanks

Reference Books:

Textbooks:
1. Williams Stallings – Cryptography and Network Security Principles and Practices (Unit 1 to 5) Pearson Education (LPE), 7th Edition
2. Network Security, Firewalls, and VPNs, 3rd Edition by J. Michael Stewart, Denise Kinsey (Unit 6)

References:
1. Cryptography & Network Security B.A. Forouzan McGrawHill
2. Cryptography and network security – Atul Kahate (TMGH)
3. Handbook of Applied Cryptography - Menezes, an Oorschot, and S.A. Vanstone

Course Code:	23DSEU5E09	L	T	P	Credit
Course Name:	Theory of Computation	3	1		4

Course Prerequsites:

Discrete Mathematics, Sets, Cartesian Product and Functions

Course Description:

This course deals with the theoretical background of computer science.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Explain the fundamental concepts of formal languages, grammars, and automata.
CO2	Classify formal languages on the basis of their features.
CO3	Relate the computational models with the modern day computer technologies.
CO4	Design computational machines of various types for specified problems.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1			1									
CO2	2	2		1	3									
CO3	2	2	2	2	2									2
CO4	2	1	2	1	1	1								3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit 1	**Mathematical Induction, Regular Languages & Finite Automata**	**8 Hours**
The Principle of Mathematical Induction Recursive Definitions, Definition & types of grammars & languages, Regular expressions and corresponding regular languages, examples and applications, unions, intersection & complements of regular languages, Finite automata-definition and representation, on-deterministic F.A.,NFA with null transitions, Equivalence of FA's , NFA's and NFA's with null transitions.		
Unit 2	**Kleene's Theorem**	**4 Hours**
Part I & II statements and proofs, minimum state of FA for a regular language, minimizing number of states in Finite Automata.		
Unit 3	**Grammars and Languages**	**10 Hours**
Derivation and ambiguity, BNF & CNF notations, Union, Concatenation and *'s of CFLs, Eliminating production & unit productions from CFG, Eliminating useless variables from a context Free Grammar. Parsing: Top-Down, Recursive Descent and Bottom-Up Parsing.		
Unit 4	**Push Down Automata**	**4 Hours**
Definition, Deterministic PDA & types of acceptance, Equivalence of CFG's & PDA's.		
Unit 5	**CFL's and non CFL's**	**4 Hours**
Pumping Lemma and examples, intersections and complements		
Unit 6	**Turing Machines**	**10 Hours**
Models of computation, definition of Turing Machine as Language acceptors, combining Turing Machines, Computing a function with a TM, Non-deterministic TM and Universal TM, Recursively enumerable languages,Unsolvable problems.		

Text Books:

1.Introduction to languages & Theory of computations – John C. Martin (MGH)
2.Discrete Mathematical Structures with applications to Computer Science—J .P.Trembley &R.Manohar

Reference Books:

1.Introduction to Automata Theory , Languages and computation – John E. Hopcraft , Rajeev Motwani, Jeffrey D. Ullman (Pearson Edition)
2.Introduction to Theory of Computations – Michael Sipser (Thomson Brooks / Cole)
3.Theory Of Computation- Vivek Kulkarni, 1st edition OXFORD university Press
4.Theory Of Computation A problem Solving Approach Kavi Mahesh Wiley India

Course Code:	23DSEU5E10
Course Name:	Generative AI

L	T	P	Credit
3	0	0	3

Course Prerequsites:

Course Description:

Course Outcomes: After the completion of the course the student will be able to -

CO1	Explain fundamental concepts of Generative AI.
CO2	Design and implement effective prompt engineering techniques for various NLP tasks
CO3	Apply tuning and optimization techniques
CO4	Develop creative and productive applications using generative AI tools

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3											2	
CO2	2	3	2	3	3								3	2
CO3	3	3	2	3	3								1	
CO4	2	2	3	2	3	3					3		3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit 1	**Introduction to Genertaive AI**	**4 Hours**
1.what is AI, History, what is Generative AI 2.Types of Generative models 3.AI Prompt Writing? prompts, type of prompts 4.What is text to-text Generative AI 5.General Rules for Prompt Writing 6.Generative languages models 7.ChatGPT 3.5, chatGPT4.0, Examples, Google Bard, Ethics in AI		
Unit 2	**Prompt Engineering - NLP and ML Foundations**	**10 Hours**
1. Techniques for Prompt Engineering 2. Benefits of Prompt Engineering, what is NLP 3.What is ML, and examples 4. Common NLP Tasks-text classification, languge Translation, 5.Named Entity Recognition (NER) 6. Question answering , text Generation, sentiment analysis 7.Text summarization, recommendation system		
Unit 3	**Tuning and optimization Techniques**	**7 Hours**
1.Fine-tuning prompts 2.Prompt Tuning 3.Filtering and post-processing 4.Reinforcement learning 5.Use cases and applications 6.Pre-training 7.Designing effective prompts		
Unit 4	**AI for Creative Applications**	**7 Hours**
1.Presentations gamma.ai 2.TL, draw,AI overpowered tools 3.Image generation: Explorning tools like DALL-E and their creative applications 4.product design ideas 5.Poem generator, video description 6.Music generation		
Unit 5	**AI for Productivity Improvement**	**7 Hours**
1.Rytr for blog idea and outline, business idea pitch 2.Cover Letter,Job Description 3.Reply to reviews,keyword Extractor, tagline and Headlines etc 4.ResumeBuilding com, Blog writing/ Text summarization using copy.ai 5.Image code-Blackbox		
Unit 6	**Generative AI tools and case Studies**	**6 Hours**
1.Hugging face transformers 2.OpenAI GPT3 API 3.Google cloud AI platform, Mid Journey,DALL E-2, Google Bard 4.case Studies-Token(API) key generation on LLM(openAI, Google,Hugging face) in Google colab 5.Hugging face demonstration of various models-image-to-text, 6.language translation, summarization 7.text generation, text-to-image 8.image-to-text,AI-power point and excel 9.Use of AI in word,power point and excel		

Text Books:

1. "Generative AI for everyone" by Altaf Rehman, Bluerose Publishers Pvt. Ltd., First Edition, 2024
2. "Prompt Engineering for Genrative AI" by Jems Phoenix and Mike Taylor, Shroff Publishers and distributors Pvt. Ltd, First Edition, 2025
3. "Generative AI for Begineers Playbook" by Branson Adams, Walking Crow Publishing, First Edition, 2023

Reference Books:

1. "Rise of Generative AI and ChatGPT" by Utpal Chakraboraty, Sumit Kumar and Soumyadeep Roy, BPB

Course Code:	23DSEU5E11
Course Name:	Information Security Tutorial

L	T	P	Credit
		2	1

Course Prerequsites:

Computer Network and Programing Language like Java/Python

Course Description:

This course is to designed to do the practical implementation of Cryptographic algorithms and have the hands-on experience on open source/free tools available to demonstrate the security concepts.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Demonstrate encryption and authentication mechanisms.
CO2	Implement various cryptographic algorithms using various prgramming languages.
CO3	Make use of various security tools to analyze the security concepts.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2			1										
CO2		2		2									2	
CO3			2		3			2					2	
CO4														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal	100%	

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Course Contents:	
Assessment No. 1 :Classical Encryption Techniques : Substitution Ciphers	**2 Hours**
To implement the program of substitution ciphers like Caesar Cipher, Playfair Cipher, Hill Cipher	
Assessment No. 2 : Classical Encryption Techniques : Transposition Ciphers	**2 Hours**
To implement the program of Transposition ciphers like Rail fence technique, Columnar transposition	
Assessment No. 3 : Symmetric Ciphers : DES	**2 Hours**
Implement a program to perform Encryption and Decryption using DES cipher	
Assessment No. 4 : Symmetric Ciphers : AES	**2 Hours**
Implement a program to perform Encryption and Decryption using AES cipher	
Assessment No. 5 : Asymmetric Ciphers : RSA Algorithm	**2 Hours**
Implement a program to perform Encryption and Decryption using RSA algorithm	
Assessment No. 6 :Key Exchange Algorithm: Diffie Hellman Algorithm	**2 Hours**
To implement a program using Diffie Hellman key exchange algorithm	
Assessment No. 7 : Message Integrity using Hash function	**2 Hours**
To implement the program on Hash functions –SHA, MD5 etc to show the integrity check on the files transferred	
Assessment No. 8 :Digital Signature algorithm using RSA or DSS Approach	**2 Hours**
Implement the Digital Signature algorithm using RSA approach (SHA256withRSA) or DSS approach(SHA256with DSA)	
Assessment No. 9 : Demonstration of Creation of Digital Signature & Digitally Signed Certificate	**2 Hours**
To implement a program to show encryption and decryption using RSA algorithm in	
Assessment No. 10 : Demonstration of SSL protocol	**2 Hours**
Working of SSL protocol using Network analyzer tools like Wireshark	
Assessment No. 11 : Demonstration of User Authentication Tools	**2 Hours**
Use any of the user authentication tool like Kerberos, NTLM, LDAP, RADIUS	
Assessment No. 12 :Demonstration of Firewall & IDS/ IPS Systems	**2 Hours**
Use any of the Windows and Linux based firewall for demonstration	
Assessment No. 13 : Demonstration and Implementation of Malicious Softwares	**2 Hours**
Assessment No. 14 : Demonstration of VAPT Tools	**2 Hours**
Text Book:	
Williams Stallings – Cryptography and Network Security Principles and Practices (Unit 1 to 5) Pearson Education (LPE), 7th Edition	

Course Code:	23DSEU5E12	L	T	P	Credit
Course Name:	Theory of Computation Tutorial		1		1

Course Prerequsites:

1. Discrete Mathematics, Sets, Cartesian Product and Functions

Course Description:

This course deals with the theoretical background of computer science.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Explain the fundamental concepts of formal languages, grammars, and automata.
CO2	Classify formal languages on the basis of their features.
CO3	Relate the computational models with the modern day computer technologies.
CO4	Design computational machines of various types for specified problems.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1			1									
CO2	2	2		1	3									
CO3	2	2	2	2	2									2
CO4	2	1	2	1	1	1								3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

D.Y. PATIL EDUCATION SOCIETY Kasba Bawada, Kolhapur KOLHAPUR

Course Contents:
Tutorial 1: Mathematical Foundations and Introduction Sets, relations, functions, and basic proof techniques Strings, languages, and alphabet operations Introduction to formal computational models Mathematical induction and proof by contradiction
Tutorial 2: Deterministic Finite Automata (DFA) DFA definition, design, and state diagrams Language acceptance and transition functions DFA construction for pattern recognition Closure properties and decision problems
Tutorial 3: Nondeterministic Finite Automata (NFA and ε-NFA) NFA design and ε-transitions Subset construction (NFA to DFA conversion) ε-NFA to NFA conversion
Tutorial 4: Regular Expressions and Regular Languages Regular expression syntax and semantics Thompson's construction (RE to ε-NFA) State elimination method (DFA to RE)
Tutorial 5: Properties of Regular Languages Pumping lemma for regular languages Proving languages are not regular Myhill-Nerode theorem and DFA minimization Closure properties and decidability problems
Tutorial 6: Context-Free Grammars (CFG) CFG definition and derivation processes Parse trees and ambiguity resolution Grammar design for programming language constructs Chomsky Normal Form and Greibach Normal Form
Tutorial 7: Pushdown Automata (PDA) PDA definition and stack-based computation PDA design for context-free languages Equivalence between CFGs and PDAs
Tutorial 8: Properties of Context-Free Languages Pumping lemma for context-free languages CYK algorithm for membership testing Closure properties of CFLs
Tutorial 9: Turing Machines Turing machine definition and operation TM design for computational problems Multi-tape TMs
Tutorial 10: Decidability and Complexity Theory Decidable vs. undecidable problems Reduction techniques for proving undecidability

Text Books:

1.Introduction to languages & Theory of computations – John C. Martin (MGH)
2.Discrete Mathematical Structures with applications to Computer Science—J .P.Trembley &R.Manohar

Reference Books:

1.Introduction to Automata Theory , Languages and computation – John E. Hopcraft , Rajeev Motwani, Jeffrey D. Ullman (Pearson Edition)
2.Introduction to Theory of Computations – Michael Sipser (Thomson Brooks / Cole)
3.Theory Of Computation- Vivek Kulkarni, 1st edition OXFORD university Press
4.Theory Of Computation A problem Solving Approach Kavi Mahesh Wiley India

Course Code:	23DSEU5E13
Course Name:	Generative AI Lab

L	T	P	Credit
0	0	2	1

Course Prerequsites:

Basic understanding of Python programming, Machine Learning fundamentals

Course Description:

This laboratory course provides hands-on experience with generative artificial intelligence technologies, tools, and applications. Students will work with various generative AI models, implement prompt engineering techniques, and develop creative applications using state-of-the-art AI tools and platforms.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Implement and demonstrate fundamental generative AI models and techniques using practical tools and platforms
CO2	Design, develop and evaluate effective prompt engineering strategies for various NLP tasks
CO3	Apply and optimize generative AI models using fine-tuning, reinforcement learning, and other advanced techniques
CO4	Create innovative applications using generative AI tools

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3											3	3
CO2	3	3	2	3	3								3	3
CO3	3	3	2	3	3								3	3
CO4	1	2	3	2	3	3								

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal	100%	Practical performance, Internal POE

D.Y. PATIL EDUCATION SOCIETY Kasba Bawada, Kolhapur KOLHAPUR

Course Contents:		
Experiment 1:	**Study of various Generative AI Tools and Platforms**	**4 Hours**
Experiment 2:	**Implement different types of prompts (zero-shot, few-shot, chain-of-thought)**	**2 Hours**
Experiment 3:	**Implement text classification using prompt engineering**	**2 Hours**
Experiment 4:	**Develop applications for content generation and summarization**	**2 Hours**
Experiment 4:	**Use of AI APIs and implement model customization**	**4 Hours**
Experiment 5:	**Generate images using DALL-E and Midjourney**	**4 Hours**
Experiment 6:	**Build applications for creative content using AI**	**4 Hours**
Experiment 7:	**Create AI-powered productivity tools**	**4 Hours**
Experiment 8:	**AI for Productivity Improvement**	**4 Hours**

Text Books:

1. "Generative AI for everyone" by Altaf Rehman, Bluerose Publishers Pvt. Ltd., First Edition, 2024
2. "Prompt Engineering for Genrative AI" by Jems Phoenix and Mike Taylor, Shroff Publishers and distributors Pvt. Ltd, First Edition, 2025
3. "Generative AI for Begineers Playbook" by Branson Adams, Walking Crow Publishing, First Edition, 2023

Reference Books:

1. "Rise of Generative AI and ChatGPT" by Utpal Chakraboraty, Sumit Kumar and Soumyadeep Roy, BPB Publications,

Course Code:	23DSEU5O14
Course Name:	Business Analysis Using Python

L	T	P	Credit
2			2

Course Prerequsites:

Basic understanding of programming concepts, Python, knowledge of statistics and basic mathematics knowledge of spreadsheets or data handling tools.

Course Description:

This course teaches students how to use Python for analyzing business data, identifying trends, and making informed decisions through real-world examples.

Course Outcomes: After the completion of the course the student will be able to -

CO1	To introduce students to the role of data in business decision-making
CO2	To equip students with Python tools for data extraction, analysis, and visualization.
CO3	To teach students to use statistical and machine learning methods for business insights.
CO4	To develop real-world business intelligence solutions using Python.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1													
CO2	2	1	1	1	2									
CO3	2	1	1	1	2							1	1	
CO4	1	2	3	1	2							1	1	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	End Semester Examination	100%	

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Course Contents:		
Unit 1	**Introduction to Business Analytics & Python Basics**	**5 Hours**
Role of Business Analytics in organizations **Types of Business Analytics:** Descriptive, Predictive, and Prescriptive **Python Basics:** Data types, functions, loops, list comprehension **Python libraries:** pandas, numpy, matplotlib, seaborn **Working with data:** CSV, Excel, JSON **Data cleaning & preprocessing techniques**		
Unit 2	**Exploratory Data Analysis & Visualization**	**7 Hours**
Understanding business problems through EDA **statistics** correlation, regression and hypothesis testing Advanced visualizations with seaborn and matplotlib Detecting outliers, missing values, and anomalies Case study: Retail sales data or marketing campaign data		
Unit 3	**Predictive Analytics & Machine Learning**	**7 Hours**
Introduction to supervised and unsupervised learning **Regression models**: Linear, Multiple, Logistic **Classification:** Decision Trees, KNN, Naive Bayes **Clustering techniques:** K-Means Model evaluation metrics (Accuracy, Precision, Recall, F1 Score) Business application examples (e.g., customer churn prediction, sales forecasting)		
Unit 4	**Business Intelligence and Reporting with Python**	**6 Hours**
Introduction to BI tools & Python integration, Automating reports with Python, Data storytelling and presentation, Working with dashboards using plotly, dash, or streamlit **Capstone project: Solving a business case using Python**		

Textbooks and Reference Books:
1. "Python for Data Analysis" by Wes McKinney 2. "Data Science for Business" by Foster Provost and Tom Fawcett 3. "Business Analytics: Data Analysis & Decision Making" by Albright & Winston 4. Online Python and Business Analytics resources: Kaggle, Towards Data Science, etc.

D. Y. PATIL DEEMED TO BE UNIVERSITY
SCHOOL OF ENGINEERING AND MANAGEMENT
Teaching and Evaluation Scheme from Year 2023-24 (as per NEP-2020)
B. Tech. Data Science Engineering (SEMESTER- VI)

Sr. No.	Course Code	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	Contact Hrs			ISE	MSE	ESE	INT	OE/ PoE	
					L	P	T						
1	23DSEU6P01	PCC	Data Engineering	**3**	3	-	-	20	30	50	-	-	100
2	23DSEU6P02	PCC	Machine Learning	**3**	3	-	-	20	30	50	-	-	100
3	23DSEU6P03	PCC	Data Engineering Lab	**1**	-	2	-	-	-	-	25	25	50
4	23DSEU6P04	PCC	Machine Learning Lab	**1**	-	2	-	-	-	-	25	-	25
5	23DSEU6P05	PCC	Data Analytics Tools	**2**	1	2	-	-	-	-	25	25	50
6	23DSEU6M06	MDM-IV	Fundamentals of Business Intelligence	**2**	2	-	-	-	-	50	-	-	50
7	23DSEU6E07	PEC-II	Cyber Security and Forensics	**3**	3	-	-	20	30	50	-	-	100
8	23DSEU6E08		Software Architecture										
9	23DSEU6E09		Internet of Things										
10	23DSEU6E10	PEC-II	Cyber Security and Forensics Tutorial	**1**	-	-	1	-	-	-	25	-	25
11	23DSEU6E11		Software Architecture Tutorial										
12	23DSEU6E12		Internet of Things Tutorial										
13	23DSEU6E13	PEC-III	Blockchain Technology	**3**	3	-	-	20	30	50	-	-	100
14	23DSEU6E14		Cloud Computing										
15	23DSEU6E15		High Performance Computing										
16	23DSEU6E16	PEC-III	Blockchain Technology Lab	**1**	-	2	-	-	-	-	25	-	25
17	23DSEU6E17		Cloud Computing Lab										
18	23DSEU6E18		High Performance Computing Lab										
19	23DSEU6N19	VSEC	Web Application Development - II	**2**	1	2	-	-	-	-	25	50	75
20	23DSEU6D20	AC	Liberal Learning	-	2*	-	-	-	-	-	50*	-	
21	23DSEU6D21	AC	Finishing School Training - VI	-	2*	-	-	-	-	-	50*	-	
			Total	**22**	**16**	**10**	**1**						**700**

HONORS

Sr. No.	Course Code	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	L	P	T	ISE	MSE	ESE	INT	OE/	
1	23DSEU6Z01	Honors	Ethical Hacking	3	3	-	-	20	30	50	-	-	100
2	23DSEU6Z02	Honors	Ethical Hacking Lab	1	-	2	-	-	-	-	25	-	25

Note:
$ - Open & Distance Learning
* - Values are not included in total marks
Min. Marks for Passing: 40% of total marks of individual course

Course Code:	23DSEU6P01
Course Name:	Data Engineering

L	T	P	Credit
3	0	0	3

Course Prerequsites:

Database Engineering Concepts

Course Description:

Advanced Database Engineering is an extension to database systems. Advanced database focuses and presents the features, benefits of advanced data models like Object oriented & Object relational models. Explores ahead the extension of SQL to PL/SQL to draw the benefits to the database designer & to the developer's community. This course covers NoSQL Databases like Key-Value Database, Document Database, etc.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Understand and Use the knowledge of PL/SQL in writing queries
CO2	Demonstrate the use of data mining & data warehousing techniques in business data analytics
CO3	Illustrate design, architectures, data storage, distribution &query processing in Parallel & distributed databases.
CO4	Construct a database using the SQL security features.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	1	1					1		2	2	1
CO2	2	3	2	1	3		2	2	1	3	3	2	3	3
CO3	2	3	2	1	3		2	1		1	1	1	3	3
CO4	2	2	1	2	2	2	2	3		1	2	1	3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit 1	**Advanced SQL**	**5 Hours**
Introduction to PL/SQL, PL/SQL Functions & Procedures, Oracle Sequences, Embedded SQL		
Unit 2	**Object-Database Systems**	**6 Hours**
Motivating Example, Structured Data Types, Operations on Structured Data, Encapsulation and ADTs, Inheritance, Objects aIDs, and Reference Types, Database Design for an ORDBMS,ORDBMS Implementation Challenges, OODBMS, Comparing RDBMS, OODBMS, and ORDBMS		
Unit 3	**NoSQL Database Management**	**7 Hours**
Introduction, Data management with distributed databases, ACID and BASE NoSQL Types: Key-Value Database, Document Database, Column Family Database, and Graph Database Comparisonof relational databases and NoSQL		
Unit 4	**Data Warehousing and Data Mining**	**8 Hours**
DATA WAREHOUSING AND DECISION SUPPORT: Introduction to Decision Support, OLAP: Multidimensional Data Model, Multidimensional Aggregation Queries, Finding AnswersQuickly, Data Warehousing, Views and Decision Support, View Materialization. **DATA MINING:** Introduction to Data Mining, Counting Co-occurrences, Mining for Rules,Tree-Structured Rules, Clustering, Similarity Search over Sequences, Incremental Mining andData Streams, Additional Data Mining Tasks		
Unit 5	**Parallel and Distributed Databases**	**8 Hours**
Introduction, Architectures for Parallel Databases, Parallel Query Evaluation, ParallelizingIndividual Operations, Parallel Query Optimization, Introduction to Distributed Databases,Distributed DBMS Architectures, Storing Data in a Distributed DBMS, Distributed Catalog Management, Distributed Query Processing, Updating Distributed Data, Distributed Transactions,Distributed Concurrency Control, Distributed Recovery.		
Unit 6	**Database Security**	**6 Hours**
Introduction to Database Security Issues, Discretionary Access Control Based on Granting andRevoking Privileges, Mandatory Access Control and Role-Based Access Control for MultilevelSecurity, SQL Injection, Privacy Issues, and Preservation, Challenges of Database Security, OracleLabel-Based Security		

Text Books:

1. Oracle® PL/SQL™ by Example FOURTH EDITION BENJAMIN ROSENZWEIG ELENA SILVESTROVA RAKHIMOV(Unit : 1)
2. Database Management System - Raghu Ramakrishnan, Johannes Gehrke - MGH, [4e] (Units: 2,4,5)
3. NoSQL for Mere Mortals- Dan Sullivan- 1st Edition, Pearson Education(Unit-3)
4. Fundamentals of Database Systems -R. Elmasri S. B. Navathe - Addison Wesley-SixthEdition(Unit-6)

Reference Books:

1. Database System Concepts - Silberschatz, Korth, Sudarshan - MGH, 6th Edition
2. Data Mining - Margaret H. Dunham - Pearson Education
3. NoSQL Distilled: A brief guide to merging world of Polyglot persistence - Pramod J. Sadalage and Marin Fowler - Addison Wesley
4. Database Systems, Design, Implementation and Management - Coronel-Morris- Rob - Cengage Learning, [9e]

Course Code:	23DSEU6P02	L	T	P	Credit
Course Name:	Machine Learning	3	0	0	3

Course Prerequsites:

Basic knowledge of linear algebra, probability & statistics, calculus, Python programming, and introductory data science concepts.

Course Description:

This course introduces the fundamental concepts, techniques, and applications of Machine Learning, covering supervised, unsupervised, and reinforcement learning methods, along with model evaluation, tuning, and basic deep learning, to equip students with practical skills for solving real-world data-driven problems using Python-based tools.

Course Outcomes:	After the completion of the course the student will be able to -
CO1	Apply fundamental machine learning algorithms such as regression, classification, and clustering to real-world problems
CO2	Analyze and evaluate model performance using appropriate metrics and validation techniques.
CO3	Implement machine learning solutions using Python libraries
CO4	Demonstrate understanding of advanced topics like neural networks, reinforcement learning etc.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2	1			2	1	1	1	3	3
CO2	2	3	2	3	2	1			1	1	1		3	3
CO3	2	2	2	2	2	1			1	1	1	1	3	3
CO4	2	2	2	2	2	1			1	1	1	1	3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation1 [10 Marks]	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination [30 Ma	30%	50% Course Contents
3	In Semester Evaluation2 [10 Marks]	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	nd Semester Examination [50 Marks	50%	100% Course Contents

D.Y. PATIL EDUCATION SOCIETY Kasba Bawada, Kolhapur KOLHAPUR

Course Contents:

Unit 1	**Introduction to Machine Learning**	**5 Hours**
Introduction to AI and ML, Types of Machine Learning: Supervised, Unsupervised, Reinforcement, ML Applications in Real World, Steps in Machine Learning Process, Overfitting & Underfitting, Evaluation Metrics: Accuracy, Precision, Recall, F1 Score		
Unit 2	**Supervised Learning**	**9 Hours**
Linear Regression (Single & Multiple Variable), Logistic Regression, k-Nearest Neighbors (k-NN), Support Vector Machines (SVM), Naïve Bayes Classifier, Decision Trees and Random Forests		
Unit 3	**Unsupervised Learning**	**6 Hours**
Clustering: K-Means, Hierarchical Clustering, Dimensionality Reduction: PCA, LDA, Anomaly Detection, Association Rule Mining (Apriori, FP-Growth)		
Unit 4	**Neural Networks & Deep Learning Basics**	**7 Hours**
Perceptron Model, Activation Functions, Multi-layer Perceptron, Forward and Backward Propagation, Introduction to Deep Learning & CNN basics, Overfitting in Deep Learning & Regularization (Dropout, L2)		
Unit 5	**Model Evaluation and Tuning**	**5 Hours**
Cross-validation Techniques, Confusion Matrix, ROC-AUC Curve, Hyperparameter Tuning: Grid Search, Random Search, Feature Engineering and Selection		
Unit 6	**Advanced Topics & Tools**	**8 Hours**
Reinforcement Learning: Q-learning, Markov Decision Process, Ensemble Methods: Bagging, Boosting (AdaBoost, XGBoost), ML Tools and Libraries: Scikit-learn, TensorFlow, Keras Applications: NLP basics, Image Classification, Ethics in Machine Learning & Bias Mitigation		

Text Books:

1. Tom M. Mitchell, Machine Learning, McGraw Hill, 1997.
2. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, 4th Edition.
3. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly, 3rd Edition.

Reference Books:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press.
2. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press.
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer.
4. Christopher Bishop, Pattern Recognition and Machine Learning, Springer.

Course Code:	23DSEU6P03
Course Name:	Data Engineering Laboratory

L	T	P	Credit
0	0	2	1

Course Prerequsites:

SQL fundamental

Course Description:

Advanced Database Engineering is an extension to database systems. Advanced database focuses and presents the features, benefits of advanced data models like Object oriented & Object relational models. Explores ahead the extension of SQL to PL/SQL to draw the benefits to the database designer & to the developer's community. This course covers NoSQL Databases like Key-Value Database, Document Database, etc.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Understand fundamentals of database management systems
CO2	Analyze & construct good database design
CO3	Apply SQL queries to design & manage the database

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1		3	1	1			1	1	1		
CO2	1	3	2	3	2	3	1	3	1	1	3	2		
CO3	2	3	2	2	3	3	1	3	1	1	3	2		
CO4														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal	50%	Practical performance, internal POE.
2	End Semester	50%	POE

Course Contents:	
Assessment No. 1 : Write a simple PL/SQL Program for the following i. Print the sum of “N” numbers ii. Check whether the input number is prime or not.	
Assessment No. 2 : Implement & Demonstrate Declaring, Defining, and Invoking a Simple PL/SQL Function for the below statement. i. Find the Factorial of the number.	
Assessment No. 3 : Implement a PL/SQL Procedure for the following i. Find a Maximum of three numbers using “IN” & “OUT” Parameters ii. Find the square of the Number using the “IN OUT” Parameter	
Assessment No. 4 : Using Oracle Sequence demonstrate creating and dropping of an auto-number field for Customer Table.	
Assessment No. 5 : Demonstrate NoSQL Key-Value Database.	
Assessment No. 6 : Demonstrate No SQL Document Database.	
Assessment No. 7 : Demonstrate Data Control Language Commands	
Assessment No. 8 : Construct star schema. Demonstrate Fact and dimension tables	
Assessment No. 9 : Examine SQL Injections.	
Assessment No. 10 : Demonstrate Object-oriented& Object Relational databases.	
Text Book:	

Course Code:	23DSEU6P04	L	T	P	Credit
Course Name:	Machine Learning Laboratory			2	1

Course Prerequsites:
Basic understanding of Python programming, statistics, linear algebra, and use of libraries

Course Description:
This lab course provides hands-on experience with fundamental machine learning algorithms and techniques, enabling students to implement, train, evaluate, and visualize models using Python and popular libraries, aligned with real-world data science applications.

Course Outcomes:	After the completion of the course the student will be able to -
CO1	Perform data preprocessing and visualization using Python libraries.
CO2	Implement and evaluate supervised and unsupervised learning models.
CO3	Develop and test simple neural network models using various tools

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	2	2			1	1	2	1	3	3
CO2	2	3	2	3	3	2			1	1	3	1	3	3
CO3	2	2	2	3	3	3			1	1	3	1	3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation [25 Marks]	100%	Experiment, Practical Performance and Oral Exam etc.

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

List of Experiments:	
1	Introduction to Python Libraries
2	Implement Linear Regression to predict values
3	Apply Logistic Regression for binary classification
4	Build a k-NN classifier for Iris dataset classification
5	Create and visualize a Decision Tree classifier
6	Use Naïve Bayes for text-based spam email classification
7	Apply K-Means Clustering to customer segmentation
8	Perform PCA on a dataset and plot the principal components
9	Train a simple Neural Network using Keras to classify digits
10	Use Confusion Matrix & Accuracy to evaluate a classification model.

Text Books:

1. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly, 3rd Edition
2. Tom M. Mitchell, Machine Learning, McGraw Hill, 1997

Reference Books:

1. Ethem Alpaydin, Introduction to Machine Learning, MIT Press
2. Andreas C. Müller & Sarah Guido, Introduction to Machine Learning with Python, O'Reilly
3. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press
4. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer

Course Code:	23DSEU6P05
Course Name:	Data Analytics Tools

L	T	P	Credit
1	0	2	2

Course Prerequsites:

Fundamentals of Data Science, Statistics and Probability, Programming Fundamentals (Python/R)

Course Description:

This course provides comprehensive knowledge of various data analytics tools and techniques used in modern data science applications. Students will learn to use industry-standard tools for data manipulation, analysis, visualization, and machine learning implementation.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Implement data manipulation and preprocessing techniques
CO2	Design and develop comprehensive data visualization solutions
CO3	Apply advanced analytics technique to solve complex data science problems
CO4	

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	3	3	1	1						3	2
CO2	1	3	3	2	3	2	2						3	3
CO3	3	3	3	3	3	3	3						3	3
CO4														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal	50%	Practical performance, internal POE.
2	ESE	50%	POE

Course Contents:		
Unit 1	**Introduction to Data Manipulation and Processing Tools**	**4 Hours**
Introduction to Google Colab and cloud-based analytics platforms, NumPy: Arrays, mathematical operations, broadcasting, and linear algebra functions, Pandas: DataFrames, Series, data import/export (CSV, Excel, JSON, databases), Data cleaning techniques: handling missing values, duplicates, outliers Data transformation: grouping, aggregation, merging, reshaping Working with time series data and date-time operations Introduction to Dask for big data processing		
Unit 2	**Data Visualization Tools and Techniques**	**4 Hours**
Matplotlib: Basic plotting, customization, subplots, and styling, Seaborn: Statistical visualizations, categorical plots, and advanced styling, Plotly: Interactive visualizations, dashboards, and web-based plots, Geographic data visualization with Folium, Introduction to Tableau for business intelligence		
Unit 3	**Advanced Analytics and Specialized Tools**	**6 Hours**
Natural Language Processing with NLTK and spaCy, Image processing with OpenCV and PIL, Web scraping tools: BeautifulSoup, Scrapy, and Selenium, API integration for data collection, Introduction to deep learning with TensorFlow and Keras, Time series analysis with statsmodels and Prophet		
Practical Exercises:		
Exercise 1:	Setting up Google Colab environment and importing libraries	**2 Hours**
Exercise 2:	**Matplotlib: Basic plotting, customization, subplots, and styling**	**2 Hours**
Exercise 3:	Seaborn: Statistical visualizations, categorical plots, and advanced styling	**2 Hours**
Exercise 4:	Plotly: Interactive visualizations, dashboards, and web-based plots	**2 Hours**
Exercise 5:	Geographic data visualization with Folium	**2 Hours**
Exercise 6:	Tableau desktop basics and dashboard creation	**4 Hours**
Exercise 7:	Text preprocessing and sentiment analysis using NLTK/spaCy	**4 Hours**
Exercise 8:	Image manipulation and computer vision tasks with OpenCV	**4 Hours**

Text Books:

1. "Python for Data Analysis" - Wes McKinney (O'Reilly Media) - 2nd Edition (Unit 1)
2. "Python Data Science Handbook" - Jake VanderPlas (O'Reilly Media) (Unit 2)
3. "Hands-On Machine Learning with Scikit-Learn and TensorFlow" - Aurélien Géron (O'Reilly Media) - 2nd Edition (Unit 3)

Reference Books:

1. "Data Visualization with Python and JavaScript" - Kyran Dale (O'Reilly Media)
2. "Natural Language Processing with Python" - Steven Bird, Ewan Klein, Edward Loper (O'Reilly Media)
3. "Learning OpenCV 4" - Adrian Kaehler, Gary Bradski (O'Reilly Media)
4. "Web Scraping with Python" - Ryan Mitchell (O'Reilly Media)
5. "Deep Learning with Python" - François Chollet (Manning Publications)

Course Code:	23DSEU6M06
Course Name:	Fundamentals of Business Intelligence

L	T	P	Credit
2	0	0	2

Course Prerequsites:

Basic knowledge of databases, data structures, and programming fundamentals. Familiarity with spreadsheet tools (e.g., Excel) and introductory statistics is recommended.

Course Description:

This course introduces the core concepts and tools of Business Intelligence, focusing on data analysis, visualization, and decision-making. Students will learn to use BI techniques and software to extract insights

Course Outcomes: After the completion of the course the student will be able to -

CO1	Define basic concepts ,Architecture and data warehousing related concepts of Business Intelligence
CO2	To demonstrate the impact of business reporting, information visualization, and dashboards.
CO3	To apply text analytics and web analytics business intelligence methods to various situations.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	2	3						1	2	3	2
CO2	1	2	2	2	2						1	2	3	2
CO3	1	2	2	2	2						1	2	3	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	End Semester Examination (ESE	100%	course contents

Course Contents:

Unit 1	Introduction to Business Intelligence	8 Hours

A Frame work for Business Intelligence (Bl)- The Architecture of Bl - Benefits of business intelligence- how business
intelligence differs from competitive intelligence and knowledge management.

Unit 2	Data warehousing	6 Hours

Characteristics of Data Warehousing- Data Marts- Data warehousing process- Data warehousing Architectures – Data
Integration and the Extraction, Transformation and Load (ETL) Process- OLAP Versus OLTP- Data warehousing
implementation issues – Real time data warehousing

Unit 3	Business Reporting, Visual Analytics and Business Performance Management.	6 Hours

Data and Information Visualization – Different types of Charts and Graphs- Emergence of Data visualization and Visual
analytics - Performance Dashboard - Balance Score Cards – Dashboards Versus Scorecards - Six Sigma as a performance measurement system.

Unit 4	Data mining – Supervised and unsupervised learning.	8 Hours

Data mining concepts and applications – Data mining process – Data mining methods – Classification techniques –
Decision trees.Cluster Analysis – Partition and Hierarchical methods, Association rule mining –Data mining software

Unit 5	Text Analytics, Text Mining and Sentiment Analysis	6 Hours

Text analytics and Text mining concepts and definition – Text mining process – Text mining tools – Sentiment analysis
overview – Sentiment analysis applications – Sentiment analysis process.

Unit 6	Web Analytics, Web Mining, and Social Analytics	6 Hours

Web mining overview – Web content and Web structure mining – Search Engines - Search Engine Optimization – Web
usage mining – Web analytics maturity model and web analytics tools – Social analytics and social network

Text Books:

1. Ramesh Sharda, Dursun Delen, Efraim Turban, Business Intelligence and Analytics, Pearson 10th edition, 2018

Reference Books:

1. Ramesh Sharda, Dursun Delen, Efraim Turban, Business Intelligence, Analytics, and Data Science: A Managerial
Perspective, 4th Edition, Pearson, 2017
2. "Business Intelligence For Dummies" by Swain Scheps.
3. David Loshin Morgan, Kaufman, —Business Intelligence: The Savvy Manager‟s Guide‖, Second Edition, 2012

Course Code:	23DSEU6E07		L	T	P	Credit
Course Name:	Cyber Security and Forensics		3			3

Course Prerequsites:
1. C, C++, Python or Java
2.Understanding of OS concepts (Linux/Windows)
3. Networking Basics
4. Data Structures and Algorithms concepts

Course Description:
This course introduces core concepts of cyber security and digital forensics, covering network protection, threat analysis, legal frameworks, and evidence handling. Students gain practical skills in forensic tools and security measures to counter modern cyber threats.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Identify and describe cyber threats and vulnerabilities
CO2	Apply network security principles and tools to secure communication systems
CO3	Demonstrate knowledge of cyber forensic techniques and tools
CO4	Analyze digital evidence in accordance with legal and ethical frameworks

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	2	1		3	1	2	3	1	3	1
CO2	2	2	1	1	2	1		3	1	2	3	2	3	1
CO3	2	2	2	2	2	1		3	1	2	3	1	3	1
CO4	2	1	1	2	3	1		3	1	2	3	1	3	1
CO5														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Course Contents:

Unit 1	**Introduction to Cyber Security**	**8 Hours**

1.1 Fundamentals of Cyber Security
1.2 Security frameworks: NIST, ISO27001 and Types of cyber attacks (Phishing, DoS, Ransomware, MITRE Attack etc.)
1.3 Cyber threats and vulnerabilities
1.4 Information Security goals: CIA triad (Confidentiality, Integrity, Availability)
1.5 Security mechanisms and access control models
1.6 Basics of cryptography (Symmetric vs Asymmetric, Hashing, Digital Signatures)

Unit 2	**Network Security**	**8 Hours**

2.1 SIEM basics:QRadar, splunk and Incident Response Life Cycle 2.2 Network Security basics: Protocols(TCP/IP, DNS, HTTP) Ports 2.3 Network threats and attacks (Sniffing, Spoofing, MITM, ARP poisoning)
2.4 Firewalls, Firewall rules and types (packet-filtering, proxy, stateful)
2.5 Intrusion Detection Systems (IDS) and Intrusion Prevention Systems (IPS)
2.6 Virtual Private Networks (VPNs)
2.7 Secure socket layer (SSL), HTTPS, EDR Basics
2.8 Wireless network security protocols (WEP, WPA, WPA2)

Unit 3	**Cyber Forensics Fundamentals**	**6 Hours**

3.1 Introduction to Cyber Forensics
3.2 Need for cyber forensics in investigation
3.3 Forensic investigation process (Acquisition, Analysis, Reporting)
3.4 Chain of custody
3.5 Legal and ethical issues in cyber forensics
3.6 Tools used in cyber forensics (FTK, EnCase, Autopsy)

Unit 4	**Digital Evidence and Crime Scene Management**	**6 Hours**

4.1 Types of digital evidence (emails, logs, images, etc.)
4.2 Digital evidence collection and preservation
4.3 Imaging and cloning of digital media
4.4 Evidence handling procedures and documentation
4.5 Investigating disk, memory, mobile, and network-based evidence
4.6 Challenges in digital evidence handling

Unit 5	**Cyber Laws and IT Act**	**6 Hours**

5.1 Overview of Indian IT Act 2000 and amendments
5.2 Legal aspects of digital signatures, electronic records
5.3 Cybercrime and related sections under IPC and IT Act
5.4 Intellectual Property Rights (IPR) in cyberspace
5.5 Cyber ethics and legal frameworks
5.6 Case studies on cybercrime

Unit 6	Emerging Trends and Case Studies	6 Hours

6.1 Cybersecurity in IoT and cloud computing
6.2 Blockchain and security
6.3 Artificial Intelligence in cybersecurity
6.4 Case studies on recent cyber attacks and forensic investigations
6.5 Role of CERT-IN, NCIIPC, and global agencies
6.6 Best practices for securing digital assets

Text Books:

1. Behrouz A. Forouzan – *Cryptography and Network Security*, McGraw-Hill. 2. John Sammons – *The Basics of Digital Forensics*, Syngress/Elsevier. 3. Nina Godbole & Sunit Belpure – *Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Wiley India.

Reference Books:

1. Nelson, B., Phillips, A., & Steuart, C. – *Guide to Computer Forensics and Investigations*, Cengage Learning.
2. William Stallings – *Cryptography and Network Security*, Pearson Education.
3. Marjie T. Britz – *Computer Forensics and Cyber Crime*, Pearson Education.
4. Chuck Easttom – *Computer Security Fundamentals*, Pearson Education.

Course Code:	23DSEU6E08	L	T	P	Credit
Course Name:	Software Architecture	3			3

Course Prerequsites:

Computer Network, Data Communication, Engg. Mathematics

Course Description:

This course introduces the fundamental principles, patterns, and practices of software architecture. It emphasizes the role of software architecture in software engineering, focusing on architectural styles, design documentation, evaluation methods, and quality attributes.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Understand the role and importance of software architecture in the software development life cycle.
CO2	Apply architectural styles and patterns to design software systems.
CO3	Analyze and document software architecture using suitable models and tools.
CO4	Evaluate software architecture with respect to quality attributes and business goals.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1			1							2	2		1
CO2	1	2	2	2	2			2	3	1	2	2	1	3
CO3	1			1	2				3	1	1	2	2	2
CO4	1	2	2	2	3			2	3	1	1	2	2	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination	50%	100% course contents

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Course Contents:		
Unit 1	**Introduction to Software Architecture**	**6 Hours**
Definition and scope of software architecture, Architecture vs. design vs. implementation, Role of a software architect, Stakeholders and architecture concerns,Architecture business cycle, Types of architectural structures and views		
Unit 2	**Architectural Styles and Patterns**	**8 Hours**
Architectural styles: Layered, Client-Server, Pipe and Filter, Event-Based, Shared Data, Microservices, Architectural patterns: MVC, Broker, Blackboard, Service-Oriented Architecture, Use cases and comparisons of styles, Impact of styles on quality attributes		
Unit 3	**Designing Software Architecture**	**6 Hours**
Design process overview, Mapping functional requirements to architecture, Documenting software architecture, Architecture Description Languages (ADL) overview, Modeling with UML diagrams for architecture		
Unit 4	**Quality Attributes in Architecture**	**7 Hours**
Introduction to quality attributes, Scenarios for performance, modifiability, availability, security, usability, Architectural tactics for quality, Trade-offs and sensitivity points, Constraints and design decisions		
Unit 5	**Architecture Evaluation and Analysis**	**6 Hours**
Need for evaluation, Evaluation methods: ATAM (Architecture Tradeoff Analysis Method), CBAM (Cost Benefit Analysis Method), Risk identification and analysis, Case study-based analysis		
Unit 6	**Architecture Practices & Case Studies**	**7 Hours**
Introduction to Cloud-native and Microservices architecture, Serverless and Event-driven architecture, DevOps influence on architecture, Case studies: Amazon, Netflix, and Google architecture practices, Use of architecture in modern scalable systems,		

Reference Books:

Textbooks:

1. Len Bass, Paul Clements, Rick Kazman – Software Architecture in Practice, 3rd Edition, Addison-Wesley/Pearson
2. Mary Shaw and David Garlan – Software Architecture: Perspectives on an Emerging Discipline, Pearson

References:

1. Rozanski and Woods – Software Systems Architecture
2. George Fairbanks – Just Enough Software Architecture

Course Code:	23DSEU6E09
Course Name:	Internet of Things

L	T	P	Credit
3	0	0	3

Course Prerequsites:

"Computer Networks and Internet fundamentals

Programming skills in C/C++ or Python

Basic understanding of sensors and electronic components"

Course Description:

This course introduces the fundamentals of the Internet of Things (IoT) and its integration with cloud computing. It covers IoT architecture, sensors, microcontrollers (Arduino, ESP32, Raspberry Pi), communication protocols, and cloud platforms such as AWS. Students will learn to interface devices, collect data, and use cloud services for storage and analytics. The course also explores real-world IoT applications in various domains and addresses challenges related to security, privacy, and ethics.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Understand the fundamental concepts, architecture, and enabling technologies of the Internet of Things (IoT).
CO2	Demonstrate the ability to interface sensors and actuators with microcontrollers and implement basic
CO3	Analyze the use of wireless communication protocols and cloud services in designing scalable IoT solutions.
CO4	Apply data handling and analytics techniques to IoT applications and examine real-world use cases and

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2				2							3	1
CO2	3	1	2	1	1	1					2		3	2
CO3	2	3		2	2	2							3	3
CO4														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Course Contents:

Unit 1	**Fundamentals of IoT**	**6 Hours**
Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M		
Unit 2	**IoT Physical Devices and Endpoints**	**8 Hours**
Microcontrollers, Introduction to Arduino board, various boards of Arduino. Arduino Uno : Arduino Uno Pin Layout, Arduino IDE, Arduino programming, ESP32 : ESP32 pin layout, advantages of ESP32 board, Interfacing sensors with microcontroller Raspberry-Pi : Introduction to Raspberry-Pi, installation of raspberry-pi, raspberry pi configuration,Introduction to Python, Interfacing sensors with raspberry pi.		
Unit 3	**Sensors and Protocol**	**7 Hours**
Sensors : Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Gas sensors, Temperature and Humidity Sensor , Motion Detection Sensors, Wireless Bluetooth Sensors,Level Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor, Biometric, Load, Flow, and pressure sensor Accuators: Actuators, Actuator Types, Actuator Characteristics. Protocol : Zigbee, Bluetooth and BLE, Cellular , LoRa and LoRaWAN, Wi-Fi, MQTT Wireless Technologies for IoT: WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus. IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT. Edge connectivity and protocols		
Unit 4	**IoT Physical Servers and Cloud Offerings**	**7 Hours**
Introduction to Cloud Storage models and communication APIs Web Server – Web server for IoT, Cloud for IoT, AWS services for IoT		
Unit 5	**Data Handling& Analytics**	**7 Hours**
Introduction, Bigdata, Types of data, Characteristics of Big data, Data handling Technologies, Flow of data, Data acquisition, Data Storage, Introduction to Hadoop. Introduction to data Analytics, Types of Data analytics, Local Analytics, Cloud analytics and applications		
Unit 6	**Applications of IoT**	**6 Hours**
Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection, Security and challenges in IoT		

Text Books:

1. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan
2. Peter Friess,'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014
1. Hakima Chaouchi, — "The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-140-7, Wiley Publications
2. Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things: Key Applications and Protocols", WileyPublications
3. Vijay Madisetti and ArshdeepBahga, — "Internet of Things (A Hands-on-Approach)",

Reference Books:

1. Daniel Minoli, — “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
2. Internet of Things (A Hands-on Approach)" by Arshdeep Bahga and Vijay Madisetti
3. Introduction to IoT, Sudip Misra, Anandarup Mukherjee, Arjit Roy, CAMBRIDGE UNIVERSITY, PRESS.
4. Internet of Things Hanads on Approach, Ashdreep Bhaga, Vijay Midishetti, Universities Press

Course Code:	23DSEU6E10	L	T	P	Credit
Course Name:	Cyber Security and Forensics Tutorial		1		1

Course Prerequsites:

1. C, C++, Python or Java
2.Understanding of OS concepts (Linux/Windows)
3. Networking Basics
4. Data Structures and Algorithms concepts

Course Description:

This course deals with the theoretical background of Cyber security and Digital Forensics

Course Outcomes: After the completion of the course the student will be able to -

CO1	Analyze and interpret system and network logs to detect potential security incidents.
CO2	Apply packet and malware analysis techniques to identify threats and malicious behavior.
CO3	Evaluate cyber threats using threat intelligence and correlate findings with MITRE ATT&CK techniques.
CO4	Demonstrate the ability to respond to cyber incidents by implementing incident response and security rules.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	2	1		3	1	2	3	1	3	1
CO2	2	2	1	1	2	1		3	1	2	3	2	3	1
CO3	2	2	2	2	2	1		3	1	2	3	1	3	1
CO4	2	1	1	2	3	1		3	1	2	3	1	3	1

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:
Tutorial 1: Log Analysis-Analyze logs for failed login attempts, brute-force attacks, Web proxy, Firewall, WAF, EDR, Cloud, IPS, Windows, Email gateway(Tools to use: Splunk Free Edition / Qradar)
Tutorial 2: SIEM Use Case- Create a custom correlation rule to detect brute-force login (Tools to use: QRadar Community Edition (CE))
Tutorial 3: Log Filtering & Search- Use filters to extract logs for specific IP, user, or event type(Tools to use-)
Tutorial 4: Packet Analysis- Capture and analyze packets to detect clear-text credentials **(**tools to use- Wireshark**)**
Tutorial 5: Phishing Email Investigation Analyze email headers to detect spoofing/phishing attempts/ URL/ Attachment (tools to use: MXtoolBox/VirusTotal, urlscan.io/Anyrun)
Tutorial 6: Threat Intelligence Lookup- Identify and check malicious IPs/domains using external sources(tools used-VirusTotal, AbuseIPDB, IPVoid)
Tutorial 7: Malware File Analysis (Safe)- Use static and dynamic analysis to inspect a suspicious file (tools used-Any.Run, Hybrid Analysis, VirusTotal)
Tutorial 8: EDR Alert Handling- Investigate malware/behavioral alerts(tools used: CrowdStrike Falcon (demo), SentinelOne (demo))
Tutorial 9: Vulnerability Scanning-Scan a system and generate a vulnerability report(tools used:Nessus Essentials / OpenVAS/ Qualys)
Tutorial 10: MITRE ATT&CK Mapping- Map attack patterns to MITRE techniques(MITRE ATT&CK Navigator (online tool))

Text Books:

1. Behrouz A. Forouzan – *Cryptography and Network Security*, McGraw-Hill. 2. John Sammons – *The Basics of Digital Forensics*, Syngress/Elsevier. 3. Nina Godbole & Sunit Belpure – *Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Wiley India.

Reference Books:

1. Nelson, B., Phillips, A., & Steuart, C. – *Guide to Computer Forensics and Investigations*, Cengage Learning.
2. William Stallings – *Cryptography and Network Security*, Pearson Education.
3. Marjie T. Britz – *Computer Forensics and Cyber Crime*, Pearson Education.
4. Chuck Easttom – *Computer Security Fundamentals*, Pearson Education.

Course Code:	23DSEU6E11	L	T	P	Credit
Course Name:	Software Architecture Tutorial		1		1

Course Prerequsites:

Software Engineering documentation, Object-oriented programming, design principles, Project Management

Course Description:

This tutorial course is designed to provide hands-on understanding of software architecture principles through guided exercises and case studies. Students will explore architectural styles, patterns, modeling techniques, quality attributes, and evaluation methods. The tutorials focus on real-world problem-solving, system design documentation, and architectural decision-making to bridge theoretical knowledge with practical skills.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Understand architecture basics, stakeholders, and architecture lifecycle
CO2	Apply architectural styles and patterns
CO3	Document and model architecture effectively
CO4	Evaluate and analyze architecture using quality attributes and trade-offs

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1					3		2			2
CO2	1	1	2	1	2			1	3	1	1		3	1
CO3	1	1	1	1	3			2	3	2	1	1	3	1
CO4	1	1	2	1	2			2	3	2	2	1	2	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal	100%	

Course Contents:	
Assessment No. 1 :Introduction to Software Architecture	**1 Hours**
Define architecture, design vs. implementation, and write an architecture business cycle for a given system	
Assessment No. 2 : Stakeholder Analysis	**1 Hours**
Identify stakeholders and their concerns for an online examination system	
Assessment No. 3 : Architectural Styles	**1 Hours**
Compare and contrast different architectural styles with examples	
Assessment No. 4 : Pattern-Based Design	**1 Hours**
Design a system using MVC or Layered architecture for a Library Management System	
Assessment No. 5 : UML-Based Architecture Modeling	**1 Hours**
Create Use Case and Component Diagrams for an E-Commerce application	
Assessment No. 6 :Architecture Documentation	**1 Hours**
Document architecture using 4+1 view model for a mobile banking app	
Assessment No. 7 : Quality Attribute Scenarios	**1 Hours**
Define and prioritize quality attributes (e.g., performance, security) for a Smart City Dashboard	
Assessment No. 8 :Tactics for Quality Attributes	**1 Hours**
Match architectural tactics to quality attributes using real examples	
Assessment No. 9 : Architecture Evaluation (ATAM)	**1 Hours**
Perform simplified ATAM for a Hospital Management System architecture.	
Assessment No. 10 : Modern Architecture Case Study	**1 Hours**
Analyze microservices-based architecture of Netflix/Amazon and map it to styles and patterns	
Text Book:	
Software Architecture in Practice, Len Bass, Paul Clements, Rick Kazman, 3rd Edition, Addison-Wesley / Pearson	

Course Code:	23DSEU6E12
Course Name:	Internet of Things Lab

L	T	P	Credit
0	1	0	1

Course Prerequsites:

"Computer Networks and Internet fundamentals

Programming skills in C/C++ or Python

Basic understanding of sensors and electronic components"

Course Description:

This course introduces the fundamentals of the Internet of Things (IoT) and its integration with cloud computing. It covers IoT architecture, sensors, microcontrollers (Arduino, ESP32, Raspberry Pi), communication protocols, and cloud platforms such as AWS. Students will learn to interface devices, collect data, and use cloud services for storage and analytics. The course also explores real-world IoT applications in various domains and addresses challenges related to security, privacy, and ethics.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Configure and program microcontrollers like Arduino, ESP32, and Raspberry Pi by interfacing various sensors and actuators.
CO2	Connect IoT devices to cloud platforms and visualize sensor data.
CO3	Implement IoT communication using protocols like MQTT and HTTP.
CO4	Develop a mini-project applying IoT and cloud integration in a real-world use case.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2				2							3	1
CO2	3	1	2	1	1	1					2		3	2
CO3	2	3		2	2	2							3	3
CO4														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal	100%	Assignment, Test, Quiz, Seminar, Presentation, etc.

D.Y. PATIL EDUCATION SOCIETY ★ KOLHAPUR ★ Kasba Bawada, Kolhapur

List of Experiments

1 Study and setup of Arduino/ESP32 boards and basic programming using IDE
2 Interfacing LED and Push Button with Arduino/ESP32
3 Interfacing Temperature and Humidity sensor (e.g., DHT11) and displaying data
4 Interfacing Ultrasonic sensor for distance measurement
5 Interfacing Gas sensor or Light sensor with ESP32/Arduino and displaying output
6 Interfacing with Actuators – DC Motor/Relay using Arduino/ESP32
7 Introduction to Raspberry Pi: OS Installation, Python Programming Basics
8 Sensor interfacing with Raspberry Pi and sending data over local network
9 Implementing communication between two IoT devices using MQTT protocol
10 Sending sensor data to cloud using ThingSpeak or Blynk platform
11 Using AWS IoT Core for device connection and real-time data visualization
12 Mini-project: Design and develop a complete IoT solution using microcontroller, sensors, cloud connectivity, and a simple dashboard for data monitoring

Text Books:

1. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan
2. Peter Friess,'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014
1. Hakima Chaouchi, — "The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-140-7, Wiley Publications
2. Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things: Key Applications and Protocols", WileyPublications
3. Vijay Madisetti and ArshdeepBahga, — "Internet of Things (A Hands-on-Approach)",

Reference Books:

1. Daniel Minoli, — "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
2. Internet of Things (A Hands-on Approach)" by Arshdeep Bahga and Vijay Madisetti
3. Introduction to IoT, Sudip Misra, Anandarup Mukherjee, Arjit Roy, CAMBRIDGE UNIVERSITY, PRESS.
4. Internet of Things Hanads on Approach, Ashdreep Bhaga, Vijay Midishetti, Universities Press

Course Code:	23DSEU6E13
Course Name:	Blockchain Technology

L	T	P	Credit
3			3

Course Prerequsites:

Basics of Programming, networks, and cryptography

Course Description:

This course introduces the fundamentals of blockchain technology and smart contracts. It covers the architecture, cryptographic principles, consensus mechanisms, and key platforms such as Bitcoin and Ethereum. Students will gain hands-on experience in writing and deploying smart contracts using Solidity. The course also explores real-world applications of blockchain across industries like finance, supply chain, and healthcare.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Write, deploy, and test smart contracts using Solidity on Ethereum
CO2	Set up and configure blockchain development environments and tools.
CO3	Develop mini DApps integrating smart contracts for real-world use cases.
CO4	Simulate blockchain transactions and interactions using decentralized tools.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1										1			
CO2	1	2			2					1	2		1	
CO3	1	1	2	1	3			2				2	2	2
CO4	1	2		1	1							1	2	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit 1	**INTRODUCTION TO BLOCKCHAIN**	**6 Hours**
Distributed DBMS – Limitations of Distributed DBMS, Introduction to Block chain -History, Evolution of Blockchain, Definition, Need of Blockchain, Distributed Vs Centralized Vs Decentralized, Public Ledgers : Blockchain as Public Ledgers, Distributed Ledger, Blockchain Categories – Public, Private, Consortium, Blockchain Network and Nodes, Peer-to-Peer Network, Mining Mechanism, Generic elements of Blockchain, Features of Blockchain, and Types of Blockchain, Benefits and Challenges of Blockchain Usages		
Unit 2	**BLOCKCHAIN ARCHITECTURE**	**7 Hours**
Operation of Bitcoin Blockchain, Blockchain Design Principles, Components of blockchain, Layered Architecture of Blockchain Ecosystem, Blockchain Architecture – Block, Hash, Distributed P2P, Merkle Tree, Structure of Blockchain- Types of Networks : Distributed Network , P2P Network, Consensus mechanism: Proof of Work (PoW), Proof of Stake (PoS), Byzantine Fault Tolerance (BFT), Proof of Authority (PoA) and Proof of Elapsed Time (PoET)etc. How Blockchain Works? Blockchain Demo - How Mining Works? (The NONCE and Cryptographic Puzzle) Immutable Ledger, Hard and Soft Forks, double spending		
Unit 3	**CRYPTO CURRENCY**	**6 Hours**
Bitcoin: Bitcoin and its History, Why use bitcoins? Where and how to buy bitcoins, Bitcoin transactions, How bitcoin transactions work, Bitcoin scripts and wallets. Ethereum: Ethereum Virtual Machine (EVM) – Wallets for Ethereum, Ethereum and Smart Contract, Solidity - Smart Contracts, Ether, Gas DApps , Decentralized Autonomous Organizations (DAO) Compare Bitcoin and Ether		
Unit 4	**SMART CONTRACT AND SOLIDITY FUNDAMENTALS**	**7 Hours**
Smart contracts, features of smart contract, types of Smart contract, advantages and challenges of smartcontract, Solidity: Introduction to solidity, Basic syntax, Data types, Operators, control flow, functions A programming		
Unit 5	**Solidity Advanced**	**7 Hours**
Constructors, inheritance, abstract contracts, interfaces, events, mapping, error handling, libraries		
Unit 6	**DIFFERENT BLOCKCHAIN FRAMEWORKS AND USE CASES**	**6 Hours**
Study of Blockchain Frameworks: Hyperledger, IOTA, Corda, Multichain, Quorum etc. Different use cases of blockchain other than cryptocurrencies		

Text Books:

1. Beginning Blockchain : A Beginner's Guide to Building Blockchain Solutions By Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Apress Media.
2. Imran Bashir, "Mastering BlockChain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Packt Publishing, first edition – 2012
3. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
4. Mastering Ethereum: Building Smart Contracts and DAPPS, by Andreas Antonopoulos, Dr. Gavid Wood, Oreilly Publication
5. Anshul Kaushik, "BlockChain and Crypto Currencies", Khanna Publishing House, Delhi

Reference Books:

1. Learn Ethereum: Build your own decentralized applications with Ethereum and smart contracts by by Xun (Brian) Wu , Zhihong Zou , Dongying Song

Course Code:	23DSEU6E14	L	T	P	Credit
Course Name:	Cloud Computing	3	0	0	3

Course Prerequsites:

Basic knowledge of computer networks, operating systems, and distributed systems.

Course Description:

Cloud Computing course will focus on the evolution of cloud environment, its architecture, types, prominent cloud platform examples, virtualization techniques and migration, docker-container & Kubernetes, security and management.

Course Outcomes:	After the completion of the course the student will be able to -
CO1	Explain the cloud computing architecture, types and models
CO2	Classify the virtualization techniques
CO3	Compare different architectures and platforms of cloud computing.
CO4	Summarize security threats and security measure for cloud computing

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	2				1	2	2	1	3	3
CO2	3	3	2	3	3				2	2	2	2	3	3
CO3	3	3	3	2	3	2	1	1	2	2	2	2	3	3
CO4	3	2	2	3	2	2	1		2	2	3	2	3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation1 [10 Marks]	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination [30 Mar	30%	50% Course Contents
3	In Semester Evaluation2 [10 Marks]	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	nd Semester Examination [50 Marks	50%	100% Course Contents

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Course Contents:

Unit 1	**Introduction**	**7 Hours**
Definition, Historical Developments, Computing Platforms and Technologies. Building cloud computing environments, Principles of Parallel and Distributed Computing: Parallel versus Distributed Computing, Elements of Parallel Computing, Elements of Distributed Computing, and Technologies for Distributed Computing.		
Unit 2	**Virtualization**	**7 Hours**
Characteristics, Virtualization Techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization		
Unit 3	**Cloud Computing Architecture**	**7 Hours**
Cloud Reference Model, Types of Clouds – Public, Private, Hybrid and Community cloud, Types of Services – IaaS, PaaS, SaaS, Economics of Clouds, Open Challenges, Public Clouds: Amazon Web Services (AWS), Google Cloud Platform (GCP), and Microsoft Azure.		
Unit 4	**Migration into cloud and Virtual machine Provisioning**	**7 Hours**
Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, VM Provisioning and Migration in Action, Provisioning in the Cloud Context.		
Unit 5	**Advanced Concepts – Docker, Container and Kubernetes**	**7 Hours**
Introduction to CaaS, Why containers? Difference between Virtualization and Containers. Introduction to Containers, Docker and its architecture (Jain), Understanding Docker Container, Networking. Kuberentes – Introduction, Architecture. (cookbook) Case Study (Any case study available on the Internet such as - IBM, AWS, Google Qwiklabs using Kubernetes, docker container).		
Unit 6	**Cloud Security & Management**	**7 Hours**
Fundamental cloud security – Basic terms and concepts, Threat agents, cloud security threats, case study example. Cloud Management Mechanisms - SLA management and case study. Cloud Security Mechanisms – PKI, IAM and SSO with case studies.		

Text Books:

1. Mastering Cloud Computing - Buyya R, Vecchiola C, Selvi S T, McGraw Hill Education (India), 2013
2. Cloud Computing - Principles and Paradigms - Buyya R, Broberg J, Goscinski A, Wiley,2011
3. Cloud Computing Concepts, Technology & Architecture - Thomas Erl, Zaigham Mahmood, and Ricardo Puttini
4. A to z on Docker: A complete Hands-On Guide to Docker Container – Swapnil Jain
5. Docker Cookbook - Sébastien Goasguen, O'reilly Nov. 2015 First Edition

Reference Books:

1. Cloud Computing Bible - Barrie Sosinsky ,Wiley Publishing Inc. 2011
2. Cloud Native DevOps with Kubernetes – John Arundel and Justin Domingus

Course Code:	23DSEU6E15
Course Name:	High Performance Computing

L	T	P	Credit
3	0	0	3

Course Prerequsites:

Data Structures and Algorithms, Computer Organization and Architecture, Operating Systems

Course Description:

This course introduces students to the concepts, techniques, and tools used in high-performance computing (HPC). Students will learn about parallel and distributed computing architectures, programming models, performance optimization techniques, and real-world applications.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Analyze different parallel computing architectures and select appropriate HPC systems
CO2	Design and implement parallel algorithms using various programming models
CO3	Evaluate and optimize the performance of parallel programs using profiling tools and optimization techniques
CO4	Apply HPC concepts to solve real-world computational problems

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3		3	2								2	1
CO2	2	3	2	3	3						2		3	3
CO3	3	3	2	3	3						2		3	3
CO4	3	3	3	3	3	3	3				2		3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

D.Y. PATIL EDUCATION SOCIETY Kasba Bawada, Kolhapur KOLHAPUR

Course Contents:

Unit 1	**Introduction to Parallel Architectures**	**8 Hours**
Motivation for parallel computing and history, Sequential vs parallel processing, Parallel computer architectures and classifications, Shared-memory multiprocessors and interconnection networks, Distributed-memory multicomputers, SIMD computers and vector processors, Performance metrics and scalability analysis, Parallel programming models overview		
Unit 2	**Parallel Algorithm Design and Analysis**	**7 Hours**
Parallel algorithm design methodology, Task/data decomposition strategies, Foster's parallel algorithm design methodology, Mapping techniques and load balancing, Parallel algorithm complexity analysis, Parallel efficiency and scalability, Case studies: parallel sorting and searching algorithms		
Unit 3	**Message-Passing Programming with MPI**	**8 Hours**
Message-passing programming model, MPI programming basics and environment, Point-to-point communication functions, Collective communication operations, MPI data types and communicators, Performance analysis of MPI programs, Practical applications: Sieve of Eratosthenes, Floyd's algorithm, Matrix-vector multiplication using MPI		
Unit 4	**Advanced MPI Programming and Applications**	**7 Hours**
Monte Carlo methods in parallel, Matrix multiplication algorithms, Solving linear systems of equations, Finite difference methods for PDEs, Parallel sorting algorithms, Fast Fourier Transform implementation, Combinatorial search algorithms, MPI debugging and optimization techniques		
Unit 5	**Shared-Memory Programming with OpenMP**	**6 Hours**
Shared-memory programming model, OpenMP programming fundamentals, Parallel regions and work-sharing constructs, Data environment and variable scoping, Synchronization and critical sections, Performance considerations in OpenMP, Combining MPI and OpenMP (hybrid programming)		
Unit 6	**GPU Computing and Modern HPC Systems**	**7 Hours**
Introduction to GPU computing architecture, CUDA programming model and memory hierarchy, Kernel development and thread management, Performance optimization for GPU computing, Parallel programming patterns and best practices, Modern HPC system architectures, Performance analysis tools and benchmarking, Future trends in high-performance computing		

Text Books:

1. "Parallel Programming in C with MPI and OpenMP" by Michael J. Quinn, McGraw-Hill Education, First Edition, 2003 (Unit 1, Unit 2, Unit 3, Unit 4, Unit 5)
2. "Introduction to High Performance Computing for Scientists and Engineers" by Georg Hager and Gerhard Wellein, CRC Press, First Edition, 2010 (Unit 1, Unit 6)
3. "Programming Massively Parallel Processors: A Hands-on Approach" by David B. Kirk and Wen-mei W. Hwu, Morgan Kaufmann, Fourth Edition, 2022 (Unit 6)

Reference Books:

1. "High Performance Computing: Modern Systems and Practices" by Thomas Sterling, Matthew Anderson, and Maciej Brodowicz, Morgan Kaufmann, First Edition, 2017
2. "Parallel Programming: Concepts and Practice" by Bertil Schmidt, Jorge González-Domínguez, Christian Hundt, and Moritz Schlarb, Morgan Kaufmann, First Edition, 2017
3. "High Performance Python: Practical Performant Programming for Humans" by Micha Gorelick and Ian Ozsvald, O'Reilly Media, Second Edition, 2020
4. "Introduction to Parallel Computing" by Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, Pearson, Second Edition, 2003

Course Code:	23DSEU6E16
Course Name:	Blockchain Technology Lab

L	T	P	Credit
3			3

Course Prerequsites:

Basics of Programming, networks, and cryptography

Course Description:

This course introduces the fundamentals of blockchain technology and smart contracts. It covers the architecture, cryptographic principles, consensus mechanisms, and key platforms such as Bitcoin and Ethereum. Students will gain hands-on experience in writing and deploying smart contracts using Solidity. The course also explores real-world applications of blockchain across industries like finance, supply chain, and healthcare.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Describe the fundamentals, architecture, and types of blockchain systems.
CO2	Analyze cryptographic techniques and consensus mechanisms used in blockchain.
CO3	Develop smart contracts using Solidity and deploy them on Ethereum-like platforms.
CO4	Evaluate blockchain platforms and applications for real-world problem-solving in various domains.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1										1			
CO2	1	2			2					1	2		1	
CO3	1	1	2	1	3			2				2	2	2
CO4	1	2		1	1							1	2	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation	100%	Assignment, Test, Quiz, Seminar, Presentation, etc.

Experiment List

1	Introduction to Blockchain simulators and tools (Ganache, MetaMask, Remix IDE)
2	Setting up Ethereum blockchain environment using Ganache and connecting with MetaMask
3	Creating and deploying a basic smart contract using Solidity in Remix
4	Writing a smart contract for a voting system
5	Implementing a smart contract for a crowdfunding platform
6	Demonstrating a cryptocurrency transfer between accounts using smart contract
7	Managing ownership and access control in smart contracts
8	Testing smart contracts with Truffle framework (optional advanced)
9	Mini project: Develop a DApp with front-end integration

Text Books:

1. Beginning Blockchain : A Beginner's Guide to Building Blockchain Solutions By Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Apress Media.
2. Imran Bashir, "Mastering BlockChain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Packt Publishing, first edition – 2012
3. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
4. Mastering Ethereum: Building Smart Contracts and DAPPS, by Andreas Antonopoulos, Dr. Gavid Wood, Oreilly Publication
5. Anshul Kaushik, "BlockChain and Crypto Currencies", Khanna Publishing House, Delhi

Reference Books:

1. Learn Ethereum: Build your own decentralized applications with Ethereum and smart contracts by by Xun (Brian) Wu , Zhihong Zou , Dongying Song

Course Code:	23DSEU6E17	L	T	P	Credit
Course Name:	Cloud Computing Laboratory			2	1

Course Prerequsites:

Basic understanding of computer networks, operating systems, and programming skills in Python or Java.

Course Description:

This laboratory course offers hands-on experience with fundamental cloud computing services and tools. Students will learn to work with virtual machines, cloud storage, databases, web hosting, and basic security features on platforms like AWS, Azure, or Google Cloud. The course aims to develop practical skills in deploying, managing, and monitoring cloud-based applications and resources.

Course Outcomes:	After the completion of the course the student will be able to -
CO1	Use public cloud environment
CO2	Build virtual machines using virtualization techniques
CO3	Make use of containers for software deployment

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2		3	1					2	3	3	2
CO2	2		2		3	1					2	3	3	2
CO3	2		2		3	1					2	3	3	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation [25 Marks]	100%	Experiment, Practical Performance and Oral Exam etc.

List of Experiments:	
1	Use Google Collab book for writing program
2	Use google APIs to access google cloud services
3	Create Virtual Machine using emulator - emue and virtual library
4	Create Virtual Machines using KVM library - paravirtualized machine
5	Create bare-metal virtual machine
6	Create container using lxc
7	Create a container using docker - docker desktop , docker CLI
8	Networking of Docker Containers
9	Building Docker Image
10	Check the usage reports or activity logs of your cloud resources.

Text Books:

1. Mastering Cloud Computing - Buyya R, Vecchiola C, Selvi S T, McGraw Hill Education (India), 2013
2. Cloud Computing - Principles and Paradigms - Buyya R, Broberg J, Goscinski A, Wiley,2011
3. Cloud Computing Concepts, Technology & Architecture - Thomas Erl, Zaigham Mahmood, and Ricardo Puttini
4. A to z on Docker: A complete Hands-On Guide to Docker Container – Swapnil Jain
5. Docker Cookbook - Sébastien Goasguen, O'reilly Nov. 2015 First Edition

Reference Books:

1. Cloud Computing Bible - Barrie Sosinsky ,Wiley Publishing Inc. 2011
2. Cloud Native DevOps with Kubernetes – John Arundel and Justin Domingus

Course Code:	23DSEU6E18
Course Name:	High Performance Computing Laboratory

L	T	P	Credit
0	0	2	1

Course Prerequsites:

Programming in C/C++, Basic knowledge of Linux/Unix systems

Course Description:

This laboratory course provides hands-on experience in parallel and high-performance computing. Students will implement parallel algorithms using various programming models including OpenMP, MPI, and CUDA.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Implement and analyze parallel programs using shared memory programming model (OpenMP)
CO2	Develop distributed memory parallel applications using Message Passing Interface (MPI)
CO3	Design and optimize GPU-based parallel programs using CUDA programming model
CO4	Evaluate performance of parallel programs and apply optimization techniques using profiling tools

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	3						3		3	3
CO2	3	3	2	3	3						2		3	3
CO3	3	3	3	3	3	1					3		3	3
CO4	2	3	3	3	3	3					3		3	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal	100%	Assignment, Test, Quiz, Seminar, Presentation, etc.

Course Contents:		
Experiment 1:	**Introduction to Parallel Computing Environment**	**2 Hours**
Objective: Set up and familiarize with parallel computing environment Tasks: Installation and configuration of GCC with OpenMP support Setting up MPI environment (OpenMPI/MPICH) Basic Linux commands for HPC environment Writing and compiling first "Hello World" programs in OpenMP and MPI Understanding system architecture using hardware detection tools		
Experiment 2:	**Shared Memory Programming with OpenMP - Basic Constructs**	**2 Hours**
Objective: Implement basic OpenMP parallel programs Tasks: Parallel regions and thread creation Work-sharing constructs: parallel for, parallel sections Variable scoping: private, shared, firstprivate, lastprivate Parallel computation of π using numerical integration Matrix addition and multiplication using OpenMP Performance analysis with different thread counts		
Experiment 3:	**OpenMP Synchronization and Advanced Constructs**	**4 Hours**
Objective: Implement synchronization mechanisms in OpenMP Tasks: Critical sections and atomic operations Reduction operations for parallel summation Barrier synchronization Producer-consumer problem using OpenMP Parallel sorting algorithms (Bubble sort, Quick sort) Debugging race conditions and deadlocks		
Experiment 4:	**Message Passing Programming with MPI - Fundamentals**	**4 Hours**
Objective: Develop basic MPI applications Tasks: MPI initialization, rank identification, and finalization Point-to-point communication: MPI_Send and MPI_Recv Ring communication pattern implementation Parallel computation of factorial using MPI Master-slave architecture for parallel task distribution Performance comparison with sequential version		
Experiment 5:	**MPI Collective Communication Operations**	**4 Hours**
Objective: Implement collective communication in MPI Tasks: Broadcast operation (MPI_Bcast) for data distribution Scatter and Gather operations for data decomposition Reduce operations for parallel reductions Allreduce for global computations Parallel matrix-vector multiplication using MPI Implementation of parallel prefix sum algorithm		

Experiment 6:	Introduction to GPU Computing with CUDA	4 Hours

Objective: Develop basic CUDA programs for GPU computing
Tasks:
CUDA environment setup and device query
Writing first CUDA kernel for vector addition
Memory management: host-device data transfer

Text Books:

1."Parallel Programming in C with MPI and OpenMP" by Michael J. Quinn, McGraw-Hill Education, First Edition, 2003
2."Programming Massively Parallel Processors: A Hands-on Approach" by David B. Kirk and Wen-mei W. Hwu, Morgan Kaufmann, Fourth Edition, 2022

Reference Books:

1. "Using OpenMP: Portable Shared Memory Parallel Programming" by Barbara Chapman, Gabriele Jost, and Ruud van der Pas, MIT Press, First Edition, 2007
2. "Parallel Programming with MPI" by Peter Pacheco, Morgan Kaufmann, First Edition, 1997
3. "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs" by Shane Cook, Morgan Kaufmann, First Edition, 2012
4. "High Performance Computing: Programming and Applications" by John Levesque and Gene Wagenbreth, CRC Press, First Edition, 2010

Course Code:	23DSEU6N19
Course Name:	Web Application Development - II

L	T	P	Credit
1		2	2

Course Prerequsites:

Basic Programming Knowledge, Basic knowledge of HTML, CSS, and JavaScript, Introduction to Java, Basic knowledge of relational databases

Course Description:

This course provides comprehensive training in building full-stack web applications using React for the frontend and Spring Boot for the backend. Students will learn to design responsive user interfaces, develop RESTful APIs, and integrate both ends to create modern web applications. Emphasis is placed on component-based development, routing, state management, secure API development, and deployment.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Design and implement dynamic user interfaces using React and its component-based architecture.
CO2	Develop secure and scalable backend services using Spring Boot and RESTful APIs.
CO3	Integrate frontend and backend technologies to build full-stack web applications.
CO4	Deploy and test full-stack applications with effective state management and secure API communication.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1										1			
CO2	1	2			2					1	2		1	
CO3	1	1	2	1	3			2				2	2	2
CO4	1	2		1	1							1	2	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation	50%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	POE	50%	100% course contents

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Course Contents:		
Unit 1	**Introduction to React**	**3 Hours**
Introduction to SPA and React.js JSX and Virtual DOM Functional Components and Props State and Lifecycle Methods Handling Events in React		
Unit 2	**Advanced React Features**	**5 Hours**
Conditional Rendering and Lists Forms and Input Handling Lifting State Up React Hooks: useState, useEffect Context API and Custom Hooks		
Unit 3	**React Routing and State Management**	**6 Hours**
React Router: Navigation, Route Parameters, Nested Routing Global State Management: useReducer, Context API Introduction to Redux (optional) API Calls using Axios / Fetch Error Handling and Loading States		
Unit 4	**Introduction to Spring Boot**	**5 Hours**
Overview of Spring Framework and Spring Boot Spring Boot Architecture and Dependencies (Maven/Gradle) Building REST APIs with Spring Boot		
Unit 5	**Data Persistence and Security**	**5 Hours**
Spring Data JPA and Hibernate CRUD Operations using Repositories Connecting to MySQL/PostgreSQL Spring Boot Security Basics (JWT/OAuth2 overview) Role-Based Access Control (RBAC)		
Unit 6	**Full Stack Integration and Deployment**	**4 Hours**
Connecting React Frontend with Spring Boot Backend Handling CORS and API Authentication Environment Configuration and .env files Deployment of application Project: Full-stack CRUD application with secure login		

Text Books:

Reference Books:
1. Learn Ethereum: Build your own decentralized applications with Ethereum and smart contracts by by Xun (Brian) Wu , Zhihong Zou , Dongying Song

Experiment List	
1	Setup React Development Environment (Node.js, npm, VS Code) and create a basic React app
2	Create React components using JSX, Props, and State
3	Build forms in React and handle form events and validations
4	Implement routing in React using React Router
5	Use React Hooks (useState, useEffect) for state and side effects
6	Setup Spring Boot project using Spring Initializr and build a basic REST API
7	Develop CRUD operations using Spring Boot and MySQL/PostgreSQL
8	Implement exception handling and validation in Spring Boot APIs
9	Connect React frontend with Spring Boot backend using Axios
10	Implement user login and role-based authentication (Spring Security + JWT)
11	Manage environment variables and integrate .env in frontend/backend
12	Final mini-project: Develop and deploy a full-stack web app (e.g., Task Manager, E-Commerce Admin, Event Manager)