	GEETHANJALI INSTITUTE OF SCIENCE & TECHNOLOGY
	A Unit of USHODAYA EDUCATIONAL SOCIETY
	An ISO 9001:2015 certified Institution: Recognized under Sec. 2(f)& 12(B) of UGC Act, 1956
	3rd Mile, Bombay Highway, Gangavaram (V), Kovur(M), SPSR Nellore (Dt), Andhra Pradesh, India- 524137
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DEPARTMENT OF CSE(AI&ML)

VISION

To become a learning-resource center producing system engineers suitable for career roles in Artificial Intelligence and Machine Learning domains.

MISSION

DM1. Imparting quality education through industry relevant curriculum and effective teaching-learning methodologies.

DM2. Organizing Professional skill development programmes to cater to the societal needs through Institute-Industry interface.

DM3. Incorporating life skill development programmes aimed at promoting social responsibility on ethical foundations.

DM4. Fostering employability skills by incorporating soft skills in the curriculum.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: **Professional Skills**: Proficiency in multiple skill sets which enable the learners to excel in divergent platforms in industries

PSO2: **Successful Career and Entrepreneurship:** Apply the Artificial Intelligence & Machine Learning concepts in wide ranging fields of engineering culminating in successful careers and entrepreneurs with a special focus on societal problem solving.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Carving successful careers in industry, academia with expertise in Artificial Intelligence & Machine Learning (AI & ML)

PEO2: Excelling as socially committed Artificial Intelligence & Machine Learning (AI & ML) Engineers.

PEO3: Engaged in the successful execution of multi-disciplinary projects for the welfare and progress of humankind.

PEO4: Pursuing higher studies, research activities and initiatives of entrepreneurship.

Semester-3 (Theory-6, Lab-3, SC-1, MC-1)							
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	BSC	22A0016T	Probability & Statistics	3	0	0	3
2	PCC	22A0506T	**Computer Organization**	3	0	0	3
3	PCC	22A0514T	**Python Programming**	3	0	0	3
4	ESC	22A0410T	Digital Electronics and Micro Processors	3	0	0	3
5	PCC	22A0521T	Design and Analysis of Algorithms	3	0	0	3
6	HSC	22A0022T	Managerial Economics & Financial Analysis	3	0	0	3
7	PCC(Lab)	22A0517P	**Python Programming Lab**	0	0	3	1.5
8	ESC(Lab)	22A0411P	Digital Electronics and Micro Processors Lab	0	0	3	1.5
9	PCC(Lab)	22A0524P	Design and Analysis of Algorithms Lab	0	0	3	1.5
10	SC	22A0511	**Skill Oriented Course** Basic Web Design	1	0	2	2
11	MC	22A0030T	**Mandatory Course** Constitution of India	2	0	0	0
				Total credits			**24.5**

Category	**Credits**
Basic Science Course (BSC)	3
Professional Core Courses (PCC)	12
Engineering Science Courses (ESC)	4.5
Humanities and Social Science Course (HSC)	3
Skill Oriented Course (SC)	2
Total	24.5

Semester-4 (Theory-5, Lab-3, SC-1, MC-1)							
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	BSC	22A0017T	Discrete Mathematical Structures	3	0	0	3
2	PCC	22A0512T	Database Management Systems	3	0	0	3
3	PCC	22A0507T	Object Oriented Programming Through JAVA	3	0	0	3
4	PCC	22A3301T	**Artificial Intelligence**	3	0	0	3
5	HSC	22A0021T	Universal Human Values	3	0	0	3
6	PCC(LAB)	22A0515P	Database Management Systems Lab	0	0	3	1.5
7	PCC(LAB)	22A0509P	Object Oriented Programming Through JAVA Lab	0	0	3	1.5
8	PCC(LAB)	22A3302P	**Artificial Intelligence Lab**	0	0	3	1.5
9	SC	22A0518	**Skill Oriented Course** Linux Programming	1	0	2	2
10	MC	22A0028T	**Mandatory Course** Environmental Science	2	0	0	0
						Total credits	**21.5**

Category	Credits
Basic Science Course (BSC)	3
Humanities and Social Sciences Course (HSC)	3
Professional Core Courses (PCC)	13.5
Skill oriented Course(SC)	2
Total	21.5

Semester-5 (Theory-5, Lab-2, SC-1, MC-1)							
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	PCC	22A3303T	**Automata and Compiler Design**	3	0	0	3
2	PCC	22A0508T	**Software Engineering**	3	0	0	3
3	PCC	22A0528T	**Machine Learning**	3	0	0	3
4	PEC	22A0534c 22A0520T 22A0522c	**Professional Elective-I:** 1. **Big Data Technologies** 2. **Computer Networks** 3. **No SQL**	3	0	0	3
5	OEC	22A0430T 22A0214Ta 22A0149T 22A0321Ta	**Open Elective-I:** 1. Principles of Communication Systems 2. Power Electronics 3. Building Materials 4. Automobile Engineering	3	0	0	3
6	PCC(Lab)	22A0510P	**Software Engineering Lab**	0	0	3	1.5
7	PCC(Lab)	22A0532P	**Machine Learning Lab**	0	0	3	1.5
8	SC	22A0029P	**Skill Advanced Course:** Soft Skills	1	0	2	2
9	MC	22A0526T	**Mandatory Course:** Design Thinking and Innovation	2	0	0	0
Community Service Project- 2 Months (Mandatory) after second year(to be evaluated during V semester)				0	0	0	1.5
			Total credits				**21.5**

Category	Credits
Professional Core Courses (PCC)	12
Professional Elective Courses (PEC)	3
Open Elective Courses(OEC)	3
Skill Advanced Course(SC)	2
Summer Internship	1.5
Total	21.5

Semester-6 (Theory-5, Lab-3, SC-1 MC-1)							
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	PCC	22A3304T	**Natural Language Processing**	3	0	0	3
2	PCC	22A0535c	**Deep Learning**	3	0	0	3
3	PCC	22A0533T	Cloud Computing	3	0	0	3
4	PEC	22A03305T 22A0530b 22A0530c	**Professional Elective-II:** 1. **Mobile Computing** 2. **Design Patterns** 3. **Introduction to IoT**	3	0	0	3
5	OEC	22A0413T 22A0213Ta 22A0150T 22A0327Tb	**Open Elective-II:** 1. Micro Controllers And Applications 2. Control Systems 3. Environmental Economics 4. Introduction to Composite Materials	3	0	0	3
6	PCC(Lab)	22A3306P	**Natural Language Processing Lab**	0	0	3	1.5
7	PCC(Lab)	22A3307P	**Deep Learning Lab**	0	0	3	1.5
8	PCC(Lab)	22A0533P	Cloud Computing Lab	0	0	3	1.5
9	SC	22A0525	**Skill Oriented Course:** R Programming	1	0	2	2
10	MC	22A0032T	**Mandatory Course:** Research Methodology	2	0	0	0
			Total credits				**21.5**
Industrial / Research Internship (Mandatory) 2 Months during summer vacation							

Category	**Credits**
Professional Core Courses (PCC)	13.5
Professional Elective Courses (PEC)	3
Open Elective Courses (OEC)	3
Skill Oriented Course (SC)	2
Industrial / Research Internship (Mandatory) 2 Months	-
Total	21.5

Semester-7 (Theory-6, SC-1)							
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	HSC	22A0023T 22A0024T 22A0025T	**HSC Elective-** 1. Management Science 2. Entrepreneurship and Innovation 3. Business Environment	3	0	0	3
2	PEC	22A3308T 22A0534b 22A3309T	**Professional Elective-III** **1. Recommender Systems** **2. High Performance Computing** **3. Intelligent Information Retrieval Systems**	3	0	0	3
3	PEC	22A0535a 22A3310T 22A3311T	**Professional Elective-IV** 1. **Block Chain Technology** 2. **Reinforcement Learning** 3. **Social Network Analysis**	3	0	0	3
4	PEC	22A0536a 22A0536b 22A0536c	**Professional Elective-V:** **1. Image Processing** **2. Knowledge Representation and Reasoning** 3. **Full Stack Web Development**	3	0	0	3
5	OEC	22A0241Ta 22A0432T 22A0151T 22A0327Tc	**Open Elective-III:** 1. Smart Electric Grid 2. Basic VLSI Design 3. Disaster management 4. Measurements and Mechatronics	3	0	0	3
6	OEC	22A0232Ta 22A0433T 22A0152T 22A0331Tc	**Open Elective-IV:** 1. Electric Vehicles 2. Industrial Electronics 3. Construction management 4. Introduction to Robotics	3	0	0	3
7	SC	22A0537	**Skill Advanced Course:** Mobile Application Development	1	0	2	2
Industrial / Research Internship 2 Months (Mandatory) after Third year (to be evaluated during VII semester)				0	0	0	3
			Total credits				**23**
Industrial / Research Internship (Mandatory) 2 Months during summer vacation							

Category	Credits
Professional Elective Courses (PEC)	9
Humanities and Social Science Course(HSC)	3
Open Elective Courses(OEC)	6
Skill Advanced Course(SC)	2
Industrial / Research Internship	3
Total	23

Semester-8 (Project-1)							
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	Major Project	22A3311	**Project Work or Internship in Industry**	**0**	0	24	12
						Total credits	12

Types of Courses

Types of Courses	**Course Category**	**Code**	**Department**
Foundation	Engineering Sciences	ESC	24
	Basic Sciences	BSC	21
	Humanities & Social Sciences and Management	HSMC	13.5
Core	Professional Core	PCC	51
Project	Project & Internship (12)	PROJ	16.5
	Internship (4.5)		
Elective Courses	Professional Elective	PEC	15
	Open Elective (including 2 MOOCs)	OEC	12
Mandatory Courses	Mandatory	MC	-
	Skill Oriented Courses	SC	10
		Total Credits	163

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COURSES OFFERED FOR HONOURS DEGREE IN CSE(AI&ML)

Note: 1. Honors degree subjects are having a total of 20 additional Credits
2. Students should acquire 4 credits through MOOCs compulsory to award the Honors Degree

Sl. No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	C
1	22A05H01	Secure Software Engineering	3	1	0	4
2	22A05H02	Agile Software Development Approaches	3	1	0	4
3	22A05H03	Introduction to IOT	3	1	0	4
4	22A05H04	Computer Vision	3	1	0	4
5	22A05H05	Visual Programming	3	1	0	4
6	22A05H06	Network Management Systems	3	1	0	4
7	22A05H07	Artificial Neural Networks	3	1	0	4
8	22A05H08	Distributed Systems	3	1	0	4

COURSES OFFERED FOR MINORS DEGREE IN CSE(AI&ML) to OTHER DEPARTMENTS

Note: 1. Minors degree subjects are having a total of 20 additional Credits
2. Students should acquire 4 credits through MOOCs compulsory to award the Minors Degree

Sl. No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	C
1	22A05M01	Computer Organization	3	1	0	4
2	22A05M02	Operating Systems	3	1	0	4
3	22A05M03	Advanced Java Programming	3	1	0	4
4	22A05M04	Design & Analysis of Algorithms	3	1	0	4
5	22A05M05	Computer Networks	3	1	0	4
6	22A05M06	Full Stack Web Development	3	1	0	4
7	22A05M07	Object Oriented Analysis & Design	3	1	0	4
8	22A05M08	No SQL	3	1	0	4
9	22A05M09	Software Engineering	3	1	0	4

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Semester-3 (Theory-6, Lab-3, SC-1, MC-1)							
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	BSC	22A0016T	Probability & Statistics	3	0	0	3
2	PCC	22A0506T	Computer Organization	3	0	0	3
3	PCC	22A0514T	Python Programming	3	0	0	3
4	ESC	22A0410T	Digital Electronics and Micro Processors	3	0	0	3
5	PCC	22A0521T	Design and Analysis of Algorithms	3	0	0	3
6	HSC	22A0022T	Managerial Economics & Financial Analysis	3	0	0	3
7	PCC(Lab)	22A0517P	Python Programming Lab	0	0	3	1.5
8	ESC(Lab)	22A0411P	Digital Electronics and Micro Processors Lab	0	0	3	1.5
9	PCC(Lab)	22A0524P	Design and Analysis of Algorithms Lab	0	0	3	1.5
10	SC	22A0511	**Skill Oriented Course** Basic Web Design	1	0	2	2
11	MC	22A0030T	**Mandatory Course** Constitution of India	2	0	0	0
				Total credits			**24.5**

Category	**Credits**
Basic Science Course (BSC)	3
Professional Core Courses (PCC)	12
Engineering Science Courses (ESC)	4.5
Humanities and Social Science Course (HSC)	3
Skill Oriented Course (SC)	2
Total	24.5

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PROBABILITY AND STATISTICS
(Common to CSE, AI&ML, DS, CS, CE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0016T	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	BSC

Course Objectives:

- Summarize the basic concepts of data science and its importance in engineering
- analyze the data quantitatively or categorically,
- measure of averages, variability, adopt correlation methods and principle of least squares, regression analysis

Course Outcomes (CO):

On completion of this course, student will be able to:

- Define the terms trial, events, sample space, probability, and laws of probability, Make use of probabilities of events in finite sample spaces from experiments,
- Apply Baye's theorem to real time problems and explain the notion of random variable, distribution functions and expected value.
- Apply Binomial and Poisson distributions for real data to compute probabilities, theoretical frequencies, interpret the properties of normal distribution and its applications.
- Explain the concept of estimation, interval estimation and confidence intervals; apply theconcept of hypothesis testing for large samples.
- Apply the concept of testing hypothesis for small samples to draw the inferences and estimate the goodness of fit.

Syllabus		Total Hours:48
Module – I	**Descriptive Statistics**	**10 Hrs**
Statistics Introduction, Measures of Variability (dispersion) Skewness Kurtosis, correlation, correlation coefficient, rank correlation, principle of least squares, method of least squares, regression lines, regression coefficients and their properties.		
Module – II	**Probability**	**9 Hrs**
Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties.		
Module – III	**Probability distributions**	**10 Hrs**
Discrete distribution - Binomial, Poisson approximation to the binomial distribution and their properties. Continuous distribution: normal distribution and their properties. Normal approximation to Binomial Distribution. Uniform distribution		
Module – IV	**Estimation and testing of hypothesis, large sample tests**	**9 Hrs**
Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems.		
Module – V	**Test of Significance**	**10 Hrs**
Student t-distribution (test for single mean, two means and paired t-test), testing of equality ofvariances (F-test), $\chi 2$ - test for goodness of fit, $\chi 2$ - test for independence of attributes.		

Text Books:

1. B.S.Grewal , “Higher Engineering Mathematics”, Khanna publishers.
2. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008.

Reference Books:

1. Probability & Statistics by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad S. Chand publication.
2. B.V.Ramana, “Higher Engineering Mathematics”, Mc Graw Hill publishers.
3. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.
4. Mathematical Foundations of Statistics by K. C. Kapoor & Gupta, S. Chand Publications.

Web References:

https://onlinecourses.nptel.ac.in/noc21_ma74/preview

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COMPUTER ORGANIZATION

(Common to CSE,AI&ML,DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0506T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- Illustrate the fundamental concepts of computer organization.
- Determine the Machine Instructions, develop programs.
- Develop Arithmetic Operations on Integers and Floating-Point Numbers.
- Demonstrate types of memories, use of I/O devices.
- Illustrate concepts of Pipelining, Large Computer Systems.

Course Outcomes (CO):

On completion of this course, student will be able to

- Determine the basic concepts of Computer Organization.
- Interpret the Machine Instructions and basic Input / Output Operations.
- Demonstrate Arithmetic Operations on signed and unsigned numbers, design of Control Unit.
- Differentiate types of memories and distinguish I/O Devices.
- Illustrate the concepts of Pipelining.
- Illustrate the concepts of Large Computer Systems

Syllabus		Total Hours:48
Module-I	**Basic Structure of Computer**	**9Hrs**

Basic Structure of Computer: Computer Types, Functional Units, Basic operational Concepts, Bus Structure, Software, Performance, Multiprocessors and Multi computer.

Module-II	Machine Instructions and Programs	10Hrs

Machine Instructions and Programs: Numbers, Arithmetic Operations and Programs, Instructions and Instruction Sequencing, Addressing Modes, Basic Input/output Operations, Stacks and Queues, Subroutines.

Module-III	Computer Arithmetic and Micro Programmed Control Unit	10Hrs

Computer Arithmetic: Addition and Subtraction, Multiplication algorithms, Division algorithms, Floating point arithmetic operations.
Micro Programmed Control Unit: Control memory, address sequencing, design of control unit.

Module-IV	The Memory System and Input / Output Organization	10Hrs

The Memory System: RAM, ROM, Cache Memory, Virtual Memory, And Secondary Storage.
Input / Output Organization: Accessing I/O Devices, Interrupts, Direct Memory Access, Buses, Standard I/O Interfaces.

Module-V	Pipelining, Large Computer Systems	9Hrs

Pipelining: Basic Concepts, Data Hazards, and Instruction Hazards.
Large Computer Systems: Forms of Parallel Processing, The Structure of General-Purpose multiprocessors, Interconnection Networks.

Text Books:

1. Carl Hamacher, Zvonko Vranesic, SafwatZaky, “Computer Organization”, 5th Edition, McGraw Hill Education, 2013.
2. M.Morris Mano, RajibMall, ”Computer System Architecture”, Revised Third Edition, Pearson Education India

Reference Books:

1. Themes and Variations, Alan Clements, “Computer Organization and Architecture”, CENGAGE Learning.
2. Smruti Ranjan Sarangi, “Computer Organization and Architecture”, McGraw Hill Education.

Web References:

https://archive.nptel.ac.in/courses/106/105/106105163/

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PYTHON PROGRAMMING

(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0514T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- Introduction to Programming Basics, Binary Computation, problem-solving methods and algorithm development.
- Includes procedural and data abstractions, program design,
- debugging, testing and documentation
- covers data types, control structures, functions, parameter passing, library functions, arrays, Inheritance and Object-oriented design

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the features, functions, strings, files of python.
- Analyze the flow control, looping statements and its functions in Python.
- Identify the methods to create and manipulate lists, and tuples.
- Apply the modular approach for solving the problems on Modules and Packages .
- Implement programs with the use of oops Concept in python.
- Apply dictionaries and files concepts for real world applications.

Syllabus		Total Hours:48
Module-I	**Introduction to Python**	**10Hrs**

Introduction: History of Python, Features of Python Programming, Applications of Python Programming, Running Python Scripts, Comments, Typed Language, Identifiers, Variables, Keywords, Input/output, Indentation, Data types, Type Checking, range (), format (), Math Module.

Module-II	Operators Expressions and Functions	9Hrs

Operators and Expressions: Arithmetic, Assignment, Relational, Logical, Boolean, Bitwise, Membership, Identity, Expressions and Order of Evaluations, Control Statements.

Functions: Introduction, Defining Functions, Calling Functions, Anonymous Function, Fruitful Functions and Void Functions, Parameters and Arguments, Passing Arguments, Types of Arguments, Scope of variables, Recursive Functions.

Module-III	Strings, Lists, Tuples, and Dictionaries	10Hrs

Strings, Lists, Tuples, and Dictionaries: Strings- Operations, Slicing, Methods, List- Operations, slicing, Methods, Tuple- Operations, Methods, Dictionaries- Operations, Methods, Mutable Vs Immutable, Arrays Vs Lists, Map, Reduce, Filter, Comprehensions.

Module-IV	Files, Modules and Packages	9Hrs

Files, Modules and Packages: Files- Persistent, Text Files, Reading and Writing Files, Format Operator, Filename and Paths, Command Line Arguments, File methods, Modules- Creating Modules, Import Statement, Form Import Statement, name spacing, Packages- Introduction to PIP, Installing Packages via PIP(Numpy).

Module-V	Object Oriented Programming, Errors and Exceptions	10Hrs

OOP in Python: Object Oriented Features, Classes, self-variable, Methods, Constructors, Destructors, Inheritance, Overriding Methods, Data hiding, Polymorphism.

Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions.

Text Books:

1. Vamsi Kurama, Python Programming: A Modern Approach, Pearson, 2017.
2. Allen Downey, Think Python, 2ndEdition, Green Tea Press

Reference Books:

1. R. Nageswara Rao, "Core Python Programming", 2nd edition, Dreamtech Press, 2019.
2. Allen B. Downey, "Think Python", 2ndEdition, SPD/O'Reilly, 2016.
3. Martin C.Brown, "The Complete Reference: Python", McGraw-Hill, 2018.
4. Mark Lutz, Learning Python, 5th Edition, Orielly, 2013.

Web References:

- https://nptel.ac.in/courses/106/106/106106145/
- https://www.youtube.com/watch?v=MEPlLAjPvXY

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DIGITAL ELECTRONICS AND MICRO PROCESSORS
(Common to CSE,AI&ML,DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0410T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	ESC

Course Objectives:

This course will enable students to:

- To understand all the concepts of Logic Gates and Boolean Functions.
- To learn about Combinational Logic and Sequential Logic Circuits.
- To design logic circuits using Programmable Logic Devices.
- To understand basics of 8086 Microprocessor and 8051 Microcontroller.
- To understand architecture of 8086 Microprocessor and 8051 Microcontroller.
- To learn Assembly Language Programming of 8086 and 8051.

Course Outcomes (CO):

On completion of this course, student will be able to

- Differentiate various number systems and binary codes**.**
- Solve the Boolean Expressions using Boolean algebra and k-maps.
- Implement different combinational and Sequential circuits
- Explain the internal architecture and organization of the 8086 microprocessor.
- Demonstrate the assembly level language programming for 8086 and 8051.
- Describe the architecture, hardware details and memory organization of 8051 microcontroller.

Syllabus		Total Hours:48
Unit - I	**Number Systems & Code Conversion**	**10Hrs**
Number Systems & Code conversions, Boolean Algebra & Boolean properties, Logic Gates, Truth Tables, Universal Gates, Simplification of Boolean functions using Boolean properties, SOP and POS methods – Simplification of Boolean functions using K-maps, Signed and Unsigned Binary Numbers.		
Unit - II	**Combinational Circuits**	**9Hrs**
Combinational Logic Circuits: Adders & Subtractors, magnitude Comparators, Multiplexers, De-multiplexers, Encoders, Decoders, Programmable Logic Devices.		
Unit - III	**Sequential Circuits**	**10Hrs**
Sequential Logic Circuits: Compression between combinational & sequential circuits, Latches, SR Latch, Flipflops, SR FlipFlop, JK Flip Flop, Master Slave JK, T Flip-Flops, D Flip Flop, Shift Registers, Types of Shift Registers, Counters, Synchronous Counters, Asynchronous Counters, Up-Down Counter		
Unit - IV	**Microprocessors - I**	**9Hrs**
8085 microprocessor, Block Diagram of 8085 Microprocessor, 8086 microprocessor, Functional Diagram, register organization 8086, Flag register of 8086 and its functions, Addressing modes of 8086, Pin diagram of 8086, Minimum mode & Maximum mode operation of 8086, Interrupts in 8086.		
Unit - V	**Microprocessors - II**	**10Hrs**
Instruction set of 8086, Assembler directives, Procedures and Macros, Simple programs involving arithmetic, logical, branch instructions, Ascending, Descending and Block move programs, String Manipulation Instructions. Functional Diagram of 8051, register organization 8051.		

Text Books:

1. M. Morris Mano, Michael D. Ciletti, Digital Design, Pearson Education, 5th Edition, 2013
2. Anil K. Maini, Digital Electronics: Principles, Devices and Applications, John Wiley & Sons, Ltd., 2007.

Reference Books:

1. Advanced microprocessors and peripherals-A.K Ray and K.M.Bhurchandani, TMH, 2nd edition, 2006.
2. Thomas L. Floyd, Digital Fundamentals – A Systems Approach, Pearson, 2013.
3. Charles H. Roth, Fundamentals of Logic Design, Cengage Learning, 5th, Edition, 2004.
4. D.V.Hall, Microprocessors and Interfacing. TMGH, 2nd edition, 2006.

Web Resources:

https://onlinecourses.nptel.ac.in/noc22_ee55/preview

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DESIGN AND ANALYSIS OFALGORITHMS
(Common to CSE,AI&ML,DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0521T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- Learn asymptotic notations, and analyze the performance of different algorithms.
- Understand and implement various data structures.
- Learn and implement greedy, divide and conquer, dynamic programming and backtracking algorithms using relevant data structures.
- Understand non-deterministic algorithms, polynomial and non-polynomial problems.

Course Outcomes (CO):

This course will enable students to:

- Learn asymptotic notations, and analyze the performance of different algorithms.
- Understand and implement various data structures.
- Learn and implement greedy, divide and conquer, dynamic programming and backtracking algorithms using relevant data structures.
- Understand non-deterministic algorithms, polynomial and non-polynomial problems.

Syllabus		Total Hours:48
Module-I	**Introduction & Asymptotic Notations**	**10Hrs**

Introduction:
What is an Algorithm? Algorithm Specification, Performance Analysis: Space complexity, Time complexity, Asymptotic **Notations:** Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), Mathematical analysis of non-Recursive and recursive Algorithms with Examples.

Module-II	**Divide and conquer & Greedy Method**	**9Hrs**

Divide and conquer: General method, Applications-Finding Maximum and minimum, Selection, binary search, quick sort, Strassen's matrix multiplication.

Greedy Method: General method, Applications-job sequencing with deadlines, Fractional knapsack problem, minimum cost spanning trees, Single source shortest path problem.

Module-III	**Dynamic Programming**	**10Hrs**

Dynamic Programming: General method, The Principle of Optimality, Applications- 0/1 knapsack problem, All pairs shortest path problem, Travelling salesperson problem, Optimal Binary Search Tree, Reliability design, Matrix chain multiplication.

Module-IV	**Backtracking**	**9Hrs**

Backtracking: General method, N-Queens problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles.

Branch and Bound: General method, applications - travelling sales person problem, 0/1 knapsack problem- LC branch and bound solution, FIFO branch and bound solution.

Module-V	**NP-Complete and NP-Hard problems**	**10Hrs**

NP-Complete and NP-Hard problems:
Basic concepts: deterministic and non-deterministic algorithms, Tractable and Intractable Problems , Complexity Classes: P, NP, NP-Hard and NP-Complete

Text Books:

1. Fundamentals of Computer Algorithms, Ellis Horowitz, Sartaj Sahni and Rajasekharam, Galgotia publications Pvt. Ltd.

Reference Books:

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
2. Design and Analysis of Algorithms , S. Sridhar, Oxford (Higher Education).
3. Introduction to the Design and Analysis of Algorithms, AnanyLevitin:, 2rd Edition, 2009. Pearson.
4. Design and Analysis of Computer Algorithms by Aho, Hopcraft, Ullman 1998, PEA.
5. Introduction to the Design and Analysis of Algorithms by Goodman, Hedetniemi, TMG.

Web References:

https://onlinecourses.nptel.ac.in/noc19_cs47/preview

https://nptel.ac.in/courses/106106131

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MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

(Common to CSE,AI&ML,DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0022T	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**HSC**

Course Objectives:

This course will enable students to:

- To understand the concepts of managerial economics and financial analysis this helps in optimal decision making in business environment.
- To have a thorough knowledge on the production theories and cost while dealing with the production and factors of production.
- To have a thorough knowledge regarding market structure and forms of business organizations in the market.
- To understand the concept of capital and capital budgeting in selecting the proposals.
- To have a thorough knowledge on recording, classifying and summarizing of transactions in preparing of final accounts.

Course Outcomes (CO):

On completion of this course, student will be able to

- Outline the Managerial Economic concepts for decision making and forward planning. Also know law of demand and its exceptions, to use different forecasting methods for predicting demand for various products and services.
- Assess the functional relationship between Production and factors of production and list out various costs associated with production
- Compute breakeven point to illustrate the various uses of breakeven analysis.
- Outline the different types of business organizations and provide a framework for analyzing money in its functions as a medium of exchange.
- Interpret various techniques for assessing the proposals of project for financial position of the business.
- Identify the principles of accounting to record, classify and summarize various transactions in books of accounts for preparation of final accounts.

Syllabus		**Total Hours:48**
Module-I	**INTRODUCTION TO MANAGERIAL ECONOMICS &DEMAND**	**10Hrs**

Managerial Economics – Definition – Nature & Scope - Contemporary importance of Managerial Economics - Demand Analysis - Concept of Demand - Demand Function - Law of Demand - Elasticity of Demand - Significance - Types of Elasticity - Measurement of Elasticity of Demand - Demand Forecasting - Factors governing Demand Forecasting - Methods of Demand Forecasting - Relationship of Managerial Economics with Financial Accounting and Management.

Module-II	**THEORY OF PRODUCTION AND COST ANALYSIS**	**9Hrs**

Production Function – Least-cost combination - Short-run and Long-run Production Function - Isoquants and Isocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale - Cost concepts and Cost behavior - Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems) - Managerial significance and limitations of Break-Even Analysis.

Module-III	**INTRODUCTION TO MARKETS ANDFORMS OF BUSINESS ORGANIZTIONS**	**10Hrs**

Market structures - Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition – Monopoly - Monopolistic Competition – Oligopoly - Price-Output Determination -

Pricing Methods and Strategies - Forms of Business Organizations - Sole Proprietorship - Partnership - Joint Stock Companies - Public Sector Enterprises.

Module-IV	CAPITAL AND CAPITAL BUDGETING	9Hrs

Concept of Capital - Significance - Types of Capital - Components of Working Capital Sources of Short-term and Long-term Capital - Estimating Working capital requirements – Capital Budgeting – Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

Module-V	INTRODUCTION TO FINANCIAL ACCOUNTING AND ANALYSIS	10Hrs

Accounting Concepts and Conventions - Introduction Double-Entry Book Keeping, Journal, Ledger, and Trial Balance - Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Text Books:

1.Managerial Economics, PL Mehata, Sulthan Chand Publications

Reference Books:

1. Ahuja Hl “Managerial economics” 3 rd edition, Schand, ,2013
2. S.A. Siddiqui and A.S. Siddiqui: “Managerial Economics and Financial Analysis”, New Age International,. 2013.
3. Joseph G. Nellis and David Parker: “Principles of Business Economics”, 2nd edition, Pearson, New Delhi.
4. Domnick Salvatore: “Managerial Economics in a Global Economy”, Cengage, 2013.
5. Managerial Economics, Varshney &Maheswari, Sultan Chand, 2013.
6. Managerial Economics and Financial Analysis, Aryasri, 4th edition, MGH, 2019

Web References:

https://nptel.ac.in/courses/110101005

https://onlinecourses.nptel.ac.in/noc23_mg65/preview

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PYTHON PROGRAMMING LAB
(Common to CSE, AI&ML)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0517P	0:0:3:0	1.5	CIE: 30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- To train the students in solving computational problems
- To elucidate solving mathematical problems using Python programming language
- To understand the fundamentals of Python programming concepts and its applications
- To able to write Python programs for real world problems using simple and compound data types
- To employee good programming style, standards and practices during program development

Course Outcomes (CO):

On completion of this course, student will be able to

- Develop solutions to mathematical problems.
- Develop Python programs for numerical and text based problems.
- Select appropriate programming construct for solving the problem.
- Implement basic data structures in python.
- Ability to choose appropriate data structures to represent data items in real world.
- Implement and know the application of algorithms for sorting and pattern matching.

Syllabus | **Total Hours: 48**

Experiment 1:

1. Installing Python for Windows 2. Installing numpy
3. Setting the Path to Python 4. Writing Our First Python Program
5. Executing a Python Program

Experiment 2:

1. Write a program to illustrate basic concepts of value types, and variables
2. Write a program to illustrate sequences in python
3. Write a program to illustrate operators in python

Experiment 3:

1. Write a program to illustrate input & output statements in python
2. Write a program to illustrate control statements in python
3. Write a program to read number and a digit, and count the number of times the digit occurs in the number

Experiment 4:

1. Write a program to use Strings and develop a python application and analyse various string Patterns
2. Write a program that finds a given word in a string.
3. Write a program that will read a text and count all occurrences of a particular alphabet

Experiment 5:

1. Write a program to implement operations on Array.
2. Write a program to transpose a matrix.
3. Write a program to add, subtract and multiply two matrices.

Experiment 6:

1. Write a program to create a List and apply list operations in python
2. Write a program to sort the matrix
3. Write a program to find Common Elements in Two Lists
4. Write a program for the following:
   a. Removing Spaces from a String, b. Finding Sub Strings,

c.Counting Substrings in a String, d.Replacing a String with another String

Experiment 7:

1. Write a program to create a dictionary and Implement dictionary operations in python
2. Write a program to illustrate data and time methods in python
3. Write a program to illustrate string methods in python

Experiment 8:

1. Write a program to create a module and access members from a module
2. Write a program to illustrate mathematical methods in python
3. Write a program for the following:
   a. Changing Case of a String
   b. Checking Starting and Ending of a String
   c. Sorting Strings
   d. Searching in the Strings

Experiment 9:

1. Write a program to copy content from one file to another file
2. Write a program to finding Number of Characters and Words in a given text file
3. Write a program for the following:
   a. Inserting Sub String into a String
   b. Inserting Elements in a Tuple
   c. Modifying Elements of a Tuple
   d. Deleting Elements from a Tuple

Experiment 10:

1. Write a program to getting Diagonal Elements of a Matrix
2. Write a program to find Maximum and Minimum Elements in a given set of elements
3. Write a program to find Sum and Average of Elements in a given set of elements

Reference Books:

1. Michael Dawson, ―Python Programming for absolute beginners‖, 3rd Edition, CENGAGE Learning
2. Publications, 2018.
3. Martin C. Brown, ―The Complete Reference Python‖, 4th Edition, McGraw Hill,2018
4. Allen B. Downey, ―Think Python, Second Edition, O'Reilly Media, 2017.

Web References:

https://onlinecourses.nptel.ac.in/noc22_cs26/preview

https://onlinecourses.swayam2.ac.in/cec22_cs20/preview

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DIGITAL ELECTRONICS AND MICRO PROCESSORS LAB

(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0411P	0:0:3:0	1.5	CIE: 30 SEE:70	3 Hours	ESC

Course Objectives:

This course will enable students to:

- To understand all the concepts of Logic Gates and Boolean Functions.
- To learn about Combinational Logic and Sequential Logic Circuits.
- To design logic circuits using Programmable Logic Devices.
- To understand basics of 8086 Microprocessor
- To understand architecture of 8085 & 8086 Microprocessor
- To learn Assembly Language Programming of 8086.

Course Outcomes(CO):

On completion of this course, student will be able to

- Identify the various digital ICs and understand their operation.
- Use Boolean laws and K-map to simplify the digital circuits.
- Demonstrate the basic digital circuits and verify their operation.
- Interpret the hardware architecture and assembly language programming using MASM.
- Execute arithmetic and data transfer operations using MASM in 8086.
- Implement some basic operations using Aurdino on IoT development trainer kit.

Syllabus | **Total Hours:48**

List of Experiments

Note: Minimum of 12 (6+6) experiments shall be conducted from both the sections given below:

DIGITAL ELECTRONICS:

Experiment-1

- Verification of Truth Table for AND, OR, NOT, NAND, NOR and EX-OR gates.

Experiment-2

- Realization of NOT, AND, OR, EX-OR gates with only NAND and only NOR gates.

Experiment-3

- Karnaugh map Reduction and Logic Circuit Implementation.

Experiment-4

- Verification of DeMorgan's Laws.

Experiment-5

- Implementation of Half-Adder and Half-Subtractor.
- Implementation of Full-Adder and Full-Subtractor.

Experiment-6

- Four Bit Binary Adder
- Four Bit Binary Subtractor using 1's and 2's Complement.

MICROPROCESSORS (8086 Assembly Language Programming)

Experiment-7

- 8 Bit Addition and Subtraction.
- 16 Bit Addition.

Experiment-8

- BCD Addition.
- BCD Subtraction.

Experiment-9

- 8 Bit Multiplication.
- 8 Bit Division.

Experiment-10

- Searching for an Element in an Array.
- Sorting in Ascending and Descending Orders.
- Finding Largest and Smallest Elements from an Array.

Text Books:

1. M. Morris Mano, Michael D. Ciletti, Digital Design, Pearson Education, 5th Edition, 2013.
2. Anil K. Maini, Digital Electronics: Principles, Devices and Applications, John Wiley & Sons, Ltd., 2007.

Reference Books:

1. N. Senthil Kumar, M. Saravanan, S. Jeevanathan, Microprocessor and Microcontrollers, Oxford Publishers, 2010.
2. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2nd edition, 2006.
3. Thomas L. Floyd, Digital Fundamentals – A Systems Approach, Pearson, 2013.
4. Charles H. Roth, Fundamentals of Logic Design, Cengage Learning, 5th, Edition, 2004.
5. D.V.Hall, Microprocessors and Interfacing. TMGH, 2nd edition, 2006.
6. Kenneth. J. Ayala, The 8051 microcontroller, 3rd edition, Cengage Learning, 2010

Web References:

1. https://www.vlab.co.in/

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DESIGN AND ANALYSIS OF ALGORITHMS LAB
(Common to CSE,AI&ML,DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0524P	0:0:3:0	1.5	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- Learn data structures for various applications.
- Implement different operations of data structures by optimizing the performance.
- Develop applications using Greedy, Divide and Conquer, dynamic programming.
- Implement applications for backtracking algorithms using relevant data structures.

Course Outcomes(CO):

On completion of this course, student will be able to

- To apply Divide and Conquer method to different problems and implement them.
- To apply Greedy Method to different problems and compute their time complexity.
- To apply Dynamic Programming method to different problems and implement them .
- To apply Backtracking method to different real-world problems.

Syllabus | **Total Hours:48**

List of Experiments

1. Implementation of binary search
2. Implement of quick sort
3. Implementation of Finding Maximum and minimum
4. Implementation of Optimal solution for a Knap Sack Problem using Greedy Method.
5. Implementation of minimum cost spanning tree using Prim‟s Algorithm.
6. Implementation of minimum cost spanning tree using Kruskal‟s Algorithm.
7. Implementation of All pairs shortest path problem using dynamic programming.
8. Implementation of Optimal solution for a 0/1 Knap Sack Problem using dynamic programming.
9. Implementation of sum of subsets problem using back tracking.
10. Implementation of n-queen's problem using back tracking.

Reference Books:

1. Y Daniel Liang, “Introduction to Programming using Python”, Pearson.
2. Benjamin Baka, David Julian, “Python Data Structures and Algorithms”, Packt Publishers,2017.
3. Rance D. Necaise, “Data Structures and Algorithms using Python”, Wiley Student Edition

Web Reference:

1. http://cse01-iiith.vlabs.ac.in/
2. http://peterindia.net/Algorithms.html

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HTML and Java Script (Skill Oriented Course)
(Common to CSE,AI&ML,DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0511	1:0:2:0	2	CIE:30 SEE:70	3 Hours	SC

Course Objectives:

This course will enable students to:

- Learn website development using HTML, CSS, and JavaScript.
- Understand the concepts of responsive web development using the bootstrap framework
- Learn the frame concepts tothewebsites and interactive websites.
- Discover how development process to use Google Charts to provide a better way to visualize data on a website
- Learn Content Management Systems to speed the development process

Course Outcomes (CO):

On completion of this course, student will be able to

- CO1Construct websites with valid HTML, CSS.
- Create responsive monitors.
- Develop websites using jQuery and bootstrap to provide interactivity and engaging user experiences
- Design and Develop JavaScript applications.
- Embed Google chart tools in a website for better visualization of data.
- Design and develop web applications using Content Management Systems like Word Press

Syllabus	Total Hours:48

List of Experiments

Experiment-1:

HTML: What is a browser, Internet concepts, Introduction to HTML, Basic structure of HTML document, Creating an HTML document, Mark up Tags, Heading-Paragraphs, and Line Breaks HTML Tags.

Task: Design HTML page to display different heading tags and scroll college name as a message.

Experiment-2:

Introduction to elements of HTML, Working with Text, Lists, Hyperlinks, Images, Multimedia.

Task: Design HTML page to display the list of departments in college by using ordered and unordered list.

Experiment-3:

HTML(continued):HTML Tables

Task: Design HTML page to display Class Timetable

Experiment-4:

HTML Frames and Frameset.

Task: Design college website.

Experiment-5:

HTML Form Elements.

Task: Design a Student Registration web page using forms.

Experiment-6:

Cascading Style Sheets(CSS):CSS Properties, Types of CSS, Selectors, box model ,Pseudo-elements, z-index

Task: Apply CSS on student registration form.

Experiment-7:

Bootstrap - CSS Framework: Layouts (Containers, Grid system), Forms, Other Components

Task: Style the student registration Form designed in Module-5still more beautiful using Bootstrap CSS (Re-size browser and check how the webpage displays in mobile resolution).

Experiment-8:

HTTP & Browser Developer Tools: Understand HTTP Headers (Request & Response Headers), URL & its Anatomy, Developer Tools: Elements/Inspector, Console, Network, Sources, performance, Application Storage.

Task: Analyze various HTTP requests (initiators, timing diagrams, responses) and identify problems

Experiment-9:

JavaScript: Variables, Data Types, Operators.

Task: Design a simple JavaScript program to perform arithmetic operations.

Experiment-10:

JavaScript objects, conditions, loops and functions.

Task: Write JavaScript to find the factorial of a given number and generate the Fibonacci series (Recursive and non-Recursive).

Experiment-11:

JavaScript arrays and pop-up box.

Task: Validate all Fields and Submit the student registration Form designed in Module-5

Reference Books:

1. Deitel and Deitel and Nieto, ―Internet and World Wide Web-How to Program, Prentice Hall, 5th Edition,2011.
2. Web Technologies, Uttam K.Roy, Oxford Higher Education., 1st edition, 10th impression, 2015.
3. Stephen Wynkoop and John Burke―Running a Perfect Website‖,QUE,2nd Edition,1999.
4. Jeffrey C and Jackson, ―Web Technologies A Computer Science Perspective Pearson Education, 2011.
5. Gopalan N.P. and Akilandeswari J.,―WebTechnology,PrenticeHallofIndia,2011.

Web Reference:

1. HTML:https://html.spec.whatwg.org/multipage/
2. HTML:https://developer.mozilla.org/en-US/docs/Glossary/HTML5
3. CSS:https://www.w3.org/Style/CSS/
4. Bootstrap-CSSFramework:https://getbootstrap.com/
5. Browser Developer Tools:https://developer.mozilla.org/enUS/docs/Learn/Common_questions/What_are_browser_developer_tools
6. Javascript:https://developer.mozilla.org/en-US/docs/Web/JavaScript
7. JQuery:https://jquery.com
8. GoogleCharts:https://developers.google.com/chart
9. Wordpress:https://wordpress.com

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CONSTITUTION OF INDIA
(Common **to CSE, AI&ML, CS, DS, ECE, EEE, ME**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0030T	2:0:0:0	0	CIE: 30	-	MC

Course Objectives:

This course will enable students to:

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and Election Commission of India.
- To understand the central-state relation in financial and administrative control

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand historical background of the constitution making and its importance for building a democratic India.
- Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
- Understand the value of the fundamental rights and duties for becoming good citizen of India.
- Analyze the decentralization of power between central, state and local self-government
- Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

Syllabus		Total Hours:48
Module-I	**Introduction to Indian Constitution**	**10Hrs**

Introduction to Indian Constitution – Constitution -Meaning of the term - Indian ConstitutionSources and constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.

Module-II	**Union Government and its Administration Structure of the Indian Union**	**9Hrs**

Union Government and its Administration Structure of the Indian Union - Federalism – Centre State relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat –Lok Sabha - Rajya Sabha - The Supreme Court and High Court - Powers and Functions

Module-III	**State Government and its Administration**	**10Hrs**

State Government and its Administration - Governor - Role and Position -CM and Council of ministers - State Secretariat-Organization Structure and Functions.

Module-IV	**Local Administration**	**10Hrs**

Local Administration - District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation Pachayati Raj - Functions– PRI –Zilla Parishath - Elected officials and their roles – CEO, Zilla Parishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

Module-V	**Election Commission**	**9Hrs**

Election Commission - Election Commission- Role of Chief Election Commissioner and Election Commissione rate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women

Text Books:

1. Durga Das Basu, "Introduction to the Constitution of India", Prentice – Hall of India Pvt. Ltd.. New Delhi
2. Subash Kashyap, "Indian Constitution", National Book Trust3. R RGaur,RAsthana,GP

Reference Books:

1. H.M.Sreevai, "Constitutional Law of India", 4th edition in 3 volumes
2. J.A. Siwach, "Dynamics of Indian Government & Politics"
3. M.V. Pylee, "Indian Constitution", Durga Das Basu, Human Rights in ConstitutionalLaw, Prentice – Hall of India Pvt. Ltd.. New Delhi
4. J.C. Johri, Indian Government and Politics Hans
5. M.V. Pylee, "Indian Constitution)

Web References:

1. nptel.ac.in/courses/109104074/8
2. nptel.ac.in/courses/109104045/
3. nptel.ac.in/courses/101104065/
4. www.hss.iitb.ac.in/en/lecture-details
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Semester-4 (Theory-5, Lab-3, SC-1, MC-1)							
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	BSC	22A0017T	Discrete mathematical structures	3	0	0	3
2	PCC	22A0512T	Database Management Systems	3	0	0	3
3	PCC	22A0507T	Object Oriented Programming Through JAVA	3	0	0	3
4	PCC	22A3301T	Artificial Intelligence	3	0	0	3
5	HSC	22A0021T	Universal Human Values	3	0	0	3
6	PCC(LAB)	22A0515P	Database Management Systems Lab	0	0	3	1.5
7	PCC(LAB)	22A0509P	Object Oriented Programming Through JAVA Lab	0	0	3	1.5
8	PCC(LAB)	22A3302P	Artificial Intelligence Lab	0	0	3	1.5
9	SC	22A0518	**Skill Oriented Course** Linux Programming	1	0	2	2
10	MC	22A0028T	**Mandatory Course** Environmental Science	2	0	0	0
						Total credits	**21.5**

Category	**Credits**
Basic Science Course (BSC)	3
Humanities and Social Sciences Course (HSC)	3
Professional Core Courses (PCC)	13.5
Skill oriented Course(SC)	2
Total	21.5

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DISCRETE MATHEMATICAL STUCTURES
(Common to CSE, AI&ML, DS, CS, CE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0017T	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	BSC

Course Objectives:

- Introduce the concepts of mathematical logic and gain knowledge in sets, relations and functions
- Solve problems using counting techniques and combinatorics
- Introduce generating functions and recurrence relations.
- Use Graph Theory for solving real world problems

Course Outcomes (CO):

On completion of this course, student will be able to:

- Apply mathematical logic to solve problems.
- Understand the concepts and perform the operations related to sets, relations and functions.
- Gain the conceptual background needed and identify structures of algebraic nature.
- Apply basic counting techniques to solve combinatorial problems.
- Formulate problems and solve recurrence relations.
- Apply Graph Theory in solving computer science problems.

Syllabus		Total Hours:48
Module – I	**Mathematical Logic**	**10 Hrs**
Introduction, Statements and Notation, Connectives, Well-formed formulas, Tautology, Duality law, Equivalence, Implication, Normal Forms, functionally complete set of connectives, Mathematical Induction.		
Module – II	**Set Theory**	**10 Hrs**
Basic Concepts of Set Theory, Relations and Ordering, The Principle of Inclusion-Exclusion, Pigeon hole principle and its application, Functions composition of functions, Inverse Functions, Recursive Functions, Lattices and its properties. Algebraic structures: Algebraic Systems-Examples and General Properties, Semigroups and Monoids, groups, sub groups, homomorphism, Isomorphism.		
Module – III	**Elementary Combinatorics**	**9 Hrs**
Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial Theorems.		
Module – IV	**Recurrence Relations**	**9 Hrs**
Calculating Coefficients of Generating Functions, Recurrence relations, Solving Recurrence Relations by Substitution, The Method of Characteristic roots, Solutions of homogeneous Recurrence Relations.		
Module – V	**Graph Theory**	**10 Hrs**
Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four-Color Problem.		

Text Books:

1. Joel. Mott, Abraham Kandel and Theodore P. Baker, Discrete Mathematics for Computer Scientists &Mathematicians, 2nd Edition, Pearson Education.
2. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2002.

Reference Books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, McGraw Hill Education (India) Private Limited.
2. Graph Theory with Applications to Engineering and Computer Science by Narsingh Deo.

Web References:

http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf

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DATABASE MANAGEMENT SYSTEMS
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0512T	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- To teach the role of database management system in an organization.
- To design databases using data modeling and Logical database design techniques.
- To construct database queries using relational algebra and calculus and SQL.
- To explore implementation issues in database transaction.
- To familiarize database security mechanisms.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the Basic Concepts of Database languages, Relational model, SQL.
- Choose the specific Data models for large enterprise database design.
- Analyze the data efficiently through SQL instructions.
- Apply Normal forms on database for eliminating the redundancy.
- Demonstrate the Basic Concepts of transaction management techniques.
- Apply concurrency control techniques for Database recovery.

Syllabus		Total Hours:48
Module-I	**Introduction to Database concepts and Modeling**	**10Hrs**

Conceptual Modeling Introduction: Introduction to Data bases, Purpose of Database Systems, View of Data, Data Models, Database Languages, Database Users, Database Systems architecture.

The Entity-Relationship Model: Overview of Database Design, Beyond ER Design, Entities, Attributes and Entity sets, Relationships and Relationship sets, Conceptual Design with the ER Model.

Module-II	Relational Model, Relational Algebra	9Hrs

Relational Model: Introduction to the Relational Model – Integrity Constraints over Relations, Enforcing Integrity constraints, querying relational data, Logical data base Design, Views.

Relational Algebra: Introduction to Relational algebra, selection and projection, set operations, renaming, joins, division.

Module-III	SQL	10Hrs

SQL: Basic form of SQL Query, DDL, DML queries, Views in SQL, Joins, Nested & Correlated queries, Operators, predefined functions, Aggregate Functions.

PL/SQL: Introduction, Functions & Procedures, Triggers, Cursors.

Module-IV	Normalization	9Hrs

Relational database design: Introduction, Functional Dependencies (FDs), Normalization for relational databases: 1NF, 2NF, 3NF and BCNF, Basic definitions of Multi Valued Dependencies, 4NF and 5NF.

Module-V	Transaction Management &Concurrency Control and Recovery	10Hrs

Transaction Management: Transaction processing, Transaction Concept, Transaction States, Implementation of Atomicity and Durability, Concurrent Executions.

Concurrency Control: Lock-Based Protocols, Timestamp- Based Protocols, Validation-Based Protocols, Multiple Granularity.

Recovery: Failure Classification, Recovery and Atomicity, Log-Based Recovery.

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, 6th Edition, Tata McGraw-Hill Publishing Company,2017.
2. Raghu Ramakrishnan, Database Management System, 3rd Edition, Tata McGraw-Hill Publishing Company, 2014.

Reference Books:

1. Peter Rob, A.Ananda Rao, Corlos Coronel, Database Management Systems (for JNTU), Cengage Learning, 2011.
2. Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, Database System Implementation, 1st Edition, Pearson Education, United States, 2000.
3. E. Ramez and Navathe, Fundamental of Database Systems, 7th Edition, Pearson Education
4. R.P. Mahapatra & Govind Verma, Database Management Systems, Khanna Publishing House, 2016.
5. Carlos Coronel and Steven Morris, Database Systems: Design, Implementation, and Management, 12th edition, Cengage Learning,2016.
6. John V. ,Absolute beginner's guide to databases, Petersen, QUE

Web References:

1. https://www.coursera.org/learn/database-management
2. https://www.coursera.org/learn/sql-data-science
3. https://www.w3schools.com/sql/
4. https://www.youtube.com/watch?v=fHAfc7Hjq28&list=PLWPirh4EWFpGrpcMfZ6UcdI786QdtSxV8
5. https://www.youtube.com/watch?v=HwmEcudlv44&list=PL4OCRJojkV1jN-Ed6RkQpWfBvqe0utRd6
6. http://www.w3schools.in/dbms/
7. https://www.geeksforgeeks.org/dbms/
8. https://www.javatpoint.com/dbms-tutorial
9. https://www.edureka.co/blog/dbms-tutorial/

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OBJECT ORIENTED PROGRAMMING THROUGH JAVA

(Common to CSE,AI&ML,DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0507T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- To understand object-oriented principles like abstraction, encapsulation, inheritance, polymorphism and apply them in solving problems.
- To understand the principles of inheritance and polymorphism and demonstrate how they relate to the design of abstract classes.
- To implement the concept of packages, interfaces, exception handling and concurrency mechanism.
- Demonstrate on the multi-tasking by using multiple threads.
- To understand the design of Graphical User Interface using applets and swing controls.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the Object-Oriented Programming Principles to develop java programs.
- Apply code reusability through inheritance, packages and interfaces.
- Inspect Exception Handling and multi-threading mechanisms in real time applications.
- Develop applications by using I/O streams for better performance.
- Construct GUI based applications using applets, AWT and swings for internet and system-based applications.
- Compare AWT and Swing classes for GUI based applications.

Syllabus		Total Hours:48
Module-I	**Introduction**	**10Hrs**

Introduction: History and Evolution of Java, Java Buzzwords, Object Oriented Programming Principles, A first Simple Program, Data types, Variables, Type Conversion and Casting, Arrays, Operators, Control Statements, Classes, Objects, Methods, Constructors this key word, Garbage Collection, Parameter Passing, Method Overloading, Constructor Overloading. String handling methods.

Module-II	Inheritance, Packages & Interfaces	9Hrs

Inheritance: Basics, Using Super, Creating Multilevel hierarchy, Method overriding, Dynamic Method Dispatch, Using Abstract classes, using final with inheritance.
Packages: Basics, finding packages and CLASSPATH, Access Protection, Importing packages.
Interfaces: Definition, Implementing Interfaces, Extending Interfaces, Applying Interfaces.

Module-III	Exception handling & Multithreading	10Hrs

Exception handling - Fundamentals, Exception types, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built-in exceptions, creating own exception subclasses.
Multithreading: The Java thread model, creating threads, Thread priorities, Synchronizing threads, Interthread communication.

Module-IV	Stream based I/O& Applet	9Hrs

Stream based I/O (java.io) – The Stream classes-Byte streams and Character streams, reading console Input and Writing Console Output, File class, Reading and Writing Files, Random access file operations Scanner class.
Applet: Basics, Architecture, Applet Skeleton, requesting repainting, using the status window,

passing parameters to applets

Module-V	Introducing AWT & Swings	10Hrs

Introducing AWT: AWT Classes, Window Fundamentals, Working with Frame Windows, Working with Graphics, Working with Color, Event Handling.

GUI Programming with Swings –Swing components and containers, layout managers, using a push button, jtextfield, jlabel.

Text Books:

1. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
2. Core Java: An Integrated Approach – Dr R Nageswara Rao.

Reference Books:

1. Object Oriented Programming through Java, P.Radha Krishna, Universities Press.
2. Java and Object Orientation, an introduction, John Hunt, second edition, Springer.
3. Maurach's Beginning Java2 JDK 5, SPD.
4. Introduction to Java Programming 7/e, Brief version, Y.Daniel Liang, Pearson
5. Java How to Program, 7/E: Paul Deitel, Deitel& Associates, Inc

Web References:

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ARTIFICIAL INTELLIGENCE

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3301T	3: 0:0:0	3	CIE: 30SEE:70	3Hours	ESC

Course Objectives:

This course will enable students to:

1. To understand the importance of the task environment in determining the appropriate agent design.
2. To teach the concepts of state space representation, heuristic search together with the time and Space complexities.
3. To describe the various types of learning methods and natural language processing.
4. To provide basic knowledge on natural language for communication and perception.
5. To understand the basic knowledge on robotics and philosophical foundations of AI.

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand the role of agents, environments and relationship among them. (BL-2)
- Examine various problem-solving approaches in searching and learning. (BL-2)
- Demonstrate the use of Reinforcement learning and natural language processing.(BL-3)
- Understand the natural language for communication and object perception. (BL-2)
- Demonstrate the role of Robot in various applications and list out philosophical issues in AI.(BL-2)

Syllabus		Total Hours:45
Module-I	**Introduction to Artificial Intelligence**	**9Hrs**

Introduction: AI Definition, Foundations of Artificial Intelligence, History of Artificial Intelligence. Intelligent Agents: Agents and Environments, Good Behavior Concept of Rationality, Nature of Environments, The Structure of Agents. Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform-cost search, DFS: Informed (Heuristic) Search strategies: Greedy BFS, A* search.

Module-II	**Problem Solving beyond classical search and Learning**	**9Hrs**

Local search algorithms and optimization problems**:** Hill-climbing, simulated annealing; Local Search in Continuous Spaces, Searching with Non-Deterministic Actions, Searching with partial observations, Online Search Agents and Unknown Environment.

Module-III	**Reinforcement Learning and Natural Language Processing**	**9Hrs**

Introduction, Passive Reinforcement Learning, Active reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of Reinforcement Learning**,** Language Models, Text Classification, Information Retrieval, Information Extraction.

Module-IV	**Natural Language for communication and Perception**	**9Hrs**

Phrase structure grammars, Syntactic analysis, Augmented grammars and semantic Interpretation, Machine translation, Speech Recognition. Image formation, Early Image Processing Operations, Object recognition by appearance, Reconstructing the 3D World, Object recognition from structural information, Using Vision**.**

Module-V	**Robotics and Philosophical foundations**	**9Hrs**

Introduction, Robotic Hardware, Robotic Perception, Planning to move, Planning uncertain movements, Moving, Robotic software architectures, and application domains.

Week AI, Strong AI, Ethics and Risks of AI, Agent Components and Agent architectures, Are we going in the right direction, What if AI does succeed.

Text Books:

1. Stuart Russell and Peter Norvig, Artificial Intelligence A Modern Approach, 3rdEdition, Pearson Education.
2. Elaine Rich, Kevin Knight & Shivashankar B Nair, "Artificial Intelligence", 3rd - Edition, McGraw Hill Education.

Reference Books:

1. Patrick Henny Winston, Artificial Intelligence, 3rdEdition, Pearson Education.
2. Patterson, Introduction to Artificial Intelligence and Expert Systems, 1st Edition Pearson India.
3. George F Lugar, Artificial intelligence, structures and Strategies for Complex problem solving,6thed, PEA, 2008 .
4. Poole, D. and Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press. 2010
5. Padhy, N.P , Artificial Intelligence and Intelligent Systems,. 2009, Oxford University Press.

Web References:

https://www.tutorialspoint.com/artificial_intelligence/index.htm
https://www.javatpoint.com/artificial-intelligence-ai
https://www.youtube.com/watch?v=JMUxmLyrhSk

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UNIVERSAL HUMAN VALUES
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0021T	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	HSC

Course Objectives:

This course will enable students to:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

Course Outcomes (CO):

On completion of this course, student will be able to

- Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able to apply what they have learnt to their own self in differentday-to-day settings in real life, at least a beginning would be made in this direction.

Syllabus		Total Hours:48
Module-I	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**	**10Hrs**

Purpose and motivation for the course, recapitulation from Universal Human Values-I
Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
Continuous Happiness and Prosperity- A look at basic Human Aspirations
Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority
Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
Method to fulfil the above human aspirations: understanding and living in harmony at various levels.
Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Module-II	**Understanding Harmony in the Human Being - Harmony in Myself!**	**9Hrs**

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
Understanding the needs of Self ('I') and 'Body' - happiness and physical facility Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) Understanding the characteristics and activities of 'I' and harmony in 'I'
Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Module-III	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship**	**10Hrs**

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
Understanding the meaning of Trust; Difference between intention and competence

Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.
Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module-IV	**Understand the Nature and Existence hole existence as Coexis**	**9Hrs**

Understanding the harmony in the Nature
Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature,Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
Holistic perception of harmony at all levels of existence.
Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can beused), pollution, depletion of resources and role of technology etc.

Module-V	**Implications of the above Holistic Understanding of Harmony on Professional Ethics**	**10Hrs**

Natural acceptance of human values Definitiveness of Ethical Huma Conduct
Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
Case studies of typical holistic technologies, management models and production systems Strategy for transition from the present state to Universal Human Order:
a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers
b. At the level of society: as mutually enriching institutions and organizations Sum up.
Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

Text Books:

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values andProfessional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1.Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.

2.A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.The Story of Stuff (Book).

3.Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"

4.E. FSchumacher. "Small is Beautiful"Slow is Beautiful –Cecile Andrews

5.J C Kumarappa "Economy of Permanence" Pandit Sunderlal "Bharat Mein Angreji Raj" Dharampal, "Rediscovering India"

6.Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"India Wins Freedom - Maulana Abdul Kalam Azad Vivekananda - Romain Rolland(English) Gandhi - Romain Rolland (English)

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DATABASE MANAGEMENT SYSTEMS LAB
(Common to CSE, AI&ML, CS, DS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0515P	0:0:3:0	1.5	CIE: 30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- Illustrate the different issues involved in the design and implementation of a databasesystem.
- Use data manipulation language to query, update, and manage a database.
- Design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Course Outcomes (CO):

On completion of this course, student will be able to

- Apply database tools to perform various operations for the given database.
- Design database and retrieve information from database
- Develop ER diagrams and normalize the solution of a database.
- Implement the integrity constraints and PL/SQL programs to build efficient databases.
- Develop solutions for database applications using procedures and functions.
- Develop solutions for database applications using cursors and triggers.

Syllabus | **Total Hours: 48**

Experiment 1: Practice session: Students should be allowed to choose appropriate DBMS software, install it, configure it and start working on it. Create sample tables, execute some queries, use SQLPLUS features, and use PL/SQL features like cursors on sample database.
Experiment 2: Draw E-R diagram for library management system
Experiment 3: Draw E-R diagram for university management system
Experiment 4: Draw E-R diagram for hospital management system
Experiment 5: Implement all DDL Commands
Experiment 6: Implement all DML Commands
Experiment 7: Implement all TCL and DCL Commands
Experiment 8: a) Create relationship between the tables using Nested Queries
b) Implement different types of joins on tables
Experiment 9: Implement set operations on tables
Experiment 10: Create a table and apply various key constraints.
Experiment 11: Views – Create a Virtual table based on the result set of an SQL statement.
Experiment 12: a) Write a PL/SQL program to swap two numbers.
b) Write a PL/SQL program to find the largest of three numbers.
Experiment 13: a) Write a PL/SQL program to find the total and average of 6 subjects and display the grade.
b) Write a PL/SQL program to find the sum of digits in a given number.
Experiment 14: a) Write a PL/SQL program to display the number in reverse order.
b) Write a PL/SQL program to check whether the given number is prime or not.
c) Write a PL/SQL program to find the factorial of a given number.
Experiment 15: Write PL/SQL programs to implement procedures and functions.
Experiment 16: Write a PL/SQL Program on cursors
Experiment 17: Write a PL/SQL Program to implement triggers

Text Books:

1. Raghu Ramakrishnan, Johannes Gehrke, Jeff Derstadt, Scott Selikoff and Lin Zhu,Database Management Systems solutions manual, third Edition, 2013.

References Books:

1. RamezElmasri, Shamkant, B. Navathe, “Database Systems”, Pearson Education, 6th Edition, 2013.
2. Peter Rob, Carles Coronel, “Database System Concepts”, Cengage Learning, 7th Edition, 2008.

Web References:

http://www.scoopworld.in

http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php

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OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0509P	0:0:3:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- Practice object-oriented programs and build java applications.
- Implement java programs for establishing interfaces.
- Implement sample programs for developing reusable software components.
- Create database connectivity in java and implement GUI applications.

Course Outcomes(CO):

On completion of this course, student will be able to

- Recognize the Java programming environment.
- Develop efficient programs using multithreading.
- Design reliable programs using Java exception handling features.
- Extend the programming functionality supported by Java.
- Select appropriate programming constructs to solve a problem.

Syllabus | **Total Hours:48**

List of Experiments

Experiment-1

a. Installation of Java software, study of any Integrated development environment, Use Eclipse or NetBeans platform and acquaint with the various menus. Create a test project, add a test class and run it.

See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods and classes. Try debug step by step with java program to find prime numbers between 1 to n.

b. Write a to Java program that prints all real solutions to the quadratic equation ax2+bx+c=0. Read in a, b, c and use the quadratic formula.

Experiment-2

a. Write a Java program find the factorial of given number
b. Write a Java program to find whether given number is prime or not
c. The Fibonacci sequence is defined by the following rule. The first two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. Write a java program that uses both recursive and non-recursive functions.

Experiment -3

a. Write a Java program to find the sum of individual digits of a number
b. Write a java program for Arithmetic calculator using switch case menu

Experiment -4

a. Write a java program to multiply two given matrices.
b. Write a java program to implement method overloading and constructors overloading.
c. Write a java program to implement method overriding.

Experiment -5

a. Create a Java class called Student with the following details as variables within it.USN, Name, Branch, Phone. Write a Java program to create n Student objects and print the USN, Name, Branch, and Phone of these objects with suitable headings.
b. Write Java program on use of inheritance, preventing inheritance using final, abstract classes

Experiment -6

a. Write a Java program to implement exception handling.
b. Write a java program to split a given text file into n parts. Name each part as the name of the original file followed by .part where n is the sequence number of the part file.

Experiment -7

a. Write a java program that displays the number of characters, lines and words in a text file.
b. Write a java program that reads a file and displays the file on the screen with line number before each line

Experiment -8

Write a program that creates a user interface to perform integer division. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 and Num2 were not integers, the program would throw a Number Format Exception. If Num2 were zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box

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Experiment -9

a. Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.
b. Write a java program that implements inter thread communication.

Experiment -10

a. Develop an applet in Java that displays a simple message.
b. Develop an applet in Java that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named "Compute" is clicked.

Experiment -11

a. Develop a Java application to implement the opening of a door while opening man should present before hut and closing man should disappear.
b. Develop a java application for simple calculator.

Experiment -12

a. Develop a Java application to demonstrate the mouse event handlers.
b. Develop a Java application by using Swings.

Reference Books:

1. P. J. Deitel, H. M. Deitel, "Java for Programmers", Pearson Education, PHI, 4th Edition, 2007.
2. P. Radha Krishna, "Object Oriented Programming through Java", Universities Press, 2nd Edition, 2007
3. Bruce Eckel, "Thinking in Java", Pearson Education, 4th Edition, 2006.
4. 4. Sachin Malhotra, Saurabh Chaudhary, "Programming in Java", Oxford University Press, 5th Edition, 2010

Web Reference:

1. www.niecdelhi.ac.in
2. https://www.linkedin.com/in/achin-jain-85061412
3. www.rank1infotech.com

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ARTIFICIAL INTELLIGENCE LAB					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A3302P	**0:0:3:0**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

This course will enable students to:

- To teach the methods of implementing algorithms using artificial intelligence techniques
- To illustrate search algorithms
- To demonstrate the building of intelligent agents

Course Outcomes (CO):

After completion of this course, students will be able to:

- Implement search algorithms
- Solve Artificial intelligence problems
- Implementation of dynamic programming
- Implementation of optimization techniques
- Design chatbot and virtual assistant
- Design humanoid robot

Syllabus	**Total Hours:36**

List of Experiments:A

Experiment-1: Write a program to implement DFS and BFS
Experiment-2: Write a Program to find the solution for traveling salesman Problem
Experiment-3: Write a program to implement Simulated Annealing Algorithm
Experiment-4: Write a program to find the solution for the Wumpus world problem
Experiment-5: Write a program to implement 8 puzzle problem
Experiment-6: Write a program to implement Towers of Hanoi problem
Experiment-7: Write a program to implement A* Algorithm
Experiment-8: Write a program to implement Hill Climbing Algorithm
Experiment-9: Build a Chatbot using AWS Lex, Pandora bots.
Experiment-10: Build a bot that provides all the information related to your college.
Experiment-11: Build a virtual assistant for Wikipedia using Wolfram Alpha and Python
Experiment-12: Implementation of humanoid Robot using AI techniques.

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LINUX PROGRAMMING (SKILL)
(Common to CSE, AIML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0518	1:0:2:0	2	CIE: 30 SEE:70	3 Hours	SC

Course Objectives:

This course will enable students to:

- Analyze the Linux utilities and Linux environment.
- Learn the fundamentals of shell scripting/programming.
- Understand system administration processes by providing a hands-on experience.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the Basic commands and utilities in Linux Environment
- Identify and use Linux utilities to create and manage simple file processing operations,
- organize directory structures with appropriate security.
- Analyze the Linux utilities and Linux environment.
- Use shell script to automate different tasks as Linux.
- Illustrate file processing operations such as standard I/O and formatted I/O.
- Develop various client server applications using TCP or UDP protocols.

Syllabus | **Total Hours:48**

Introduction to Linux/Unix:- Architecture of Unix, Features of Unix , Unix Commands – man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip, : User and session management commands: useradd, groupadd, userdel, groupdel.

Linux/Unix Utilities:- Introduction to unix file system, file handling utilities, vi editor, Text processing utilities and backup utilities: commands to be covered are tail, head, sort, nl, uniq, sed, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr and awk.
Unix Session, Standard Streams, Redirection, Pipes.

Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count characters, Words or Lines, Comparing Files

Shell Programming:
Introduction to shells, Variables, input and output, Environment variables, Basic script concepts, Expressions, Decision making and repetition etc.

Socket programming: Client Sever Implementation Using Sockets and Shared Memory

Experiment 1: Study and Practice on various commands like man, echo, printf, clear, script, passwd, cal,uname, who, date, tty, stty, pwd, who,.

Experiment 2: Study and Practice on various commands like cd, mkdir, rmdir cp, mv, ln, rm, unlink, du, df, mount, umount, find, unmask, ulimit, ps.

Experiment 3: Study and Practice on various commands like tail, head, sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr.

Experiment 4:

Session-1

a) Log into the system
b) Use vi editor to create a file called myfile.txt which contains some text.
c) Correct typing errors during creation.
d) Save the file
e) logout of the system

Session-2

a) Log into the system
b) open the file created in session 1
c) Add some text
d) Change some text
e) Delete some text
f) Save the Changes
g) Logout of the system

Experiment 5:

a) Login to the system
b) Use the appropriate command to determine your login shell
c) Use the /etc/passwd file to verify the result of step b.
d) Use the who command and redirect the result to a file called myfile1. Use the more command to see the contents of myfile1.
e) Use the date and who commands in sequence (in one line) such that the output of date will display on the screen and the output of who will be redirected to a file called myfile2. Use the more command to check the contents of myfile2.

Experiment 6:

a) Log into the system
b) Use the cat command to create a file containing the following data. Call it mytable use tabs to separate the fields.

1425	Ravi	15.65
4320	Ramu	26.27
6830	Sita	36.15
1450	Raju	21.86

c) Use the cat command to display the file, mytable.
d) Use the vi command to correct any errors in the file, mytable.
e) Use the sort command to sort the file mytable according to the first field. Call the sorted file my table (same name)
f) Print the file mytable
g) Use the cut and paste commands to swap fields 2 and 3 of mytable. Call it my table (same name)
h) Print the new file, mytable
i) Logout of the system.

Experiment 7:

a) Write a sed command that deletes the first character in each line in a file.
b) Write a sed command that deletes the character before the last character in each line in a file.
c) Write a sed command that swaps the first and second words in each line in a file.

Experiment 8:

1. Write a shell script that accepts a file name, starting and ending line numbers as arguments and displays all the lines between the given line numbers.
2. Write a shell script that deletes all lines containing a specified word in one or more files supplied as arguments toit.

Experiment 9:

1. Write a program to generate Fibonacci series
2. Write a program to check whether given string is palindrome or not
3. Write a shell script to find factorial of a given integer.

Experiment 10:

1. Write a shell script that receives any number of file names as arguments checks if every argument supplied is a file or a directory and reports accordingly. Whenever the argument is a file, the number of lines on it is also reported.
2. Write a shell script to list all of the directory files in a directory

Experiment 11:

1. Write an awk script to count the number of lines in a file that do not contain vowels.
2. Write an awk script to find the number of characters, words and lines in a file.
3. Write an awk script to calculate average marks of each student.
4. Write an awk script to replace a string in a file.

Experiment12:

Simulate the following commands

a) Simulate cat command b) Simulate cp command

Experiment 13:

1. Write client and server programs (using java) for interaction between server and client processes using Unix domain sockets.
2. Write client and server programs (using java) for interaction between server and client processes using Internet domain sockets.

Reference Books:

1. Sumitabha Das, "Your Unix The Ultimate Guide", Tata McGraw-Hill, New Delhi, India, 2007.
2. B. A. Forouzan and R. F. Gilberg, "Unix and Shell Programming", Cengage Learning.
3. Robert Love, "Linux System Programming", O'Reilly, SPD.
4. Stephen G. Kochan, Patrick Wood, "Unix Shell Programming", Sams publications, 3rd Edition, 2007.
5. T. Chan, "Unix System Programming using C++", Prentice Hall India, 1999.

Web References:

https://nptel.ac.in/courses/117106113

https://archive.nptel.ac.in/courses/117/106/117106113/

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ENVIRONMENTAL SCIENCE

(Common **to CSE, AI&ML, CS, DS, ECE,EEE, ME**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0028T	2:0:0:0	0	CIE:30		MC

Course Objectives:

This course will enable students to:

- To make the students to get awareness on environment.
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life.
- To save earth from the inventions by the engineers.

Course Outcomes (CO):

On completion of this course, student will be able to

- Recognize the knowledge about environment, natural resources and different techniques involved in its conservation.
- Describe the information about different eco-systems and its functions.
- Explain the different types of bio-diversity along with values and conservation methods.
- Predict various environmental pollutions and able to design the environmental friendly process in engineering.
- Apply the sustainable development concepts in life, society and industry.

Syllabus		Total Hours:48
Module-I	**Multidisciplinary Nature of Environmental Studies and Natural Resources**	**10Hrs**

Definitions, components of Environment, Scope and Importance –Need for Public Awareness Renewable and non-renewable resources –Forest resources – Use and over – exploitation, deforestation, – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Module-II	Ecosystems	9Hrs

Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers– Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem

a. Grassland ecosystem.
b. Desert ecosystem

Module-III	Biodiversity And Its Conservation	10Hrs

Introduction Definition: genetic, species and ecosystem diversity – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values — India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching, Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Module-IV	Environmental Pollution	9Hrs

Definition, Cause, effects and control measures of:

1. air pollution
2. water pollution
3. noise pollution

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes

Module-V	Social Issues and The Environment	10Hrs

From Unsustainable to Sustainable development – Urban problems related to energy –Environment Protection Act. – Air (Prevention and Control of Pollution) act

Definition, Cause, effects and control measures of:Global warming, Acid rain, Ozone layer depletion

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain –Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Text Books:

1. Text book of Environmental Studies for Undergraduate Courses- Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies- Kaushik &Kaushik, New Age Publishers.

Reference Books:

1. Environmental studies- R.Rajagopalan, Oxford University Press
2. Comprehensive Environmental studies- J.P.Sharma, Laxmi publications.

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Semester-5 (Theory-5, Lab-2, SC-1, MC-1)							
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	PCC	22A3303T	Automata and Compiler Design	3	0	0	3
2	PCC	22A0508T	Software Engineering	3	0	0	3
3	PCC	22A0528T	Machine Learning	3	0	0	3
4	PEC	22A0534c 22A0520T 22A0522c	Professional Elective-I: 1. Big Data Technologies 2. Computer Networks 3. No SQL	3	0	0	3
5	OEC	22A0430T 22A0214Ta 22A0149T 22A0321Ta	Open Elective-I: 1. Principles of Communication Systems 2. Power Electronics 3. Building Materials 4. Automobile Engineering	3	0	0	3
6	PCC(Lab)	22A0510P	Software Engineering Lab	0	0	3	1.5
7	PCC(Lab)	22A0532P	Machine Learning Lab	0	0	3	1.5
8	SC	22A0029P	**Skill Advanced Course:** Soft Skills	1	0	2	2
9	MC	22A0526T	**Mandatory Course:** Design Thinking and Innovation	2	0	0	0
Summer Internship 2 Months (Mandatory) after second year (to be evaluated during V semester)				0	0	0	1.5
			Total credits				**21.5**
Honors / Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				**4**	**0**	**0**	**4**

Category	**Credits**
Professional Core Courses (PCC)	12
Professional Elective Courses (PEC)	3
Open Elective Courses(OEC)	3
Skill Advanced Course(SC)	2
Summer Internship	1.5
Total	21.5

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AUTOMATA AND COMPILER DESIGN					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A3303T	**3: 0:0:0**	**3**	**CIE:30SEE:70**	**3Hours**	**PCC**

Course Objectives:

This course will enable students:

- Understand formal definitions of machine models
- To illustrate finite state machines to solve problems in computing
- Understanding of formal grammars
- To learn the various phases of compiler.
- To learn the various parsing techniques.

Course Outcomes (CO):

On completion of this course, student will be able to:

- Understand the fundamental concepts of Formal Languages and Automata
- Apply the knowledge of Automata Theory, Grammars & Regular Expressions for solving various problems.
- Design of Context Free Grammar for formal language
- Discuss the major phases of compilers and use the knowledge of the Lex tool
- Develop the parsers and experiment with the knowledge of different parsers design
- Summarize various optimization techniques and examine the design issues of code generator

Syllabus		**Total Hours:48**
MODULE-I	**Finite Automata**	**10Hrs**

Why Study Automata Theory? The Central Concepts of Automata Theory, Automation, Finite Automation, Transition Systems, Acceptance of a String by a Finite Automaton, DFA, Design of DFAs, NFA, Design of NFA, Equivalence of DFA and NFA, Conversion of NFA into DFA, Finite Automata with Є-Transition, Minimization of Finite Automata, Mealy and Moore Machines, Applications and Limitation of Finite Automata..

MODULE -II	**Regular Expressions**	**9Hrs**

Regular Expressions, Equivalence of two Regular Expressions, Finite Automata and Regular Expressions, Inter Conversion, Equivalence between Finite Automata and Regular Expressions, Pumping Lemma, Closers Properties, Applications of Regular Expressions, Grammars, Classification of Grammars-Chomsky Hierarchy, Finite Automata and Regular Grammars, Regular Expressions and Regular Grammars.

MODULE -III	**Context Free Grammars**	**10Hrs**

Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols, E-Productions and Unit Productions, Normal Forms for Context Free Grammars-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.

MODULE -IV	**Introduction To Compiling**	**9Hrs**

Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols, E-Productions and Unit Productions, Normal Forms for Context Free Grammars-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.

MODULE -V	**Syntax Analysis**	**10Hrs**

Syntax Analysis: The role of the Parser, First and Follow, Predictive Parsing, LR Parsers-SLR, Canonical LR, LALR, Parser Generator(YACC).

Syntax-Directed Definition, S-Attributed SDD, L-Attributed SDD, Translation Schemes, three address code,

Principle Sources Of Code Optimizations, Issues Code generation

Text Books:

1. Introduction to Automata Theory, Languages and Computation, J.E.Hopcroft, R.Motwani and J.D.Ullman, 3rd Edition, Pearson, 2008.
2. Compilers Principles, Techniques and Tools‖, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman., Pearson,2014.

Reference Books:

1. Theory of Computer Science-Automata, Languages and Computation, K.L.P.Mishra and N.Chandrasekaran, 3rd Edition, PHI, 2007.
2. Introduction to Automata Theory, Formal Languages and Computation, Shyamalendu Kandar, Pearson, 2013.
3. Compilers Principles and Practice‖, Parag H. Dave, Himanshu B. Dave, PEARSON.
4. Lex &Yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly .

Web References:

https://onlinecourses.nptel.ac.in/noc21_cs07/preview
https://onlinecourses.nptel.ac.in/noc21_cs19/preview

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SOFTWARE ENGINEERING
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0508T	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- To learn the basic concepts of software engineering and life cycle models.
- To understand the requirements engineering and agile models.
- To interpret the basic concepts of software design
- To understand the basic concepts of black box and white box software testing and enable to design test cases for unit, integration, and system testing
- To understand the basic concepts in risk management and reengineering.

Course Outcomes (CO):

On completion of this course, student will be able to

- Use software life cycle activities for process models (L3).
- Use software requirements specifications for given problems (L3).
- Apply design concepts, component Level and user interface design for a given problems(l3)
- Apply various test cases for a given problems (L3).
- Apply quality management concepts at the application level. (L3)
- Determine risk management plans and implementation(l3)

Syllabus		Total Hours:48
Module-I	**Software, Software Engineering and Software Process**	**10 Hrs**

Basic concepts: abstraction versus decomposition, evolution of software engineering techniques, Software development life cycle (SDLC) models: Iterative waterfall model, Prototype model, Evolutionary model, Spiral model, RAD model, Agile models, software project management: project planning, project estimation, COCOMO, project scheduling, Organization and team structure, risk management.

Module-II	Requirements Engineering and Agile Models	9 Hrs

The Nature of software, The unique nature of web apps, The software myths

Requirements Engineering: Functional and non-functional requirements, the software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management

Agile development model: What is agility, what is an agile process, XP, Agile process models, CMMI

Module-III	Design Concepts, Component Level and User Interface Design	9 Hrs

Design Concepts: Good Software Design, Cohesion and coupling, The design Process, Design concepts, design models

Component Level Design: Introduction to components, designing class-based components

User Interface Design: Golden rules, User Interface analysis and design

Module-IV	Software Testing Strategies, Project Metrics and Quality Management	10 Hrs

Software Testing Strategies: coding standards and guidelines, code review, testing, types of testing.

Process and project metrics: software measurement, A framework for product metrics.

Quality Management: Quality, Software quality**,** metrics for software quality, software quality assurance.

Module-V	Risk Management and Reengineering	10 Hrs

Risk Management: Risk identification, Risk projection, risk refinement, RMMM

Maintenance and reengineering: Software maintenance, reengineering, reverse engineering and forward engineering

Case Study: Implementation of safe home system using software engineering principles.

Text Books:

1. Pressman R, "Software Engineering- Practioner Approach", McGraw Hill.
2. Somerville, "Software Engineering", Pearson 2.

Reference Books:

1. Rajib Mall, "Fundamentals of Software Engineering", 5th Edition, PHI, 2018.
2. Richard Fairley, "Software Engineering Concepts", Tata McGraw Hill.
3. Jalote Pankaj, "An integrated approach to Software Engineering", Narosa.

Web Resources:
https://nptel.ac.in/courses/106/105/106105182/
http://peterindia.net/SoftwareDevelopment.html

RG 22 Regulations

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An ISO 9001:2015 certified Institution: Recognized under Sec. 2(f)& 12(B) of UGC Act, 1956

3rd Mile, Bombay Highway, Gangavaram (V), Kovur(M), SPSR Nellore (Dt), Andhra Pradesh, India- 524137

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MACHINE LEARNING					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0528T	**3: 0:0:0**	**3**	**CIE:30SEE:70**	**3Hours**	**PCC**

Course Objectives:

This course will enable students to:

- Understand basic concepts of Machine Learning
- Study different learning algorithms
- Illustrate evaluation of learning algorithms

Course Outcomes (CO):

On completion of this course, student will be able to

- Identify machine learning techniques suitable for a given problem
- Solve the problems using various machine learning techniques
- Design application using machine learning techniques

Syllabus		**Total Hours:48**
Module-I	**Introduction – Human Learning & Machine Learning**	**9Hrs**

Human Learning, Types of Human Learning, Machine Learning, Types of Machine Learning, Applications of Machine Learning, Issues in Machine Learning.

Basic types of Data in Machine Learning, Data Preprocessing : Data Cleaning, Data transformation and Data Reduction

Module-II	**Modeling and Evaluation**	**10Hrs**

Introduction, selecting a Model, training a Model, Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model

Module-III	**Supervised Learning :Classification**	**9Hrs**

Classification – Methods of Classification : Classification model, Classification Learning Steps, Classification by Decision tree Induction, Classification by Back propagation, K-Nearest Neighbor Classification, Random Forest Algorithm, Naïve Baye's Classification

Module-IV	**Supervised Learning : Regression**	**10Hrs**

Regression – Assumptions in Regression Analysis, Types of Regression: Simple Linear Regression, Multiple Linear Regression, Polynomial Regression, Logistic Regression, Curve Fitting- Method of Least Squares.

Module-V	**Unsupervised Learning : Clustering**	**10Hrs**

Clustering- Different types of clustering techniques, Partitioning Methods: K-Means Algorithm, K-Medoids algorithm, Hierarchical Clustering Methods, Density based Clustering Methods- DBSCAN, DENCLUE, OPTICS

Text Books:

1. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

Reference Books:

1. EthernAlpaydin, "Introduction to Machine Learning", MIT Press, 2004.
2. Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.
3. Andreas C. Müller and Sarah Guido "Introduction to Machine Learning with Python: A Guide for Data Scientists", Oreilly.

Web References:

1. Andrew Ng, "Machine Learning Yearning"
2. https://www.deeplearning.ai/machine-learning
3. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html

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BIG DATA TECHNOLOGIES
(Common to CSE,AI&ML,DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0534c	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Understand the basic concepts and importance of Big Data
- Familiarize with the installation of Hadoop and how to analyze the Big Data
- Understand the design concepts of HDFS
- Provide good insight for developing a MapReduce applications
- Understand Hadoop environment.
- Explore the concepts of Pig, Hive, Spark and HBase

Course Outcomes (CO):

After the completion of the course students will able to

- Understand the concepts and tools of big data.
- Analyzing the Data with Hadoop
- Develop MapReduce application
- Illustrate the Anatomy of MapReduce and Hadoop environment Determine why existing technologies are inadequate to analyze the large data
- Apply large-scale analytic tools to solve some of the open big data problems.
- Analyze analytic tools

Syllabus		Total Hours:48
Module-I	**Introduction to Big Data**	**10Hrs**
Introduction to Big Data: Big data fundamentals, importance of big data, Structuring Big Data, Big Data Analytics, Meet Hadoop: Data, Data Storage and Analysis, History of Apache Hadoop, Hadoop Ecosystem, Installation of Hadoop, Analyzing the Data with Hadoop, Scaling Out.		
Module-II	**HDFS and MapReduce**	**9Hrs**
HDFS: HDFS Concepts, HDFS Architecture, The Command-Line Interface, Data flow: Anatomy of a file read and Anatomy of a file write. **Map Reduce:** Developing a Map Reduce application: The Configuration API, setting up the Development Environment, Running Locally on Test Data, Running on a Cluster.		
Module-III	**How MapReduce Works and Hadoop Environment**	**10Hrs**
How MapReduce Works: Anatomy of a MapReduce Job Run, Failures, Shuffle and Sort. **Hadoop Environment:** Setting up a Hadoop Cluster, Cluster specification, Cluster Setup and Installation, Hadoop Configuration.		
Module-IV	**Data Analyzation using Pig as a tool**	**9Hrs**
Pig: Pig Concepts**,** Apache Pig Architecture, Installing and Running Pig, Comparison with Databases, Pig Latin, User Defined Functions, Data Processing Operators.		
Module-V	**Open Source tools for Big Data: Hive, Spark**	**10Hrs**

	and HBase	

Hive: Hive concepts, Hive Architecture, Installing Hive, Comparison with traditional Databases, HiveQL, Tables, Querying Data.

Spark: Spark Concepts, Architecture of Spark, Installing Spark, Anatomy of a Spark Job Run.

HBase: Introduction to HBase, HBase Architecture, Installation.

Text Books:

1. Tom White, "Hadoop: The Definitive Guide"Fourth Edition, O'reilly Media, 2015.
2. Big Data Black Book, DT Editorial services ,Dreamtech Press
3. Big Data, Big Analytics: Emerging business intelligence and analytic trends for today's businesses, Michael Minnelli, Michelle Chambers, and Ambiga Dhiraj, Wiley Cio Series

Reference Books:

1. Big Data, Big Analytics: Emerging business intelligence and analytic trends for today's businesses, Michael Minnelli, Michelle Chambers, and Ambiga Dhiraj, Wiley Cio Series
2. Glenn J. Myatt, Making Sense of Data , John Wiley & Sons, 2007 Pete Warden,Big Data Glossary, O'Reilly, 2011.
3. Michael Berthold, David J.Hand, Intelligent Data Analysis, Spingers, 2007.
4. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos,Uderstanding Big Data : Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill Publishing, 2012.
5. Anand Rajaraman and Jeffrey David UIIman, Mining of Massive Datasets Cambridge University Press, 2012

Web References:

https://onlinecourses.swayam2.ac.in/arp19_ap60/preview

https://www.shiksha.com/online-courses/big-data-analytics-courses-certification-training-by-nptel-st601-tg91

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COMPUTER NETWORKS
(Common **to CSE, AI&ML, CS, DS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0520T	3: 0:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students:

- Determine the basic concepts of Computer Networks.
- Determine the layered approach for design of computer networks
- Distinguish OSI and TCP/IP reference models
- Predict the network path used in Internet environment
- Use the format of headers of IP, TCP and UDP
- Illustrate the concepts of application layer, network security fundamentals.

Course Outcomes (CO):

On completion of this course, student will be able to:

- Use the software and hardware components of a computer network
- Apply the reference model of a computer network
- Solve the error correction and detection in existing protocols
- Predict path for routing, and congestion control algorithms
- Determine the functionality of TCP and UDP
- Use the appropriate application layer applications

Syllabus		Total Hours:48
Module-I	**The Internet and the Reference Models**	**10Hrs**

Introduction: Computer Network, Network Topologies, types of networks, Reference models- The OSI Reference Model the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models.

Physical Layer –Introduction to physical layer, Guided Media- Twisted-pair cable, Coaxial cable, Fiber optic cable, Unguided media: Wireless-Radio waves, microwaves, infrared.

Module-II	The Data Link Layer	9Hrs

The Data Link Layer: Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols

Module-III	The Network Layer	10Hrs

The Network Layer: Network Layer design issues, Routing algorithms, Congestion control and Internetworking, Network layer in internet.

Module-IV	Transport Layer	9Hrs

Transport Layer: Transport layer services, service primitives, Elements of transport protocols**,** The Internet Transport Protocols: TCP/IP, UDP.

Module-V	The Application Layer and Network security	10Hrs

The Application Layer : DNS, SMTP, FTP, Email and security, network security.

Text Books:

1. Andrew S.Tanenbaum, David j.wetherall, Computer Networks, 5th Edition, PEARSON.
2. PJames F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 6th edition, Pearson, 2019.

Reference Books:

1. Forouzan, Datacommunications and Networking, 5th Edition, McGraw Hill Publication.
2. Youlu Zheng, Shakil Akthar, "Networks for Computer Scientists and Engineers", Oxford Publishers, 2016.

Web References:

https://nptel.ac.in/courses/106105183/25
http://www.nptelvideos.in/2012/11/computer-networks.html
https://nptel.ac.in/courses/106105183/3

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No SQL
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0522c	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Objectives:

- Discuss the history unstructured data
- To know non-relational databases and their importance in Data science.
- Understand the differences between Relational and No SQL databases
- To explore the several types of No SQL databases and understand the role in Big Data

Course Outcomes(CO):

On completion of this course, student will be able to

- Explain and compare different types of No SQL Databases
- Compare and contrast RDBMS with different No SQL databases.
- Demonstrate the detailed architecture and performance tune of Document-oriented No SQL databases.
- Explain performance tune of Key-Value Pair No SQL databases.
- Explain performance tune of Column-oriented and Graph No SQL databases
- Apply No sql development tools on different types of No SQL Databases.

Syllabus		Total Hours:48
Module-I	**Overview and history of No SQL Databases**	**8Hrs**

Definition of the four types of No SQL databases. The value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The emergence of No SQL, Key Points.

Module-II	**RDBMS Vs No SQL**	**8Hrs**

Comparison of relational databases to new No SQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges No SQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregated-Oriented Databases, Replication and Sharding, MapReduce on databases, Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication

Module-III	**Document Databases**	**8Hrs**

No-SQL Key-Value Databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analysis or Real Time Analytics.

Module-IV	**Column Oriented Databases**	**12Hrs**

Column-oriented No SQL databases using Apache HBASE, Column-oriented No SQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.

Module-V	**Key Value Databases**	**12Hrs**

No SQL Key-Value databases using Riak, Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets, Firebase- Cloud hosted No SQL Database, Graph No SQL databases using Neo4j, No SQL database development tools and programming languages, Graph Databases features, consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases.

Text Books:

1. Sadalage, P. & Fowler, Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications, 1st Edition 2019.

Reference Books:

1. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence Paperback – Illustrated, 8 August 2012 by Martin Fowler (Author), Pramod Sadalage (Author)

Web References:

1. https://www.ibm.com/cloud/learn/nosql-databases
2. https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp
3. https://www.geeksforgeeks.org/introduction-to-nosql/
4. https://www.javatpoint.com/nosql-databa

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PRINCIPLES OF COMMUNICATION SYSTEMS
Common to (EEE, CSE, AI&ML, IT, CS, DS)

Course Code	L:T:P:S	Credits	Exam. Marks	Exam Duration	Course Type
22A0430T	3:0:0:0	3	CIE:30SEE:70	3 Hours	OEC

Course Objectives:

- To understand the concept of various modulation schemes and multiplexing.
- To apply the concept of various modulation schemes to solve engineering problems.
- To analyses various modulation schemes.
- To evaluate various modulation scheme in real time applications.

Course Outcomes:

After the completion of the course students will able to:

- Understand the concept of various modulation schemes.
- Understand the concept of Different multiplexing techniques.
- Apply the concept of various modulation schemes to solve engineering problems.
- Analyze various modulation schemes.
- Evaluate various modulation schemes in real time applications.
- Understand the concept of various Communication systems.

Syllabus

Unit –I

Amplitude Modulation: Introduction to Noise and Fourier Transform. An overview of Electronic Communication Systems. Need for Frequency Translation
Amplitude Modulation: DSB-FC, DSB-SC, SSB-SC and VSB, Radio Transmitter and Receiver.

Unit –II

Frequency Modulation: Introduction to Angle Modulation, Tone modulated FM Signal, Arbitrary Modulated FM Signal, FM Modulation and Demodulation. Stereophonic FM Broadcasting.

Unit –III

Pulse Modulation: Sampling Theorem- Low pass and Band pass Signals. Pulse Amplitude Modulation and Concept of Time Division Multiplexing and Frequency Division Multiplexing. Pulse Width Modulation. Digital Representation of Analog Signals.

Unit –IV

Digital Modulation: Binary Amplitude Shift Keying, Binary Phase Shift Keying and Quadrature Phase Shift Keying, Binary Frequency Shift Keying. Regenerative Repeater, M-ary and comparison

Unit –V

Communication Systems: Satellite, RADAR, Optical, Micro wave communication, Mobile and Computer Communication (Block diagram approach only).

Text Books:

1. Herbert Taub, Donald L Schilling and Goutam Saha, “Principles of Communication Systems”, 3 rd Edition, Tata McGraw-Hill Publishing Company Ltd., 2008.

References:

1. B. P. Lathi, Zhi Ding and Hari M. Gupta, "Modern Digital and Analog Communication Systems", 4th Edition, Oxford University Press, 2017.
2. K. Sam Shanmugam "Digital and Analog Communication Systems", Wiley India Edition, 2008.

Web References:

https://onlinecourses.nptel.ac.in/noc22_ee05/preview

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POWER ELECTRONICS
(Common to all Except EEE)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
22A0214Ta	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

The objectives of the course are to make the students learn about:

- Get an overview of semi-conductor devices (such as PN junction diode & Transistor) and their switching characteristics.
- Understand the characteristics of AC to DC converters.
- Understand about the practical applications Electronics in industries.

Course Outcomes(CO):

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

- Basic concepts of diode and transistor and its operation
- Basic operating principles of power semiconductor switching devices.
- The operation of power electronic converters, inverters, AC voltage controllers, and cycloconverter
- How to apply the learnt principles and methods to practical applications.

Syllabus — **Total Hours: 48 Hrs**

Unit-I — POWER SEMI CONDUCTOR DEVICES -I — 10 Hrs

Classification of Switching Devices Based on Frequency and Power Handling Capacity, Thyristors – Silicon Controlled Rectifiers (SCR's) – TRIACs, GTOs - Characteristics and Principles of Operation and other Thyristors.

Unit-II — POWER SEMI CONDUCTOR DEVICES-II — 9 Hrs

BJT – Power Transistor - Power MOSFET – Power IGBT – Static Characteristics – Turn On and Turn Off Methods SCR- Dynamic Characteristics of SCR - Two Transistor Analogy – Triggering Circuits- Series and Parallel Connections of SCR's – Specifications and Ratings of SCR's, BJT, IGBT

Unit -III — PHASE CONTROLLED CONVERTERS — 9 Hrs

Phase Control Technique – Single Phase Line Commutated Converters – Mid Point and BridgeConnections – Half Controlled Converters, Fully Controlled Converters with Resistive, RL Loads and RLE Load– Derivation of Average Load Voltage and Current – Effect of Source Inductance – Numerical Problems.

Unit -IV — INVERTERS — 10 Hrs

Inverters – Single Phase Inverter – Basic Series Inverter – Basic Parallel Capacitor Inverter Bridge Inverter – Waveforms – Simple Forced Commutation Circuits for Bridge Inverters – Single Phase Half and Full Bridge Inverters-Pulse Width Modulation Control-Harmonic Reduction Techniques-Voltage Control Techniques for Inverters – Numerical Problems,

Unit -V — AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS — 10 Hrs

AC Voltage Controllers – Single Phase Two SCR's in Anti Parallel – With R and RL Loads – Modes of Operation of TRIAC – TRIAC with R– Derivation of RMS Load Voltage, Current and Power Factor Wave Forms – Firing Circuits - Numerical Problems

Cyclo Converters – Single Phase Mid Point Cycloconverters with Resistive and Inductive Load (Principle of Operation only) – Bridge Configuration of Single Phase Cycloconverter (Principle of Operation only) – Waveforms

Textbooks:

1. Power Electronics, M. D. Singh and K. B. Khanchandani, Mc Graw Hill Education (India) Pvt. Ltd., 2nd Edition, 2007, 23rd Reprint 2015.

2. Power Electronics: Circuits, Devices and Applications, Muhammad H. Rashid, Pearson, 3rdEdition, 2014, 2nd Impression 2015

Reference Books:

1. Power Electronics, K. R. Varmah, Chikku Abraham, CENGAGE Learning, 1st Edition, 2016.

2. Power Electronics, P. S. Bimbhra, Khanna Publishers, 2012.

3. Power Electronics: Devices, Circuits, and Industrial Applications, V. R. Moorthi, OXFORD University Press, 1st Edition, 2005, 12th Impression 2012.

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Building Materials
(ME, CSE,AI&ML, CS, DS, ECE,EEE)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
22A0149T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

- To identify the traditional materials that are used for building constructions.
- To explain basic concepts of building components such as stair case and masonry
- To know the causes of dampness in structures and its preventive measures
- To understand the building rules, building bye laws and acoustics of building

Course Outcomes(CO):

On completion of this course, student will be able to

- To understand the characteristics of different building materials
- Differentiate brick masonry, stone masonry construction and bonds used in construction of walls of buildings
- To know about the causes of dampness in buildings and its ill effects
- To understand the principles of planning in buildings
- Describe capable of understanding building rules and knowledge about, bye-laws and building elements..

Syllabus — Total Hours:48

Unit-I	MATERIALS	9 Hrs

Traditional materials: Stones- Types of stone masonry -Brick-types of brick masonry- lime Cement – Timber – Seasoning of timber - their uses in building works

Unit-II	BUILDING COMPONENTS	9 Hrs

Lintels, Arches and Vaults – Staircases, Lifts – Types. Different types of flooring-Concrete, Mosaic, Terrazo floors; Different types of roofs- Pitched, Flat and Curved Roofs. Lean-to-Roof, Coupled Roofs, Trussed roofs - King and Queen Post Trusses. Doors & Windows- Types and Specifications

Unit -III	DAMPNESS	10 Hrs

Dampness and its prevention: Causes of dampness- ill effects of dampness-requirements of an ideal material for damp proofing-materials for damp proofing –methods of damp proofing.

Unit -IV	BUILDING PLANNING	10 Hrs

Elements of building planning- basic requirements-orientation-planning for energy efficiency-planning based on utility-other requirements

Unit -V	BUILDING RULES AND BYE-LAWS	10 Hrs

Zoning regulations; Regulations regarding layouts or subdivisions; Building regulations; Rules for special type of buildings; Calculation of plinth, floor and carpet area; Floor space index. Building Information System

Textbooks:

1. Building Drawing by M.G. Shah, C.M. Kale and S.Y. Patki, Tata McGraw-Hill, New
2. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, ‚Building Construction' - Laxmi Publications (P) Ltd., New Delhi

Reference Books:

1. Building Materials, S. K. Duggal, New Age International Publications.
2. N. Kumaraswamy, A. Kameswara Rao, building planning and drawing, 7th Ed, Charotar

Web References:

http://nptel.ac.in/courses/105104103/
http://www.academicpub.org/jwrhe/
http://www.peo.on.ca/index.php/ci_id/21843/la_id/1

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AUTOMOBILE ENGINEERING

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0321Ta	3: 0:0:0	3	CIE:30SEE:70	3Hours	OEC

Course Objectives:

This course will enable students:

- Impart the knowledge of vehicle structure and its components.
- Demonstrate various components of petrol engines and diesel engines.
- Trains about the various electrical system, circuits, and testing of automobiles.
- Explain the concepts of steering, suspension and braking system in automobile.

Course Outcomes (CO):

On completion of this course, student will be able to:

- Identify different parts of automobile
- Explain the working of various parts like engine and brakes
- Describe the working of steering and the suspension systems.
- Summarize the wheels and tires
- Outline the future developments in the automobile industry

Syllabus		Total Hours:48
MODULE-I	**INTRODUCTION TO VEHICLE STRUCTURE AND ENGINE COMPONENTS**	**9 Hrs**

Vehicle construction - Chassis and body - Specifications - Engine - Types - Construction - Location of engine - Cylinder arrangement - Construction details - Cylinder block - Cylinder head - Cylinder liners - Piston – piston rings - Piston pin - Connecting rod - Crankshaft - Valves. Lubrication system - Types - Oil pumps - Filters. Crankcase ventilation

MODULE-II	**IGNITION AND FUEL SUPPLY SYSTEMS**	**10Hrs**

Ignition system - Coil and Magneto - Spark plug - Distributor – Electronic ignition system - Fuel system - Carburetor - Fuel pumps - Fuel injection systems - Mono point and Multi point – Unit Injector – Nozzle types - Electronic Fuel Injection system (EFI) – GDI, MPFI, DTSI.

MODULE-III	**STEERING AND SUSPENSION SYSTEM**	**10Hrs**

Principle of steering - Steering Geometry and wheel alignment - Steering linkages – Steering gearboxes - Power steering - front axle - Suspension system - Independent and Solid axle – coil, leaf spring and air suspensions - torsion bar - shock absorbers.

MODULE-IV	**WHEELS, TYRES AND BRAKING SYSTEM**	**9 Hrs**

Wheels and Tyres - Construction - Type and specification - Tyre wear and causes - Brakes - Needs – Classification –Drum and Disc Mechanical - Hydraulic and pneumatic - Vacuum assist – Retarders – Anti-lock Braking System(ABS).

MODULE-V	**VAUTOMOBILE ELECTRICAL SYSTEMS AND ADVANCES IN AUTOMOBILE ENGINEERING**	**10Hrs**

Battery-General electrical circuits- Active Suspension System (ASS) - Electronic Brake Distribution (EBD) – Electronic Stability Program(ESP), Traction Control System (TCS) - Global Positioning System (GPS), Hybrid vehicle, Fuel Cell.

Text Books:

1.Kirpal Singh, Automobile Engineering, Vol.1&2, Standard Publications, 13/e, 2020.
2. William.H.Crouse, Automotive Mechanics, 10/e , McGraw-Hill, 2006.

Reference Books:

1. David A. Corolla, Automotive Engineering: Powertrain, Chassis System and Vehicle Body, Butterworth-Heinemann Publishing Ltd, 2009.
2. Richard Stone, Jeffrey K. Ball, Automotive Engineering Fundamentals" SAE International, 2004
3. Bosch, Automotive Hand Book, 6/e, SAE Publications, 2007.
4. K. Newton and W. Steeds, The motor vehicle, 13/e, Butterworth-Heinemann Publishing Ltd, 1989.
5. Joseph Heitner, Automotive Mechanics Principles and Practices, 2/e, CBS publishing 2004

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SOFTWARE ENGINEERING LAB

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0510P	0:0:3:0	1.5	CIE:30 SEE:70	3Hours	PCC

Course Objectives:

This course will enable students to:

- To learn and implement the fundamental concepts of Software Engineering.
- To explore functional and non-functional requirements through SRS.
- To practice the various design diagrams through the appropriate tool.
- To learn to implement various software testing strategies.

Course Outcomes (COs):

After completion of this course, students will be able to:

- Acquaint with historical and modern software methodologies
- Understand the phases of software projects and practice the activities of each phase
- Practice clean coding • Take part in project management
- Adopt skills such as distributed version control, unit testing, integration testing, build management, and deployment

Syllabus — **Total Hours: 48**

List of Experiments

Experiment-1: Draw the Work Breakdown Structure for the system to be automated
Experiment-2: Schedule all the activities and sub-activities Using the PERT/CPM charts
Experiment-3: Define use cases and represent them in use-case document for all the stakeholders of the system to be automated
Experiment-4: Identify and analyze all the possible risks and its risk mitigation plan for the system to be automated
Experiment-5: Diagnose any risk using Ishikawa Diagram (Can be called as Fish Bone Diagram or Cause& Effect Diagram)
Experiment-6: Define Complete Project plan for the system to be automated using Microsoft Project Tool
Experiment-7: Define the Features, Vision, Business objectives, Business rules and stakeholders in the vision document
Experiment-8: Define the functional and non-functional requirements of the system to be automated by using Use cases and document in SRS document
Experiment-9: Define the following traceability matrices : 1. Use case Vs. Features 2. Functional requirements Vs. Usecases
Experiment-10: Estimate the effort using the following methods for the system to be automated: 1. Function point metric 2. Usecase point metric
Experiment-11: Develop a tool which can be used for quantification of all the non-functional requirements
Experiment-12: Write C/C++/Java/Python program for classifying the various types of coupling.
Experiment-13: Write a C/C++/Java/Python program for classifying the various types of cohesion.
Experiment-14: Write a C/C++/Java/Python program for object oriented metrics for design proposed by Chidamber and Kremer. (Popularly called CK metrics)
Experiment-15: Convert the DFD into appropriate architecture styles.
Experiment-16: Draw a complete class diagram and object diagrams using Rational tools

Experiment-17: Define the design activities along with necessary artifacts using Design Document.
Experiment-18: Reverse Engineer any object-oriented code to an appropriate class and object diagrams.
Experiment-19: Test a piece of code that executes a specific functionality in the code to be tested and asserts a certain behavior or state using Junit.
Experiment-20: Test the percentage of code to be tested by unit test using any code coverage tools
Experiment-21: Define appropriate metrics for at least 3 quality attributes for any software application of your interest

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MECHINE LEARNING LAB
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0532P	0:0:3:0	1.5	CIE: 30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice.

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand the Mathematical and statistical prospective of machine learning algorithms through python programming
- Appreciate the importance of visualization in the data analytics solution
- Derive insights using Machine learning algorithms

Syllabus | **Total Hours:48**

List of Experiments

Experiment 1: Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

Experiment 2: For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

Experiment 3: Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

Experiment 4: Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.

Experiment 5: Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

Experiment 6: Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

Experiment 7: Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

Experiment 8: Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

Experiment 9: Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

Experiment 10: Implement parametric and non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Reference Book:

1. Python Machine Learning Workbook for beginners, AI Publishing, 2020

Web References:

https://www.udemy.com/course/machinelearning/

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SOFT SKILLS (SKILL)
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0029P	1:0:2:0	2	CIE: 30 SEE:70	3 Hours	SC

Course Objectives:

This course will enable students to:

- To encourage all round development of the students by focusing on soft skills.
- To make the students aware of critical thinking and problem-solving skills.
- To develop leadership skills and organizational skills through group activities.
- To function effectively with heterogeneous teams.

Course Outcomes(CO):

On completion of this course, student will be able to

- Memorize various elements of effective communicative skills.
- Interpret people at the emotional level through emotional intelligence.
- Apply critical thinking skills in problem solving.
- Analyze the needs of an organization for team building.
- Judge the situation and take necessary decisions as a leader.
- Develop social and work-life skills as well as personal and emotional well-being.

Syllabus		Total Hours:48
Module-I	**Soft Skills & Communication Skills**	**10Hrs**

Introduction, meaning, significance of soft skills –Vital Components of communication skills - Inter-personal skills - Verbal and Non-verbal Communication.

Activities: Narration about self- strengths and weaknesses- clarity of thought - Interpersonal Skills- Group Discussion – Debate – Mutual Understanding - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic. Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- Negotiation skills –Role Play- Non-verbal communication – Public speaking – Mock interviews – Anchoring Skills..

Module-II	**Critical Thinking**	**9Hrs**

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking.

Activities: Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues – placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis.

Module-III	**Problem Solving & Decision Making**	**10Hrs**

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Methods of decision making – Effective decision making in teams – Methods & Styles.

Activities: Placing a problem which involves conflict of interests, choice and views – formulating the

problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision. Case Study & Group Discussion.

Module-IV	Emotional Intelligence & Stress Management	9Hrs

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips.

Activities: Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, and sympathy, and confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates.

Module-V	Leadership Skills	10Hrs

Team-Building – Decision-Making – Accountability – Planning – Public Speaking – Motivation – Risk Taking - Team Building - Time Management.

Activities: Forming group with a consensus among the participants- choosing a leader- encouraging the group members to express views on leadership- democratic attitude- sense of sacrifice – sense of adjustment – vision – accommodating nature- eliciting views on successes and failures of leadership using the past knowledge and experience of the participants, Public Speaking, Activities on Time Management, Motivation, Decision Making, Group discussion etc.

Text Books:

1. Personality Development and Soft Skills (English, Paperback, MitraBarunK.)Publisher: Oxford University Press; Pap/Cdr edition (July 22, 2012)
2. Personality Development and Soft Skills: Preparing for Tomorrow, Dr Shikha Kapoor Publisher : I K International Publishing House; 0 edition (February 28, 2018)

Reference Books:

1. Soft skills: personality development for life success by Prashant Sharma, BPB publications 2018.
2. Soft Skills By Alex K. Published by S.Chand
3. Soft Skills: An Integrated Approach to Maximise Personality Gajendra Singh Chauhan, Sangeetha Sharma Published by Wiley.
4. Communication Skills and Soft Skills (Hardcover, A. Sharma) Publisher: Yking books
5. SOFT SKILLS for a BIG IMPACT (English, Paperback, RenuShorey) Publisher: Notion Press .
6. Life Skills Paperback English Dr. Rajiv Kumar Jain, Dr. Usha Jain Publisher: Vayu Education of India

Web Resources:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc

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DESIGN THINKING AND INNOVATION
(Common to CSE, AIML, CS, DS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0526T	2: 0:0:0	2	CIE:30	-	MC

Course Objectives:

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Outcomes(CO):

On completion of this course, student will be able to:

- Define the concepts related to design thinking.
- Explain the fundamentals of Design Thinking and innovation
- Apply the design thinking techniques for solving problems in various sectors.
- Analyse to work in a multidisciplinary environment
- Evaluate the value of creativity
- Formulate specific problem statements of real time issues

Syllabus		Total Hours:48
Module-I	**Introduction to Design Thinking**	**9Hrs**

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

Module -II	Design Thinking Process	9Hrs

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brain storming, product development Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

Module -III	Innovation	10Hrs

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity. Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

Module -IV	Product Design	10Hrs

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies. Activity: Importance of modelling, how to set specifications, Explaining their own product design.

Module -V	Design Thinking in Business Processes	10Hrs

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs.

Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes. Activity: How to market our own product, About maintenance, Reliability and plan for startup.

Text Books:

1. Change by design, Tim Brown, Harper Bollins (2009)
2. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons

Reference Books:

1. Design Thinking in the Classroom by David Lee, Ulysses press
2. Design the Future, by Shrrutin N Shetty, Norton Press
3. Universal principles of design- William lidwell, kritinaholden, Jill butter.
4. The era of open innovation – chesbrough.H

Web References:

https://nptel.ac.in/courses/110/106/110106124/
https://nptel.ac.in/courses/109/104/109104109/
https://swayam.gov.in/nd1_noc19_mg60/preview

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Semester-6 (Theory-5, Lab-3, SC-1 MC-1)							
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	PCC	22A3304T	Natural Language Processing	3	0	0	3
2	PCC	22A0535c	Deep Learning	3	0	0	3
3	PCC	22A0533T	Cloud Computing	3	0	0	3
4	PEC	22A03305T 22A0530b 22A0530c	Professional Elective-II: 1. Mobile Computing 2. Design Patterns 3. Introduction to IoT	3	0	0	3
5	OEC	22A0413T 22A0213Ta 22A0150T 22A0327Tb	Open Elective-II: 1. Micro Controllers And Applications 2. Control Systems 3. Environmental Economics 4. Introduction to Composite Materials	3	0	0	3
6	PCC(Lab)	22A3306P	Natural Language Processing Lab	0	0	3	1.5
7	PCC(Lab)	22A3307P	Deep Learning Lab	0	0	3	1.5
8	PCC(Lab)	22A0533P	Cloud Computing Lab	0	0	3	1.5
9	SC	22A0525	Skill Oriented Course: R Programming	1	0	2	2
10	MC	22A0032T	Mandatory Course: Research Methodology	2	0	0	0
			Total credits				**21.5**
Honors / Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				**4**	**0**	**0**	**4**
Industrial / Research Internship (Mandatory) 2 Months during summer vacation							

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NATURAL LANGUAGE PROCESSING
(CommontoCSE,AI&ML,DS,CS,CE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3304T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students:

- Explain and apply fundamental algorithms and techniques in the area of natural language processing (NLP)
- Understand approaches to syntax and semantics in NLP.
- Understand current methods for statistical approaches to machine translation.
- Understand language modeling.
- Understand machine learning techniques used in NLP.

Course Outcomes (CO):

On completion of this course, student will be able to:

- Understand the logic behind Natural languages
- Understand the significance of syntax and semantics of natural languages
- Process the Natural languages
- Verify the syntax and semantics of languages
- Design new natural languages

Syllabus		Total Hours:43
MODULE -I	**INTRODUCTION TO NATURAL LANGUAGE PROCESSING**	**8Hrs**
The Study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different Levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English Syntax.		
MODULE -II	**GRAMMARS AND PARSING**	**8Hrs**
Grammars and Parsing- Top- Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks, Bayes Rule, Shannon game, Entropy and Cross Entropy		
MODULE -III	**GRAMMARS FOR NATURAL LANGUAGE PROCESSING**	**9Hrs**
Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in Parsing, Shift Reduce Parsers, Deterministic Parsers.		
MODULE -IV	**INTERPRETATION AND MODELLING**	**9Hrs**
Semantic Interpretation-Semantic & Logical form, Word senses & ambiguity, the basic logical form language, encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic roles, Speech acts &embedded sentences, Defining semantics structure model theory. Language Modelling-Introduction, n-Gram Models, Language model Evaluation, Parameter Estimation, Language Model Adaption, Types of Language Models, Language-Specific Modelling Problems, Multilingual and Cross lingual Language Modelling.		
MODULE -V	**MULTILINGUAL INFORMATION RETRIEVAL**	**9Hrs**

Multilingual Information Retrieval - Introduction, Document Pre-processing, Monolingual Information Retrieval, CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and Resources. Multilingual Automatic Summarization - Introduction, Approaches to Summarization, Evaluation, How to Build a Summarizer, Competitions and Datasets

Text Books:

1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2. Multilingual Natural Language Processing Applications: From Theory to Practice-Daniel M.Bikel and ImedZitouni, Pearson Publications.

Reference Books:

1. Natural Language Processing, A paninian perspective, Akshar Bharathi, Vineet Chaitanya, Prentice –Hall of India.
2. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
3. Jurafsky, Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2008.
4. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press,1999.

Web References:

http://peterindia.net/AILinks.html

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DEEP LEARNING
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0535c	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Demonstrate the major technology trends driving Deep Learning
- Build, train, and apply fully connected deep neural networks
- Implement efficient neural networks
- Analyse the key parameters and hyper parameters in a neural network's architecture

Course Outcomes (CO):

On completion of this course, student will be able to

- Apply Mathematical Operations on Neural Network.
- Choose proper Hyperparameters.
- Examine architecture of Deep Neural Network.
- Apply Convolutional Neural Networks in Image Classifications.
- Use RNN and LSTMs in Real time applications.
- Analyze different types of Autoencoders.

Syllabus		Total Hours:48
Module-I	**Linear Algebra**	**10Hrs**

Scalars, Vectors, Matrices and Tensors, Matrix operations, types of matrices, Norms, Eigen decomposition, Singular Value Decomposition, Principal Components Analysis.

Information Theory. Numerical Computation: Overflow and Underflow, Gradient-Based Optimization, Constrained Optimization, Linear Least Squares.

Module-II	Fundamentals of Neural Networks and Deep Learning	9Hrs

Neural Networks, Training Neural Networks, Activation Functions, Loss Functions, Hyper parameters, Building blocks of Deep Neural Networks.

Module-III	Convolutional Networks	10Hrs

The Convolution Operation, Pooling, Convolution, Basic Convolution Functions, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, Basis for Convolutional Networks.

Module-IV	Recurrent and Recursive Neural Networks	9Hrs

Recurrent Neural Network: Modelling Time Dimension, 3D Volumetric Input, General Recursive Neural Network Architecture, LSTM Networks, Applications.

Recursive Neural Network: Architecture, Varieties of RNN, Applications of RNN.

Module-V	AutoEncoders	10Hrs

Undercomplete Autoencoders, Regularized Autoencoders, Representational Power, Layer Size and Depth, Stochastic Encoders and Decoders, Denoising Autoencoders.

Text Book:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, “Deep Learning”, MIT Press,2016.
2. Josh Patterson and Adam Gibson, “Deep learning: A practitioner's approach”, O'Reilly Media, First Edition, 2017

Reference Books:

1. Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms, Nikhil Buduma, O’Reilly, Shroff Publishers, 2019.
2. Deep learning Cook Book, Practical recipes to get started Quickly, DouweOsinga, O’Reilly, Shroff Publishers, 2019.

Web References:

1. https://keras.io/datasets/
2. http://deeplearning.net/tutorial/deeplearning.pdf
3. https://arxiv.org/pdf/1404.7828v4.pdf
4. https://www.cse.iitm.ac.in/~miteshk/CS7015.html
5. https://www.deeplearningbook.org
6. https://nptel.ac.in/courses/106105215

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CLOUD COMPUTING

(Common to CSE,AI&ML,DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0533T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- To introduce the broad perceptive of cloud architecture and model
- To understand the concept of Virtualization and familiar with the lead players in cloud.
- To understand the features of cloud simulator and apply different cloud programming model
- To design of cloud Services and explore the trusted cloud Computing system

Course Outcomes(CO):

On completion of this course, student will be able to

- To Understand the basic concepts about cloud computing vision and its developments and gain the Knowledge of virtualization technology.
- Analyze the concepts of cloud services and the deployment models.
- Choose amoDesng various cloud technologies for implementing applications(GAE, Openstack,etc)
- Construct the virtual machines by using VMware simulator.
- Build scientific applications by using Cloud environment.

Develop Business and Consumer Applications.

Syllabus		Total Hours:48
Module-I	**Basics of Cloud Computing**	**10Hrs**

Introduction to Cloud: Introduction to Cloud, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Elasticity in Cloud, On-demand Provisioning.
Virtualization: Introduction, Characteristics of Virtualized Environment, Taxonomy of Virtualization Techniques, Virtualization, and Cloud computing.

Module-II	Cloud Architecture, Models and Security	9Hrs

Cloud Computing Architecture: Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds.
Cloud Deployment Model: Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud.

Module-III	Cloud Technologies and Advancements	10Hrs

Apache Hadoop, MapReduce, Hadoop Cluster setup, Virtual Box, Google App Engine, Programming Environment for Google App Engine – Open Stack

Module-IV	VMware Simulator	9Hrs

VMWare: Basics of VMWare, Advantages of VMware virtualization, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.

Module-V	Cloud Applications	10Hrs

Cloud Applications: Scientific Applications – Health Care, Geoscience.
Business And Consumer Applications - CRM and ERP, Social Networking, Media Applications, and Multiplayer Online Gaming.

Text Books:

1.Mastering Cloud Computing by RajkumarBuyya, Christian Vecchiola, S.ThamaraiSelvi from TMH 2013.

2. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly

Reference Books:

1.Cloud computing for dummies- Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, Wiley Publishing, Inc, 2010

2.Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011

3.Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010.

4.Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O 'Reilly, SPD, rp2011.

5.Essentials of Cloud Computing by K. Chandrasekaran. CRC Press. Cloud computing A Hands-On Approach by ArshdeepBahga and Vijay Madisetti.

6.Cloud computing for dummies- Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, Wiley Publishing, Inc, 2010

Web Resources:

1.https://nptel.ac.in/courses
2.https://freevideolectures.com/university/iitm

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MOBILE COMPUTING

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3305T	3: 0:0:0	3	CIE: 30SEE:70	3Hours	PEC

Course Objectives:

- Introduction to mobile computing and mobile communication.
- Coverage mobile systems will include 2G, 2.5G, 3G, 3G+, and 4G communication systems, mobile satellite communication networks, mobile IP, mobile TCP, digital audio-video broadcasting, and mobile TV.
- This course will also provide a systematic explanation of mobile computing as a discrete discipline and will provide an in-depth coverage of mobile systems and devices, mobile operating systems used for application development, mobile databases, client-server computing agents, application servers, security protocols, mobile Internet, and ad-hoc and sensor networks.

Course Outcomes (COS):

After completion of the course, students will be able to:

- Understand the Basics concepts of WLAN standards over internet, Adhoc, Protocols.
- Identify efficient medium access control protocol for wireless networks
- Apply dynamic routing protocols for Ad hoc Networks.
- Illustrate quality of any service in Ad hoc Networks using QoS strategies
- Choose appropriate wireless sensor network model for real-time applications
- Analyze security, energy efficiency, mobility, scalability, and their unique characteristics in wireless networks.

Syllabus	COURSE CONTENT	Total Hours:48
Module- I	**Wireless LANS and PANS**	**9Hrs**

Introduction, Fundamentals of WLANS, IEEE 802.11 Standards, HIPERLAN Standard, Bluetooth, Home RF. Wireless Internet: Wireless Internet, Mobile IP, TCP in Wireless Domain, WAP, Optimizing Web over Wireless.

Module-II	AD HOC Wireless Networks	10Hrs

Introduction, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet. MAC Protocols for Ad Hoc Wireless Networks: Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols.

Module-III	Routing Protocols	9Hrs

Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, on – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols.Transport Layer and Security Protocols, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks.

Module-IV	Quality of Service	10Hrs

Introduction, Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions, QoS Frameworks for Ad Hoc Wireless Networks. Energy Management: Introduction, Need for Energy Management in Ad Hoc Wireless Networks, Classification of Ad Hoc Wireless Networks.

Module-V	Wireless Sensor Networks	10Hrs
Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues.		

Textbooks:

1. 'Fundamentals of mobile Computing' Published by Asoke K. Ghosh, PHI Learning Private Limited, M-97, Connaught Circus, New Delhi-110001 and Printed by Raj Press.
2. Mobile Computing: Talukdar, TMH 2nd Edition

Reference Books:

1. Pervasive Computing: Burkhardt, Pearson Education.
2. The wireless application Protocol: Sandeep Singhal, Pearson Education.

Web References:

https://www.youtube.com/watch?v=GTtYP8RGIs&list=PLV8vIYTIdSnZMKTQSTxWbx4NGNfxyZq_N

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DESIGN PATTERNS
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0530b	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- understand design patterns and their underlying object-oriented concepts.
- understand implementation of design patterns and providing solutions to real world software design problems.
- To understand patterns with each other and understanding the consequences of combining patterns on the overall quality of a system.

Course Outcomes (CO):

On completion of this course, student will be able to

- Know the underlying object oriented principles of design patterns.
- Understand the creational patterns
- Understand the structural patterns
- Understand the behavioral patterns
- Understand the context in which the pattern can be applied.
- Understand how the application of a pattern affects the system quality and its tradeoffs.

Syllabus		Total Hours:48
Module-I	**Introduction to Design Patterns**	**10Hrs**

Design Pattern Definition, Design Patterns in Small Talk MVC, Describing Design Patterns, Catalog of Design Patterns, Organizing the Catalog, Solving of Design Problems using Design Patterns, Selection of a Design Pattern, Use of Design Patterns.

Module-II	Designing A Document Editor	9Hrs

Design problems, Document structure, Formatting, Embellishing the User Interface, Supporting Multiple Look and Feel standards, Supporting Multiple Window Systems, User Operations, Spelling Checking and Hyphenation.

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

Module-III	Structural Patterns	10Hrs

Structural Patterns-1: Adapter, Bridge, Composite.

Structural Patterns-2: Decorator, Facade, Flyweight, Proxy, Discuss of Structural Patterns

Module-IV	Behavioral Patterns	9Hrs

Behavioral Patterns-1: Chain of Responsibility, Command, Interpreter, Iterator.

Behavioral Patterns-2: Mediator, Memento, Observer.

Module-V	Behavioral Patterns	10Hrs

Behavioral Patterns-2(cont'd): State, Strategy, Template Method, Visitor, Discussion of Behavioral

Patterns. What to Expect from Design Patterns.

Text Books:

1. Design Patterns By Erich Gamma, Pearson Education

Reference Books:

1. Pattern's in JAVA Vol-I By Mark Grand, Wiley DreamTech.
2. Pattern's in JAVA Vol-II By Mark Grand, Wiley DreamTech.
3. JAVA Enterprise Design Patterns Vol-III By Mark Grand, Wiley DreamTech.
4. Head First Design Patterns By Eric Freeman-Oreilly-spd
5. Design Patterns Explained By Alan Shalloway,Pearson Education.
6. Pattern Oriented Software Architecture, F.Buschmann&others, John Wiley & Sons

Web References:

https://elearn.nptel.ac.in/shop/iit-workshops/completed/cloud-architecture-design-patterns-pc-on-cloud/

https://www.youtube.com/watch?v=1xUz1fp23TQ

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Introduction to IoT
(Common to CSE,AI&ML,DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0530c	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Introduce the fundamental concepts of IoT and physical computing ,Expose the student to a variety of embedded boards and IoT Platform,Create a basic understanding of the communication protocols in IoT communications.Familiarize the student with application program interfaces for IoT and Enable students to create simple IoT applications.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the Basic sensors and actuators for an IoT application.
- Select protocols for a specific IoT application .
- Utilize the cloud platform and APIs for IoT applications .
- Experiment with embedded boards for creating IoT prototypes.
- Design a solution for a given IoT application .
- Able to understand the application areas of IOT.

Syllabus		Total Hours:48
Module-I	**Overview of IoT**	**10Hrs**

The Internet of Things: An Overview, The Flavour of the Internet of Things, The "Internet" of "Things", The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things?

Design Principles for Connected Devices: Calm and Ambient Technology, Privacy, Web Thinking for Connected Devices, Affordances.

Prototyping: Sketching, Familiarity, Costs Vs Ease of Prototyping, Prototypes and Production, Open source Vs Close source, Tapping into the community

Module-II	Embedded Devices	9Hrs

Electronics, Embedded Computing Basics, Arduino, Raspberry Pi, Mobile phones and tablets, Plug Computing: Always-on Internet of Things

Module-III	Communication in the IoT	9Hrs

Internet Communications: An Overview, IP Addresses, MAC Addresses, TCP and UDP Ports, Application Layer Protocols

Prototyping Online Components:

Getting Started with an API, Writing a New API, Real-Time Reactions, Other Protocols Protocol

Module-IV	Business Models	10Hrs

Business Models: A short history of business models, The business model canvas, Who is the business model for, Models, Funding an Internet of Things startup, Lean Startups.

Manufacturing: What are you producing, Designing kits, Designing printed circuit boards**.**

Module-V	Manufacturing Process	10Hrs

Manufacturing continued: Manufacturing printed circuit boards, Mass-producing the case andother fixtures, Certification, Costs, Scaling up software.

Ethics: Characterizing the Internet of Things, Privacy, Control, Environment, Solutions.

Text Books:

1. Adrian McEwen, Hakim Cassimally - Designing the Internet of Things, Wiley Publications, 2012

Reference Books:

1. Arshdeep Bahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
2. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C.Raman, CRC Press.

Web Resources:

https://www.arduino.cc/
https://www.raspberrypi.org/

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MICRO CONTROLLERS AND APPLICATIONS
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0413T	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- Describe the Architecture of 8051 Microcontroller and Interfacing of 8051 to external memory.
- Write 8051 Assembly level programs using 8051 instruction set.
- Describe the Interrupt system, operation of Timers/Counters and Serial port of 8051.
- Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the importance of Microcontroller
- Acquire the knowledge of Architecture of 8051 Microcontroller.
- Apply and Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to using 8051 I/O ports.
- Develop the 8051 Assembly level programs using 8051 instruction set.
- Design the Interrupt system
- Understand the operation of Timers/Counters and Serial port of 8051.

Syllabus		Total Hours:48
Module-I	**8051 Microcontroller**	**10Hrs**

8051 Microcontroller: Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing..

Module-II	**Addressing Modes**	**9Hrs**

Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples to use these instructions.

Module-III	**8051 Stack, Stack and Subroutine instructions**	**9Hrs**

8051 Stack, Stack and Subroutine instructions: Simple Assembly language program examples to use subroutine instructions.8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin.

Module-IV	**8051 Serial Communication**	**10Hrs**

8051 Serial Communication- Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially.8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch.

Module-V	**8051 C programming**	**10Hrs**

8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Interfacing with relays and Opto isolators, Stepper

Motor Interfacing, DC motor interfacing, PWM generation using 8051.

Text Books:

1. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; "The 8051 Microcontroller and Embedded Systems – using assembly and C", PHI, 2006 / Pearson, 2006.
2. Kenneth J. Ayala, "The 8051 Microcontroller", 3rd Edition, Thomson/Cengage Learning

Reference Books:

1. Manish K Patel, "The 8051 Microcontroller Based Embedded Systems", McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. Raj Kamal, "Microcontrollers: Architecture, Programming, Interfacing and System Design", Pearson Education, 2005. Wayne Wolf, FPGA based system design, Prentice hall, 2004.

Web References:

https://nptel.ac.in/courses/117104072

https://onlinecourses.nptel.ac.in/noc22_ee12/preview

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CONTROL SYSTEMS
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0213Ta	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- Merits and demerits of open loop and closed loop systems; the effects of feedback
- The use of block diagram algebra and Mason's gain formula
- Transient and steady state responses , time domain specifications
- Frequency domain specifications, Bode diagrams and Nyquist plots
- The fundamental aspects of modern control

Course Outcomes(CO):

On completion of this course, student will be able to

- Evaluate the effective transfer function of a system from (i) block diagram reduction techniques (ii) Mason's gain formula
- Compute the steady state errors and transient response characteristics
- Determine the absolute stability and relative stability of a system
- Design a compensator to accomplish desired performance
- Derive state space model of a given physical system and solve the state equation

Syllabus		Total Hours:48
Module-I	**INTRODUCTION**	**10Hrs**

Open Loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feedback Characteristics, Effects of positive and negative feedback. Mathematical models – Differential equations of Translational and Rotational mechanical systems, and Electrical Systems, Block diagram reduction methods – Signal flow graph - Reduction using Mason's gain formula. Transfer Function of DC Servo motor - AC Servo motor - Synchro transmitter and Receiver.

Module-II	**TIME RESPONSE ANALYSIS**	**10Hrs**

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants

Module-III	**STABILITY**	**9Hrs**

The concept of stability – Routh's stability criterion – Stability and conditional stability – limitations of Routh's stability. The root locus concept - construction of root loci effects of adding poles and zeros to G(s)H(s) on the root loci.

Module-IV	**FREQUENCY RESPONSE ANALYSIS**	**10Hrs**

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram Stability Analysis from Bode Plots. Polar Plots- Phase margin and Gain margin-Stability Analysis.

Module-V	**STATE SPACE ANALYSIS**	**10Hrs**

Concepts of state, state variables and state model, derivation of state models from differential equations. Transfer function models. Block diagrams. Diagonalization. Solving the Time invariant state Equations- State Transition Matrix and it's Properties. System response through State Space models. The concepts of controllability and observability

Text Books:

1. Modern Control Engineering, Katsuhiko Ogata, PEARSON, 1st Impression 2015.
2. Control Systems Engineering, I. J. Nagrath and M. Gopal, New Age International Publishers, 5th edition, 2007, Reprint 2012.

Reference Books:

1. Automatic Control Systems, Farid Golnaraghi and Benjamin. C. Kuo, WILEY, 9th Edition, 2010.
2. Control Systems, Dhanesh N. Manik, CENGAGE Learning, 2012.
3. John J D'Azzo and C. H. Houpis , "Linear Control System Analysis and Design: Conventional and Modern", McGraw - Hill Book Company, 1988.

Web References:

https://archive.nptel.ac.in/courses/107/106/107106081/

https://onlinecourses.nptel.ac.in/noc20_ee90/preview

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ENVIRONMENTAL ECONOMICS
(Common to CSE,AI&ML,DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0150T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- To impart knowledge on sustainable development and economics of energy
- To teach regarding environmental degradation and economic analysis of degradation
- To inculcate the knowledge of economics of pollution and their management
- To demonstrate the understanding of cost benefit analysis of environmental resources
- To make the students to understand principles of economics of biodiversity

Course Outcomes(CO):

On completion of this course, student will be able to

- The information on sustainable development and economics of energy
- The information regarding environmental degradation and economic analysis of degradation
- The identification of economics of pollution and their management
- The cost benefit analysis of environmental resources
- The principles of economics of biodiversity

Syllabus		Total Hours:48
Module-I	**SUSTAINABLE DEVELOPMENT**	**9Hrs**

Introduction to sustainable development - Economy-Environment interlinkages - Meaning of sustainable development - Limits to growth and the environmental Kuznets curve – The sustainability debate - Issues of energy and the economics of energy.

Module-II	ENVIRONMENTAL DEGRADATION	9Hrs

Economic significance and causes of environmental degradation - The concepts of policy failure, externality and market failure - Economic analysis of environmental degradation – Equi –marginal principle.

Module-III	ECONOMICS OF POLLUTION	10Hrs

Economics of optimal pollution, regulation, monitoring and enforcement - Managing pollution using existing markets: Bargaining solutions – Managing pollution through market intervention: Taxes, subsidies and permits.

Module-IV	COST – BENEFIT ANALYSIS	10Hrs

Cost – Benefit Analysis: Economic value of environmental resources and environmental damage - Concept of Total Economic Value - Alternative approaches to valuation – Cost-benefit analysis and discounting.

Module-V	ECONOMICS OF BIODIVERSITY	10Hrs

Economics of biodiversity: Economics of biodiversity conservation - Valuing individual species and diversity of species -Policy responses at national and international levels. Economics of Climate Change – stern Report

Text Books:

1. An Introduction to Environmental Economics by N. Hanley, J. Shogren and B. White Oxford University Press.(2001)
2. Blueprint for a Green Economy by D.W. Pearce, A. Markandya and E.B. Barbier Earthscan, London.(1989)

Reference Books:

1. Environmental Economics: An Elementary Introduction by R.K. Turner, D.W. Pearce and I. Bateman Harvester Wheatsheaft, London. (1994),
2. Economics of Natural Resources and the Environment by D.W. Pearce and R.K. Turner Harvester Wheat sheaf, London. (1990),

Web Resources:

https://nptel.ac.in/courses/109107171

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INTRODUCTION TO COMPOSITE MATERIALS

(Common to CSE,AI&ML,DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0327Tb	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- To be familiar with classification and characteristics of composite material and their applications.
- To gain the knowledge about manufacturing methods of composites.
- To know the testing methods related to composite materials.

Course Outcomes(CO):

To provide knowledge on characteristics of composites

- To get knowledge on manufacturing and testing methods and mechanical behaviour of composites.
- To get the exposure of different materials.

Syllabus		Total Hours:48
Module-I	**Introduction**	**10Hrs**
Definitions, Composites, Reinforcements and matrices, Types of reinforcements, Types of matrices, Types of composites, Carbon Fibre composites, Properties of composites in comparison with standard materials, Applications of metal, ceramic and polymer matrix composites.		
Module-II	**Manufacturing Methods**	**9Hrs**
Hand and spray lay - up, injection molding, resin injection, filament winding, pultrusion, centrifugal casting and prepregs. Fibre/Matrix Interface, mechanical. Measurement of interface strength.		
Module-III	**Mechanical Properties**	**9Hrs**
Stiffness and Strength: Geometrical aspects – volume and weight fraction. Unidirectional continuous fibre, discontinuous fibers, Short fiber systems, woven reinforcements –Mechanical Testing: Determination of stiffness and strengths of unidirectional composites; tension, compression, flexure and shear.		
Module-IV	**Laminates**	**10Hrs**
Plate Stiffness and Compliance, Assumptions, Strains, Stress Resultants, Plate Stiffness and Compliance, Computation of Stresses, Types of Laminates -, Symmetric Laminates, Anti-symmetric Laminate, Balanced Laminate, Quasi-isotropic Laminates, Crossply Laminate, Angle-ply Laminate. Orthotropic Laminate, Laminate Moduli, Hygrothermal Stresses.		
Module-V	**Joining Methods and Failure Theories**	**10Hrs**
Joining –Advantages and disadvantages of adhesive and mechanically fastened joints. Typical bond strengths and test procedures.		

Text Books:

1. K.K. Chawla, (1998), Composite Materials, Springer-Verlag, New York 2. B.T. Astrom, (1997),
2. Manufacturing of Polymer Composites, Chapman & Hall
3. Composite materials by J.N.Reddy

Reference Books:

1. Stuart M Lee, J. Ian Gray, Miltz, (1989), Reference Book for Composites Technology,CRC press
2. Frank L Matthews and R D Rawlings, (2006), Composite Materials: Engineering and Science, Taylor and Francis.

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NATURAL LANGUAGE PROCESSING LAB
(Common to CSE,AI&ML,DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3306P	0: 0:3:0	2	CIE: 30SEE:70	3Hours	PCC

Course Objectives:

This course will enable students:

- To introduce the students with the basics of NLP which will empower them for developing advanced NLP tools and
- solving practical problems in the field.

Course Outcomes (CO):

On completion of this course, student will be able to:

- Understand approaches to syntax and semantics in NLP.
- Analyze grammar formalism and context free grammars
- Apply the statistical estimation and statistical alignment models
- Apply Rule based Techniques, Statistical Machine translation (SMT), word alignment, phrase based translation
- Have the skills (experience) of solving specific NLP tasks, which may involve programming in Python, as well as running experiments on textual data.

Syllabus | **Total Hours:48**

List of Experiments:

Experiment-1: Word Analysis

Experiment-2: Word Generation

Experiment-3: Morphology

Experiment-4: N-Grams

Experiment-5: N-Grams Smoothing

Experiment-6: POS Tagging: Hidden Markov Model

Experiment-7: POS Tagging: Viterbi Decoding

Experiment-8: Building POS Tagger

Experiment-9: Chunking

Experiment-10: Building Chunker

Reference Books:

1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2. Natural Language Processing, A paninian perspective, Akshar Bharathi, Vineet Chaitanya, Prentice –Hall of India.

Web References:

1. Welcome to Virtual Labs - A MHRD Govt of india Initiative (vlabs.ac.in)
2. Natural Language Processing in TensorFlow | Coursera

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DEEP LEARNING LAB
(Common to CSE,AI&ML,DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3307P	0:0:3:0	1.5	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- Understand the context of Neural networks and deep learning.
- Introduce major Deep learning algorithms, the problem settings, and their applications to solve real world problems.

Course Outcomes(CO):

On completion of this course, the students are able to:

- Use Keras.
- Identify the Deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
- Solve real-world problems using different algorithms.

Syllabus	Total Hours:30

List of Experiments:

Experiment-1: Introduction of Keras.
Experiment-2: Installing Keras and packages in Keras.
Experiment-3: Train the model to add two numbers and report the result.
Experiment-4: Train the model to multiply two matrices and report the result using keras.
Experiment-5: Train the model to print the prime numbers using Keras.
Experiment-6: Implement the Recurrent Long Short Term Memory Network model using keras for Text generation.
Experiment-7: Implement CNN Model for Image Classification using Keras.
Experiment-8: Implement a traditional LSTM for sequence classification problem.
Experiment-9: Implement Autoencoder using Kerasand train on MNIST Dataset.

Web references:

1. https://rses-dl-course.github.io/
2. https://www.geeksforgeeks.org/understanding-of-lstm-networks/

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CLOUD COMPUTING LAB

(Common to CSE,AI&ML,DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0533P	0:0:3:0	1.5	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- To develop web applications in cloud
- To learn the design and development process involved in creating a cloud based application
- Understand transfer of file form one virtual machine to another
- To learn to implement and use parallel programming using Hadoop

Course Outcomes(CO):

On completion of this course, student will be able to

- Configure various virtualization tools such as Virtual Box, VMware workstation**.**
- Design and deploy a web application in a PaaS environment.
- Learn how to simulate a cloud environment to implement new schedulers.
- Install and use a generic cloud environment that can be used as a private cloud.
- Manipulate large data sets in a parallel environment.

Syllabus | **Total Hours:48**

List of Experiments

Experiment-1: Install VirtualBox/VMware Workstation with different flavors of Linux or windows OS on top of windows operating systems.

Experiment-2: Install a C compiler in the virtual machine created using virtual box and execute Simple Programs

Experiment-3: Install Google App Engine. Create hello world app and other simple web applications using python/java.

Experiment-4: Use GAE launcher to launch the web applications.

Experiment-5: Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

Experiment-6: Find a procedure to transfer the files from one virtual machine to another virtual machine.

Experiment-7: Find a procedure to launch virtual machine using try stack (Online Open stack Demo Version)

Experiment-8: Install Hadoop single node cluster and run simple applications like word count

Web References:

1. https://www.vmware.com/products/workstation-pro/workstation-pro-evaluation.html
2. http://code.google.com/appengine/downloads.html
3. http://code.google.com/appengine/downloads.html

Online Learning Resources/Virtual Labs:

1. Google Cloud Computing Foundations Course - Course (nptel.ac.in)

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R PROGRAMMING (Skill Oriented Course)

(Common to AI&ML, DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0525	1:0:2:0	2	CIE:30 SEE:70	3 Hours	SC

Course Objectives:

This course will enable students to:

- How to manipulate data within R and to create simple graphs and charts used in introductory statistics.
- The given data using different distribution functions in R.
- The hypothesis testing and calculate confidence intervals; perform linear regression modelsfor data analysis.
- The relevance and importance of the theory in solving practical problems in the real world.

Course Outcomes (CO):

On completion of this course, student will be able to

- Install and use R for simple programming tasks.
- Extend the functionality of R by using add-on packages
- Extract data from files and other sources and perform various data manipulation tasks on them.
- Explore statistical functions in R.
- Use R Graphics and Tables to visualize results of various statistical operations on data.
- Apply the knowledge of R gained to data Analytics for real-life applications

Syllabus	Total Hours:48

List of Experiments

Experiment-1: Installation of R-Programming Environment.
Experiment-2: Implementation of Data types, variables and Reserved words.
Experiment-3: Implementation of operators, statements, Loops and functions.
Experiment-4: Implementation of objects**:** Vector, List, Array.
Experiment-5: Write a R program to combine three arrays so that the first row of the first array is followed by the first row of the second array and then first row of the third array.
Experiment-6: Implementation of objects**:** Data frame, Matrix, Factors.
Experiment-7: Write a R program to create a data frame using two given vectors and display the duplicated elements and unique rows.
Experiment-8: Collect the Data sets for Performing Mathematical operations.
Experiment-9: Implementation of Data Visualization using R: visualization packages in R, Pie Charts, Bar Charts, Box Plots, Histograms, Line Graphs, Scatter Plots.
Experiment-10: Collect Dataset and Perform Statistical Analysis.
Experiment-11: Collect Dataset and Perform data visualization.

Text Books:

1. Beginning R, the statistical programming language by Dr Mark Gardener.

Reference Books:

1. "R Programming for Beginners: Fast and Easy Learning" by Steven Keller, Kindle Edition.
2. "A Handbook of Statistical Analyses Using R" by Brian Everitt and TorstenHothorn.
3. "R Graphics Cookbook" by Winston Chang.

Web Reference:

1. https://www.rstudio.com/
2. https://www.w3schools.com/
3. https://www.r-project.org/

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RESEARCH METHODOLOGY

(Common **to CSE, AI&ML, CS, DS, ECE, EEE, ME**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0032T	2:0:0:0	0	CIE: 30	-	MC

Course Objectives:

This course will enable students to:

- To understand the basic concepts of research and research problem
- To make the students learn about various types of data collection and sampling
- Design to enable them to know the method of statistical evaluation
- To make the students understand various testing tools in research
- To make the student learn how to write a research report
- To create awareness on ethical issues n research

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand basic concepts and its methodologies
- Understand the concept of sampling and sampling design
- Design survey questionnaires for different kinds of research
- Read. comprehend and explain research articles in their academic discipline
- Analyze various types of testing tools used in research
- Design a research paper without any ethical issues

Syllabus		Total Hours:48
Module-I	**INTRODUCTION TO RESEARCHMETHODOLOGY**	**10Hrs**

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining Research Problem – Research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

Module-II	SAMPLING AND DATA COLLECTION METHODS	9Hrs

Sampling Design – steps in Sampling Design –Characteristics of a Good Sample Design – Random Sampling Design. Measurement and Scaling Techniques-Errors in Measurement – Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation. Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

Module-III	CORRELATION	10Hrs

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

Module-IV	STATISTICAL INFERENCE	9Hrs

Statistical Inference: Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multivariate Analysis

Module-V	REPORT WRITING	10Hrs

Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research

Text Books:

1. C.R.Kothari, "Research Methodology:Methods and Techniques",2nd edition, New Age International Publishers.
2. A Step by Step Guide for Beginners, "Research Methodology": Ranjit Kumar, Sage Publications

Reference Books:

1. P.Narayana Reddy and G.V.R.K.Acharyulu, "Research Methodology and Statistical Tools", 1st Edition, Excel Books,New Delhi.
2. Donald R. "Business Research Methods", Cooper & Pamela S Schindler, 9th edition.
3. 3. S C Gupta, "Fundamentals of Statistics", 7th edition Himalaya Publications

Web Reference:

https://onlinecourses.swayam2.ac.in/cec20_hs17/preview

https://onlinecourses.nptel.ac.in/noc22_ge08/preview

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Semester-7 (Theory-6, SC-1)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	HSC	22A0023T 22A0024T 22A0025T	**Humanity Science Elective – I:** 1. Management Science 2. Entrepreneurship and Innovation 3. Business Environment	3	0	0	3
2	PEC	22A3308T 22A0534b 22A3309T	Professional Elective-III: 1. Recommender Systems 2. High Performance Computing 3. Intelligent Information Retrieval Systems	3	0	0	3
3	PEC	22A0535a 22A3310T 22A3311T	Professional Elective-IV: 1. Block Chain Technology 2. Reinforcement Learning 3. Social Network Analysis	3	0	0	3
4	PEC	22A0536a 22A0536b 22A0536c	Professional Elective-V: 1. Image Processing 2. Knowledge Representation and Reasoning 3. Full Stack Web Development	3	0	0	3
5	OEC	22A0241Ta 22A0432T 22A0151T 22A0327Tc	**Open Elective-III:** 1. Smart Grid 2. Basic VLSI Design 3. Disaster management 4. Measurements and Mechatronics	3	0	0	3
6	OEC	22A0232Ta 22A0433T 22A0152T 22A0331Tc	**Open Elective-IV:** 1. Electric Vehicles 2. Industrial Electronics 3. Construction Management 4. Introduction to Robotics	3	0	0	3
7	SC	22A0537	**Skill Advanced Course:** Mobile Application Development	1	0	2	2
Industrial / Research Internship 2 Months (Mandatory) afterThird year (to be evaluated during VII semester)				0	0	0	3
				Total credits			**23**
Honors / Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				**4**	**0**	**0**	**4**

Category	Credits
Professional Elective Courses (PEC)	9
Humanities and Social Science Course (HSC)	3

Open Elective Courses (OEC)	6
Skill Advanced Course (SC)	2
Industrial / Research Internship	3
Total	23

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MANAGEMENT SCIENCE
(Common to CSE, AI&ML, DS, CS, CE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0023T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	HSC

Course Objectives:

This course will enable students to:

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts.
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management.
- To make the students aware of the contemporary issues in management.

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand the concepts & principles of management and designs of organization in a practical world
- Apply the knowledge of Work-study principles & Quality Control techniques in industry
- Analyze the concepts of HRM in Recruitment, Selection and Training & Development.
- Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.
- Create Modern technology in management science.

Syllabus		Total Hours:48
Module – I	**INTRODUCTION TO MANAGEMENT**	**10 Hrs**

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles -Eltan Mayo's Human relations - Systems Theory - Organizational Designs - Line organization –Line & Staff Organization-Functional Organization-Matrix Organization-Project Organization-Committee form of Organization-Social responsibilities of Management.

Module – II	**OPERATIONS MANAGEMENT**	**10 Hrs**

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production),Work Study-Statistical Quality Control-Deming's contribution to Quality. Material Management - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - Marketing Management - Concept -Meaning-Nature-Functions of Marketing-Marketing Mix-Channels of Distribution-Advertisement and Sales Promotion-Marketing Strategies based on Product Life Cycle.

Module – III	**HUMAN RESOURCES MANAGEMENT**	**10 Hrs**

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning (HRP)- Employee Recruitment-Sources of Recruitment- Employee Selection -Process and Tests in Employee Selection –Employee Training and Development-On-the-job & Off-the-job training methods-Performance Appraisal Concept- Methods of Performance Appraisal – Placement-Employee Induction –Wage and Salary Administration.

Module – IV	**STRATEGIC & PROJECTMANAGEMENT**	**10 Hrs**

Definition & Meaning-Setting of Vision -Mission -Goals –Corporate Planning Process-Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis –Project Management-Network Analysis-Program Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project with in given time-Project Cost-Analysis-Project Crashing (Simple problems).

Module – V	**CONTEMPORARY ISSUES IN MANAGEMENT**	**8 Hrs**

The concept of Management Information System (MIS)-Materials Requirement Planning (MRP)- Customer Relations Management (CRM)-Total Quality Management (TQM) –Six Sigma Concept-Supply Chain Management (SCM)-Enterprise Resource Planning (ERP)-Performance Management-Business Process Outsourcing (BPO)-Business Process Re-engineering and Bench Marking-Balanced Score Card-Knowledge Management.

Text Books:

1. A. RAryasri, “Management Science”,TMH,2 013
2. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi,2012.

Reference Books:

1. Koontz & Weihrich, “Essentials of Management”, 6th edition, TMH, 2005.
2. Thomas N.Duening & John M.Ivancevich, “Management Principles and Guidelines”, Biztantra.
3. Kanishka Bedi, “Production and Operations Management”, Oxford University Press, 2004.
4. Samuel C.Certo, “Modern Management”,9th edition, PHI, 2005

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ENTREPRENEURSHIP AND INNOVATION

(Common to CSE, AI&ML, DS, CS, CE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0024T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	HSC

Course Objectives:

This course will enable students to:

- To make the student understand about Entrepreneurship
- To enable the student in knowing various sources of generating new ideas in setting up of New enterprise
- To facilitate the student in knowing various sources of finance in starting up of a business
- To impart knowledge about various government sources which provide financial assistance to entrepreneurs / women entrepreneurs
- To encourage the student in creating and designing business plans

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand the concept of Entrepreneurship and challenges in the world of competition.
- Apply the Knowledge in generating ideas for New Ventures.
- Analyze various sources of finance and subsidies to entrepreneur / women Entrepreneurs.
- Evaluate the role of central government and state government in promoting entrepreneurship.
- Create and design business plan structure through incubations.

Syllabus		Total Hours:48
Module – I	**STARTING UP NEW VENTURE**	**10 Hrs**
Entrepreneurship-Concept, knowledge and skills requirement-Characteristics of successful entrepreneurs-Entrepreneurship process-Factors impacting emergence of entrepreneurship-Differences between Entrepreneur and Intrapreneur-Understanding individual entrepreneurial mind set and personality-Recent trends in Entrepreneurship.		
Module – II	**STARTING UP NEW VENTURE**	**10 Hrs**
Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas-Opportunity recognition-Feasibility study-Market feasibility, technical / operational feasibility - Financial feasibility - Drawing business plan - Preparing project report – Presenting business plan to investors.		
Module – III	**SOURCES OF FINANACE**	**10 Hrs**
Sources of finance - Various sources of Finance available - Long term sources - Short term sources - Institutional Finance – Commercial Banks, SFC's in India- NBFC's in India - theirway of financingin India for small and medium business -Entrepreneurship development programs in India – The entrepreneurial journey- Institutions in aid of entrepreneurship development		
Module – IV	**WOMEN ENTREPRENEURSHIP**	**10 Hrs**
Women Entrepreneurship-Entrepreneurship Development and Government-Role of Central Government and State Government in promoting women Entrepreneurship - Introduction to various incentives, subsidies and grants – Export- oriented Units - Fiscal and Tax concessions available - Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India-Issues & Challenges-Entrepreneurial motivations.		

Module – V	INTRODUCTION TO INCUBATION & INNOVATION	8 Hrs

Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation – Types, Advantages and Disadvantages of incubation.
Innovation Meaning & Definition - Forms of innovation - Innovation, features and characteristics - Factors initiating innovations - Innovation process and its stages.

Text Books:

1. D F Kuratko and T V Rao, "Entrepreneurship**"**- A South-Asian Perspective–Cengage Learning, 2012. (For PPT,Case Solutions Faculty may visit: login.cengage.com)
2. Nandan H, "Fundamentals of Entrepreneurship", PHI, 2013

Reference Books:

1. Vasant Desai, "Small Scale Industries and Entrepreneurship", Himalaya Publishing 2012.
2. Rajeev Roy "Entrepreneurship", 2nd Edition, Oxford, 2012.
3. B.Janakiram and M.Rizwana ‖ "Entrepreneurship Development: Text & Cases", Excel Books, 2011.
4. Stuart Read, Effectual "Entrepreneurship", Routledge, 2013.

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BUSINESS ENVIRONMENT

(Common to CSE, AI&ML, DS, CS, CE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0025T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	HSC

Course Objectives:

This course will enable students to:

- To make the student understand about the business environment.
- To enable the min knowing the importance of fiscal and monitory policy.
- To facilitate the min understanding the export policy of the country.
- Impart knowledge about the functioning and role of WTO.
- Encourage the student in knowing the structure of stock market.

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand various types of business environment.
- Evaluate fiscal and monitory policy
- Analyze India's Trade Policy
- Understand the role of WTO
- Apply the knowledge of Money markets in future investment

Syllabus		Total Hours:48
Module – I	**AN OVERVIEW OF BUSINESS ENVIRONMENT**	**10 Hrs**

Overview of Business Environment – Types of Environments - Internal & External –Micro and Macro environment- Competitive structure of industries - Environmental analysis - Scope of business-Characteristics of business-Process & limitations of environment alanalysis.

Module – II	**FISCAL POLICY & MONETARY POLICY**	**10 Hrs**

FISCAL POLICY-Public Revenues-Public Expenditure-Public debt Development activities financed by public expenditure - Evaluation of recent fiscal policy of Government of India - Highlights of Budget - MONETARY POLICY - Demand and Supply of Money – RBI –Objectives of monetary and credit policy-Recent trends-Role of Finance Commission.

Module – III	**INDIA'S TRADE POLICY & BALANCE OF PAYMENTS**	**10 Hrs**

INDIA'S TRADE POLICY - Magnitude and direction of Indian International Trade – Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank - BALANCE OF PAYMENTS–Structure & Major components-Causes for Disequilibrium in Balance of Payments-Correction measures–WTO - Nature and Scope - Organization and Structure – Role and functions of WTO in promoting world trade

Module – IV	**MONEY MARKETS AND CAPITAL**	**10 Hrs**

	MARKETS	
Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets -Reforms and recent development– SEBI - Stock Exchanges - Investor protection and role of SEBI.		
Module – V	**INTRODUCTION TO INFLATION**	**8 Hrs**
Inflation – Meaning & Definition – Causes – Effects – Types – Advantages & Disadvantages Deflation – Meaning & Definition - Causes & Effects.		

Text Books:

1. Francis Cherunilam (2009), "International Business": Text and Cases, Prentice Hall of India.
2. K.Aswathappa, "Essentials of Business Environment": Texts and Cases & Exercises 13th Revised Edition. HPH 2016.

Reference Books:

1. K.V.Sivayya,V.B.MDas (2009), Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
2. Sundaram, Black (2009), International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.
3. Chari.S.N (2009), International Business, Wiley India.
4. E.Bhattacharya (2009), International Business, Excel Publications, New Delhi.

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RECOMMENDER SYSTEMS
(Professional Elective-III)
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3308T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- To provide students with basic concepts and its application in various domain
- To make the students understand different techniques that a data scientist needs to know for analysing big data
- To design and build a complete machine learning solution in many application domains.

Course Outcomes (CO):

On completion of this course, student will be able to

- Aware of various issues related to Personalization and Recommendations.
- Design and implement a set of well-known Recommender System approaches used in E commerce and Tourism industry.
- Develop new Recommender Systems for a number of domains especially, Education, Health-care.

Syllabus		**Total Hours:50**
Module-I	**An Introduction to Recommender Systems, Neighborhood-Based Collaborative Filtering**	**10 Hrs**

Introduction, Goals of Recommender Systems, Basic Models of Recommender Systems, Domain Specific Challenges in Recommender Systems. Advanced Topics and Applications. Introduction, Key Properties of Ratings Matrices, Predicting Ratings with Neighborhood Neighborhood-Based Collaborative Filtering: Based Methods, Clustering and Neighborhood-Based Methods, Dimensionality Reduction and Neighborhood Methods, Graph Models for Neighborhood-Based Methods, A Regression Modeling View of Neighborhood Methods

Module-II	**Model-Based Collaborative Filtering, Content-Based Recommender Systems**	**8 Hrs**

Introduction, Decision and Regression Trees, Rule-Based Collaborative Filtering, Naive Bayes Collaborative Filtering, Using an Arbitrary Classification Model as a Black-Box, Latent Factor Models, Integrating Factorization and Neighborhood Models. Content-Based Recommender Systems: Introduction, Basic Components of Content-Based Systems, Preprocessing and Feature Extraction, Learning User Profiles and Filtering, Content-Based Versus Collaborative Recommendations, Using Content-Based Models for Collaborative Filtering, Summary.

Module-III	**Knowledge-Based Recommender Systems, Ensemble Based and Hybrid Recommender Systems**	**10Hrs**

Introduction, Constraint-Based Recommender Systems, Case-Based Recommenders, Persistent Personalization in Knowledge-Based Systems, Summary. Introduction, Ensemble Methods from the Classification Perspective, Weighted Hybrids, Switching Hybrids, Cascade Hybrids, Feature Augmentation Hybrids, Meta-Level Hybrids, Feature Combination Hybrids, Summary.

Module-IV	**Evaluating Recommender Systems, Context-**	**10 Hrs**

	Sensitive Recommender Systems	
Introduction, Evaluation Paradigms, General Goals of Evaluation Design, Design Issues in Offline Recommender Evaluation, Accuracy Metrics in Offline Evaluation, Limitations of Evaluation Measures, Limitations of Evaluation Measures. Introduction, The Multidimensional Approach, Contextual Pre-filtering: A Reduction-Based Approach, Contextual Pre-filtering: A Reduction-Based Approach, Contextual Modeling		
Module-V	**Time- and Location-Sensitive Recommender Systems**	**12 Hrs**
Introduction, Temporal Collaborative Filtering, Discrete Temporal Models, Location-Aware Recommender Systems, Location-Aware Recommender Systems Location-Aware Recommender Systems, Summary.		

Text Books:

1. Charu C. Aggarwal, "Recommender Systems", Springer,2016

Reference Books:

1. Francesco Ricci, LiorRokach, "Recommender Systems Handbook", 2nd ed., Springer, 2015 Edition.

Web References:

1. https://datahack.analyticsvidhya.com/contest/janatahack-recommendation-systems/

2.https://datahack.analyticsvidhya.com/contest/janatahack-recommendation-systems/%202.%20Recommender%20Systems%20%7C%20Coursera

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HIGH PERFORMANCE COMPUTING
(Common to AI&ML,DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0534b	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Learn concepts of parallel processing as it pertains to high-performance computing.
- Solve problems a raised in Parallel Processing.
- Design and analyze parallel programs on high performance computing resources using parallel programming paradigms.

Course Outcomes (CO):

On completion of this course, student will be able to

- Distinguish different Parallel Processing Computers.
- Analyze the computational speed and performance of parallel programming using message
  - passing paradigm using open-source APIs.
- Apply Pipeline and Synchronization techniques in different parallel processing platforms.
- Solve Load Balancing Problems.
- Utilize techniques to automatically implement, optimize, and adapt programs to different platforms
- Solve Performance issues in Parallel Processing

Syllabus		Total Hours:48
Module-I	**Parallel Computers**	**9 Hrs**
The Demand for Computational Speed, Potential for Increased Computational Speed, Types of Parallel Computers, Cluster Computing.		
Module-II	**Message Passing Computing**	**10 Hrs**
Basics of Message - Passing Programming, using a Cluster of Computers, Evaluating Parallel Programs, Debugging and Evaluating Parallel Programs Empirically.		
Module-III	**Pipelined Computations and Synchronous Computations**	**9 Hrs**
Pipeline Techniques, Computing Platform for Pipelined Applications, Pipeline Program Examples, Synchronization, Synchronization Computations, Synchronous Iteration Program Examples.		
Module-IV	**Load Balancing and Termination Detection**	**10Hrs**
Load Balancing, Dynamic Load Balancing, Distributed Termination Detection Algorithms, Program Example.		
Module-V	**Programming with Shared Memory**	**10Hrs**
Shared Memory Multiprocessors, Constructs for Specify Parallelism, Sharing Data, Parallel Programming Languages and Constructs, Performance Issues.		

Text Books:

1. Parallel Programming: Techniques and Applications using Networked Work-stations and Parallel Computers" (2nd ed.) by B. Wilkinson and M. Allen, Prentice Hall.

Reference Books:

1. An Introduction to Parallel Computing: Design and Analysis of Algorithms, Second Edition - A.Grama, A. Gupta, G. Karypis and V. Kumar, Pearson.

Web References:

https://nptel.ac.in/courses/112105293
https://archive.nptel.ac.in/courses/112/105/112105293/

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INTELLIGENT INFORMATION RETRIEVAL SYSTEMS
(Common to CSE,AI&ML,DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3309T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Teach how to retrieve information
- Discuss indexing and how to use it
- Demonstrate how to automate indexing

Course Outcomes (CO):

After the completion of the course students will able to

- Recognize the Boolean Model, Vector Space Model, and Probabilistic Model.
- Understand retrieval utilities.
- Understand different formatting tags
- Understand cross-language information retrieval
- Understand the clustering techniques
- Determine the efficiency.

Syllabus		Total Hours:48
Module-I	**Introduction**	**10Hrs**

Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses.

Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities

Module-II	Cataloguing and Indexing, Data structure	9Hrs

Cataloguing and Indexing: History and objectives of Indexing, Indexing Process, Automatic Indexing, Information extraction.

Data structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models.

Module-III	Automatic Indexing, Document and Term Clustering	10Hrs

Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages.
Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Manual Clustering Automatic Term Clustering, Complete Term Relation Method, Clustering Using Existing Clusters, One Pass Assignments, Item Clustering, hierarchy of Clusters.

Module-IV	Automatic Indexing, Information visualization	9Hrs

Automatic Indexing: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext.

Information visualization: Introduction to Information visualization, Cognition and perception, Information Visualization Technologies.

Module-V	**Text Search Algorithms, Multimedia Information Retrieval, Information System Evaluation**	**10Hrs**

Text Search Algorithms: Introduction to Text Search techniques, software Text Search algorithms, Hardware Text Search Systems.

Multimedia Information Retrieval: Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph retrieval, Imagery Retrieval, Video Retrieval.

Information System Evaluation: Introduction to Information System Evaluation, Measures Used in System Evaluation, Measurement Example- TREC results.

Text Books:

1. Information Storage and Retrieval Systems: Theory and Implementation by Gerald J. Kowalski, Mark T. Maybury, Springer, 2013.

Reference Books:

1. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
2. Modern Information Retrieval by Yates Pearson Education.
3. Information Storage & Retrieval by Robert Korfhage – John Wiley & Sons.

Web References:

https://www.tutorialandexample.com/information-retrieval

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Block Chain Technology

(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0535a	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Illustrate the fundamental concepts of black chain.
- Determine the crypto currency primitives.
- Compare and contrast the bit coins and Crypto currency
- Illustrate the different security features

Course Outcomes (CO):

On completion of this course, student will be able to

- Describe the basic concepts and technology used for block chain.
- Describe the primitives of the distributed computing and cryptography related to block chain.
- Illustrate the concepts of Bit coin and their usage.
- Implement Ethereum block chain contract.
- Apply security features in block chain technologies.
- Use smart contract in real world applications.

Syllabus — **Total Hours:48**

Module-I	**Introduction**	**9Hrs**

Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Nakamoto's concept with Block chain based crypto currency, Technologies Borrowed in Block chain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc

Module-II	Basic Distributed Computing & Crypto primitives:	**10Hrs**

Atomic Broadcast, Consensus, Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems

Module-III	Bitcoin basics	**10Hrs**

Bitcoin blockchain, Challenges and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use

Module-IV	Ethereum basics:	**10Hrs**

Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts, Writing smart contracts using Solidity & JavaScript

Module-V	Privacy, Security issues in Block chain:	**9Hrs**

Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Block chains: Sybil attacks, selfish mining, 51% attacks advent of algorand; Sharding based consensus algorithms to prevent these attacks

Text Books:

1. Josh Thompson, 'Block chain: The Block chain for Beginnings, Guild to Block chain Technology and Block chain Programming', Create Space Independent Publishing Platform, 2017.
2. Narayanan, Bonneau, Felten, Miller and Goldfeder, "Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction", Princeton University Press.

Reference Books:

1. Imran Bashir, "Mastering Block chain: Distributed ledger technology, decentralization, and smart contracts explained", Packt Publishing.

2. Merunas Grincalaitis, "Mastering Ethereum: Implement Advanced Block chain Applications Using Ethereum-supported Tools, Services, and Protocols", Packet Publishing.

Web References:

1. https://onlinecourses.nptel.ac.in/noc22_cs44/preview
2. https://nptel.ac.in/courses/106104220

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REINFORCEMENT LEARNING
(Common to CSE, AI&ML,DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3310T	3:1:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- To learn RL task formulation (action space, state space, environment definition)
- To learn Tabular based solutions (dynamic programming, Monte Carlo, temporal-difference)
- To learn Function approximation solutions (Deep Q-networks)
- To learn Policy gradient from basic (REINFORCE) towards advanced topics (proximal policy optimization, deep deterministic policy gradient, etc.)
- To learn Model-based reinforcement learning

Course Outcomes (CO):

On completion of this course, student will be able to

- Formulate Reinforcement Learning problems
- Apply various Tabular Solution Methods to Markov Reward Process Problems
- Apply various Iterative Solution methods to Markov Decision Process Problems
- Comprehend Function approximation methods

Syllabus — **Total Hours:48**

Module-I	Introduction	10Hrs

Course logistics and overview. Origin and history of Reinforcement Learning research. Its connections with other related fields and with different branches of machine learning. Probability Primer

Brush up of Probability concepts - Axioms of probability, concepts of random variables, PMF, PDFs, CDFs, Expectation. Concepts of joint and multiple random variables, joint, conditional and marginal distributions. Correlation and independence

Module-II	Markov Decision Process	10 Hrs

Introduction to RL terminology, Markov property, Markov chains, Markov reward process (MRP). Introduction to and proof of Bellman equations for MRPs along with proof of existence of solution to Bellman equations in MRP. Introduction to Markov decision process (MDP), state and action value functions, Bellman expectation equations, optimality of value functions and policies, Bellman optimality equations.

Prediction and Control by Dynamic Programming - Overview of dynamic programming for MDP, definition and formulation of planning in MDPs, principle of optimality, iterative policy evaluation, policy iteration, value iteration, Banach fixed point theorem, proof of contraction mapping property of Bellman expectation and optimality operators, proof of convergence of policy evaluation and value iteration algorithms, DP extensions.

Module-III	Monte Carlo Methods for Model Free Prediction and Control	9 Hrs

Overview of Monte Carlo methods for model free RL, First visit and every visit Monte Carlo, Monte Carlo control, On policy and off policy learning, Importance sampling.

TD Methods - Incremental Monte Carlo Methods for Model Free Prediction, Overview TD(0),

TD(1) and TD(λ), k step estimators, unified view of DP, MC and TD evaluation methods, TD Control methods - SARSA, Q-Learning and their variants

Module-IV	Function Approximation Methods	10 Hrs

Getting started with the function approximation methods, Revisiting risk minimization, gradient descent from Machine Learning, Gradient MC and Semi-gradient TD(0) algorithms, Eligibility trace for function approximation, After states, Control with function approximation, Least squares, Experience replay in deep Q-Networks.

Module-V	Policy Gradients	9 Hrs

Getting started with policy gradient methods, Log-derivative trick, Naive REINFORCE algorithm, bias and variance in Reinforcement Learning, Reducing variance in policy gradient estimates, baselines, advantage function, actor-critic methods.

Text Books:

1. Sutton, Richard S., and Andrew G. Barto. Reinforcement learning: An introduction. MIT press, 2018.
2. Leon-Garcia, Alberto. Probability and random processes for electrical engineering. Pearson Education India, 1994

Reference Books:

1. Murphy, Kevin P. Machine learning: a probabilistic perspective. MIT press, 2012.

Web References:

https://www.freecodecamp.org/news/an-introduction-to-reinforcement-learning-4339519de419/
https://www.geeksforgeeks.org/what-is-reinforcement-learning/

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SOCIAL NETWORK ANALYSIS
(Common **to CSE, AI&ML, CS, DS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3311T	**3: 1:0:0**	**3**	**CIE: 30SEE:70**	**3Hours**	**PEC**

Course Objectives:

This course will enable students to:

- Understand the basic concepts of Social network analysis
- Identify communities in social networks
- Perform predictive analytics in social networks

Course Outcomes(CO):

On completion of this course, student will be able to

After completion of the course, students will be able to

- Detect communities in social networks
- Predict links in social networks
- Perform Social Influence Analysis

Syllabus		Total Hours:48
Module-I	**Fundamentals of Networks**	**10 Hrs**

Networks in the real world: Social networks, Information networks, Technological networks, biological networks

Mathematics of networks: Networks and their representation, Types of networks: Weighted, directed and hyper graphs, the adjacency, Laplacian, and incidence matrices, Degree, paths, components, independent paths, connectivity, and cut sets.

Module-II	Centrality measures	9 Hrs

Degree centrality, Closeness centrality, Homophily, Transitivity and Preferential attachment, Clustering coefficient and Assortative mixing, Eigenvector centrality, Katz centrality, Betweenness centrality, Page rank, Hubs and Authorities

Module-III	Community Detection in Social Networks	10 Hrs

Detecting communities in social networks, Definition of community, Applications of community detection. Algorithms for community detection: The Kernighan-Lin Algorithm, Agglomerative/Divisive Algorithms, Markov Clustering, Multi-level Graph Partitioning, Spectral Algorithms, Modularity Maximization, Other Approaches, Evaluating communities

Module-IV	Predictive Analytics in Social Networks	10 Hrs

Link prediction problem, Link prediction measures, Feature based Link Prediction, Evaluation Node classification problem Node classification: Problem definition and applications; Iterative classification methods; Label propagation method; Graph regularization method; Evaluation

Module-V	Current Research in Social Networks	9 Hrs

Social Influence Analysis, privacy in social networks, integrating sensors and social networks, multimedia information networks in social media and social tagging and applications.

Text Book:

1. Newman, M. E. J. (2010), "**Networks: An introduction**. "Oxford University Press.
2. Alexander Kouznetsov, "**Social Network Analysis for Start-ups: Finding connections on the social web",** Shroff publishers and distributors Pvt. Ltd

Reference Books:

1. Tanmay Chakraborty "**Social Network analysis**" Wiley
2. Newman, M. E. J. (2010). Networks: an introduction. Oxford; New York: Oxford University Press.
3. Aggarwal, C. C. (2011). An introduction to social network data analytics. In Social network data analytics (pp. 1-15). Springer, Boston, MA.
4. Barabási, A. L. (2013). Network science. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 371(1987), 20120375.

Web References:

https://social-network-analysis.in/

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IMAGE PROCESSING
(PROFESSIONAL ELECTIVE-V)
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0536a	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Objectives:

Provide a theoretical and mathematical foundation of fundamental Digital Image Processing concepts.

- Image Acquisition
- Sampling And Quantization
- Preprocessing
- Enhancement
- Restoration
- Segmentation and Compression

Course Outcomes(CO):

On completion of this course, student will be able to

- Demonstrate the knowledge of the fundamental concepts of a image processing system.
- Analyze images in the frequency domain using various transforms.
- Evaluate the techniques for image enhancement and image restoration.
- Interpret image segmentation and representation techniques.
- Categorize various compression techniques.
- Interpret Image compression standards

Syllabus		Total Hours:48
Module-I	**Basics to Image Processing**	**10Hrs**

Digital Image Fundamentals: Digital Image through Scanner, Digital Camera. Concept of Gray Levels. Gray Level to Binary Image Conversion. Sampling and Quantization. Relationship between Pixels. Imaging Geometry. 2D Transformations-DFT, DCT, KLT and SVD

Module-II	**Image Enhancement**	**9Hrs**

Image Enhancement in Spatial Domain Point Processing, Histogram Processing, Spatial Filtering, Enhancement in Frequency Domain, Image Smoothing, Image Sharpening.

Module-III	**Image Restoration**	**10Hrs**

Image Restoration Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration

Module-IV	**Image Segmentation**	**9Hrs**

Image Segmentation Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region Oriented Segmentation.

Module-V	**Image Compression**	**10Hrs**

Image Compression Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Source Encoder and Decoder, Error Free Compression, Lossy Compression.

Text Book:

1. Digital Image Processing: R.C. Gonzalez & R. E. Woods, Addison Wesley/ Pearson Education, 2nd Ed, 2004

Reference Books:

1. Fundamentals of Digital Image Processing: A. K. Jain, PHI.
2. Digital Image Processing using MAT LAB: Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins: Pearson Education India, 2004.
3. Digital Image Processing: William K. Pratt, John Wilely, 3rd Edition, 2004.

Web References:

https://archive.nptel.ac.in/courses/117/105/117105135/

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Knowledge Representation and Reasoning
(Common **to CSE, AI&ML, CS, DS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0536b	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- To investigate the key concepts of knowledge representation (KR) techniques and different notations.
- To integrate the KR view as a knowledge engineering approach to model organizational knowledge.
- To introduce the study of ontologies as a KR paradigm and applications of ontologies.
- To understand various KR techniques.
- To understand process, knowledge acquisition and sharing of ontology.

Course Outcomes (CO):

On completion of this course, student will be able to

- Analyze and design knowledge-based systems intended for computer implementation.
- Acquire theoretical knowledge about principles for logic-based representation and reasoning.
- Ability to understand knowledge- engineering process.
- Ability to implement production systems, frames, inheritance systems and approaches to handle uncertain or in complete knowledge.

Syllabus	Total Hours:48
Module-I	**10Hrs**
The Key Concepts: Knowledge, Representation, Reasoning, Why knowledge representation and reasoning, Role of logic. Logic: Historical background, Representing knowledge in logic, Varieties of logic, Name, Type, Measures, Unity and diversity	
Module-II	**9Hrs**
Ontology: Ontological categories, Philosophical background, Top-level categories, describing physical entities, Defining abstractions, Sets, Collections, Types and Categories, Space and Time	
Module-III	**10Hrs**
Knowledge Representations: Knowledge Engineering, Representing structure in frames, Rules and data, Object-oriented systems, Natural language Semantics, Levels of representation	
Module-IV	**9Hrs**
Processes: Times, Events and Situations, Classification of processes, Procedures, Processes and Histories, Concurrent processes, Computation, Constraint satisfaction, Change Contexts: Syntax of contexts, Semantics of contexts, First-order reasoning in contexts, Modal reasoning in contexts, Encapsulating objects in contexts.	
Module-V	**10Hrs**
Knowledge Soup: Vagueness, Uncertainty, Randomness and Ignorance, Limitations of logic, Fuzzy logic, Non-monotonic Logic, Theories, Models and the world, Semiotics Knowledge Acquisition and Sharing: Sharing Ontologies, Conceptual schema, accommodating multiple paradigms, Relating different knowledge representations, Language patterns, Tools for knowledge acquisition	

Text Books:

1. Knowledge Representation logical, Philosophical, and Computational Foundations by JohnF. Sowa, Thomson Learning.
2. Knowledge Representation and Reasoning by Ronald J. Brachman, Hector J. Levesque, Elsevier

Reference Books:

1. Foundations of Knowledge Representation and Reasoning: 810 (Lecture Notes in Computer Science),by Gerhard Lakemeyer,28 June 1994

Web References:

1. https://www.sciencedirect.com/topics/computer-science/knowledge-representation-and-reasoning
2. https://www.professional-ai.com/reasoning-in-artificial-intelligence.html

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FULL STACK WEB DEVELOPMENT
(Common **to CSE, AI&ML, CS, DS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0536c	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- To become knowledgeable about the most recent web development technologies.
- Idea for creating two tier and three tier architectural web applications.
- Design and analyze real time web applications.
- Constructing suitable client and server-side applications.
- To learn core concept of both front end and back end programming.

Course Outcomes(CO):

On completion of this course, student will be able to

- Summarize the knowledge on front end and back-end Tools
- Develop a fully functioning website on a web server.
- Use code packages based on their documentation to produce working results in a project.
- Construct web pages functioning from external data.
- Implement web application that employing efficient database access.

Syllabus		Total Hours:48
Module-I	**Web Development Basics**	**10Hrs**
Web Development Basics: Web development Basics - HTML & Web servers Shell - UNIX CLI Version control - Git &GitHub HTML, CSS		
Module-II	**Frontend Development**	**9Hrs**
Frontend Development: JavaScript basics OOPS Aspects of JavaScript Memory usage and Functions in JS AJAX for data exchange with server jQuery Framework jQuery events, UI components etc. JSON data format.		
Module-III	**REACT JS**	**10Hrs**
REACT JS: Introduction to React, React Router and Single Page Applications React Forms, Flow Architecture and Introduction to Redux More Redux and Client-Server Communication.		
Module-IV	**Architecture Requirements and Designing**	**9Hrs**
Java Web Development: JAVA PROGRAMMING BASICS, Model View Controller (MVC) Pattern, MVC Architecture using Spring RESTful API using Spring Framework, Building an application using Maven		
Module-V	**Databases & Deployment**	**10Hrs**
Databases & Deployment: Relational schemas and normalization Structured Query Language (SQL) Data persistence using Spring JDBC Agile development principles.		

Text Books:

1. Web Design with HTML, CSS, JavaScript and JQuery Set Book by Jon Duckett Professional JavaScript for Web Developers Book by Nicholas C. Zakas
2. Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-byStep Guide to Creating Dynamic Websites by Robin Nixon

Reference Books:

1. Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB. Copyright © 2015 BYAZAT MARDAN
2. Full-Stack JavaScript Development by Eric Bush.
3. Mastering Full Stack React Web Development Paperback – April 28, 2017 by TomaszDyl , Kamil Przeorski , Maciej Czarnecki

Web References:

https://www.udemy.com/course/the-complete-web-development-2020

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SMART ELECTRIC GRID
(Open Elective-III)
(Common **to CSE, AI&ML, CS, DS, ECE,EEE, ME**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0241Ta	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

Student will be able to

- Overview of the technologies required for the smart grid
- Switching techniques and different means for data communication
- Standards for information exchange and smart metering
- Methods used for information security on smart grid
- Smart metering and protocols for smart metering
- Power quality management with upgraded technologies.

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand the concepts and design of Smart grid.
- Understand the various communication technologies in smart grid.
- Understand the various measurement technologies in smart grid.
- Understand the analysis and stability of smart grid.
- Learn the renewable energy resources and storages integrated with smart grid.
- familiarize the high-performance computing for Smart Grid applications.

Syllabus		Total Hours: 48
Module-I	**INTRODUCTION TO SMART GRID**	**10 Hrs**
Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, Concept of Resilient &Self-Healing Grid, Present development & International policies in Smart Grid, Diverse perspectives from experts and global Smart Grid initiatives		
Module-II	**SMART GRID TECHNOLOGIES**	**8 Hrs**
Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management, High Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).		
Module–III	**SMART METERS**	**10 Hrs**
Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED) & their application for monitoring & protection.		
Module-IV	**POWER QUALITY MANAGEMENT IN SMART GRID**	**10 Hrs**

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

Module–V	**HIGH PERFORMANCE COMPUTING**	**10 Hrs**

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN),Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

Textbooks:

1. Smart Grid, Janaka Ekanayake, Liyanage, Wu, Akihiko Yokoyama, Jenkins, Wiley Publications, 2012, Reprint 2015.
2. Smart Grid: Fundamentals of Design and Analysis, James Momoh, Wiley, IEEE Press., 2012, Reprint 2016.

Reference Books:

1. The Smart Grid – Enabling Energy efficiency and demand response, Clark W. Gellings, P.E., CRC Press, Taylor & Francis group, First Indian Reprint. 2015.
2. Smart Grid – Applications, Communications, and Security Edited by Lars Torsten Berger, Krzysztof Wisniewski, WILEY, 2012, Reprint 2015.
3. Practical Electrical Network Automation and Communication Systems, Cobus Strauss, ELSVIER, 2003

Web References:

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BASIC VLSI DESIGN
(Common **to CSE, AI&ML, CS, DS, ECE, EEE, ME**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0432T	3:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

- To give exposure to different steps involved in fabrication Process of PMOS & NMOS transistors, CMOS & BICOM Inverters.
- To provide knowledge on electrical properties of MOS & BICMOS devices to analyze the behavior of inverters designed with various loads.
- To provide knowledge on Basic Circuit Concepts of VLSI Design
- To apply the design Rules and draw layout of a given logic circuit and basic circuit concepts to MOS circuits.
- To Apply the design for testability methods for combinational & sequential CMOS circuits

Course Outcomes:

After the completion of the course students will able to:

- Acquire qualitative knowledge about the fabrication process of integrated circuit using MOS transistors.
- Understand the concept of Basic Electrical Properties of MOS/Bi-CMOS Devices
- Apply the basic circuit concepts to MOS circuits.
- Understand the concept of Scaling of MOS circuits and Limitations of Scaling
- Apply the design Rules to draw the Stick diagram &layout of a given logic circuit.
- Interpret the need for testability and testing methods in VLSI.

Syllabus		Total Hours: 48
Module–I	**Introduction to Fabrication Process**	**10 Hrs**

Introduction: Brief Introduction to IC technology, Moore's Law, Different modes MOSFET operation, Fabrication Process of PMOS, NMOS, CMOS & Bi-CMOS devices, Comparison between CMOS and Bi-polar Technologies.
Fabrication Steps: Wafer Preparation, Oxidation, Photolithography, Etching, Ion Implantations, Metallization, Testing.

Module– II	Basic Electrical Properties of MOS/BiCMOS devices	10 Hrs

Basic Electrical Properties: Ids Vs Vds relationships, MOS transistor Threshold Voltage-VT, figure of merit-ω0, Transconductance - gm, Output conductance-gds, Pass transistor logic, NMOS Inverter, Pull-up to Pull-down Ratio for NMOS inverter driven by another NMOS inverter, and through one or more pass transistors Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

Module– III	Basic Circuit Concepts	9 Hrs

Basic Circuit Concepts: Sheet Resistance Rs and concepts to MOS, Area Capacitances calculations, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out

Module– IV	VLSI Circuit Design Processes	10 Hrs

VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Lambda(λ)-based design rules for wires, contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters

Logic Gates and Various MOS Circuits. Scaling of MOS circuits, Limitations of Scaling.

Module– V	**CMOS Testing**	**9 Hrs**

CAD Tools for Design and Simulation, Aspects of Design Tools, Design for Testability, Testing Combinational Logic, Testing Sequential Logic, Practical Design for Test (OFT) Guidelines, Scan Design Techniques, Built-In-Self-Test (BIST), Future Trends.

Text Books:

1. Kamran Eshraghian, "Essentials of VLSI Circuits and Systems", Douglas and A. Pucknell and SholehEshraghian, Prentice-Hall of India Private Limited, 2005 Edition.
2. Behzad Razavi , "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2003

References Books:

1. Modern VLSI Design – Wayne Wolf, 3 Ed., 1997, Pearson Education.
2. Jan M. Rabaey, "Digital Integrated Circuits", AnanthaChandrakasan and Borivoje Nikolic, Prentice-Hall of India Pvt.Ltd, 2nd edition, 2009.
3. John P. Uyemura, "Introduction to VLSI Circuits and Systems", John Wiley & Sons, reprint 2009
4. CMOS VLSI Design-A Circuits and Systems Perspective, Neil H.E Weste, David Harris, Ayan Banerjee, 3rd Edn, Pearson, 2009.

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DISASTER MANAGEMENT

(Common **to CSE, AI&ML, CS, DS, ECE,EEE, ME**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0151T	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

- Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
- Develop an awareness of the chronological phases of natural disaster response and refugee relief operations
- Describe the three planning strategies useful in mitigation
- Describe public awareness and economic incentive possibilities
- Understand the tools of post-disaster management

Course Outcomes:

On completion of this course, student will be able to

- To know about the natural hazards and its management
- To know about the fire hazards and solid waste management
- To understand about the emerging infectious diseases and aids their management
- To know about the regulations of building codes and land use planning related to risk and vulnerability.
- To impart the education related to risk reduction in schools and communities

Syllabus		Total Hours: 48
Module-I	**NATURAL HAZARDS AND DISASTER MANAGEMENT**	**9 Hrs**

Introduction of DM – Inter disciplinary -nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: floods, draughts – Earthquakes – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast – landslides

Module-II	MAN MADE DISASTER	9 Hrs

Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrotirism - threat in mega cities, rail and air craft's accidents, and Emerging infectious diseases & Aids and their management.

Module–III	RISK AND VULNERABILITY	10 Hrs

Building codes and land use planning – social vulnerability – environmental vulnerability – Macroeconomic management and sustainable development, climate change risk rendition – financial management of disaster – related losses.

Module –IV	ROLE OF TECHNOLOGY IN DISASTER MANAGEMENTS	10 Hrs

Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations roads and bridges- mitigation programme for earth quakes –flowchart,

geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training- transformable indigenous knowledge in disaster reduction.

Module–V	EDUCATION AND COMMUNITY PREPAREDNESS	10 Hrs

Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community based disaster recovery -Community based disaster management and social capital-Designing resilience- building community capacity for action.

Text Books:

1. Rajib shah & R R Krishnamurthy "Disaster Management" – Global Challenges and Local Solutions' Universities press. (2009),
2. Tushar Bhattacharya, "Disaster Science & Management" Tata McGraw Hill Education Pvt. Ltd., New Delhi

Reference Books:

1. Harsh. K . Gupta "Disaster Management edited", Universities press, 2003.

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1. https://www.youtube.com/watch?v=DExlZTfKZAM&list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG

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MEASUREMENTS AND MECHATRONICS
(Common **to CSE, AI&ML, CS, DS, ECE, EEE, ME**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0327Tc	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

- To instruct the principles of interchangeable manufacture.
- To introduce basic principles of mechanical measurements.
- To impart knowledge on mechatronics systems.

Course Outcomes:

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

- design the limit gauges for interchangeable manufacture.
- apply the basic principles of mechanical measurements for engineering practice.
- illustrate the role of mechatronics systems in manufacturing.
- explain principles of mechanical, hydraulic, pneumatic and electrical actuating systems.

Syllabus		Total Hours: 48
Module-I	**Limits & Fits**	**10 Hrs**

Introduction, terminology pertaining to limits and fits – unilateral and bilateral tolerance system, hole and shaft basis systems – Interchangeability, deterministic & statistical tolerance, selective assembly. International Standard system of limits and fits

Limit Gauges: Taylor's principle – Classification and design of limit gauges.

Module-II	**Linear and Angular Measurements**	**10Hrs**

Line and end standards, slip gauges and length bars. bevel protractor – angle slip gauges – spirit levels and auto collimator.

Interferometry Applied to Measurement: NPL flatness interferometer and NPL gauge interferometer.

Surface Roughness Measurement: Differences between surface roughness and surface waviness- Numerical assessment of surface finish – CLA, R.M.S, Rz values, Methods of measurement of surface finish – Profilograph, Talysurf

Module-III	**Mechanical Measurements**	**10Hrs**

Introduction to measurement: Elements of generalized measurement system

Displacement Measurement- Linear Variable Differential Transformer (LVDT), encoders, potentiometers.

Temperature Measurement - Pyrometers, Resistance Temperature Detector (RTD)

Strain Measurement-Electrical strain gauge – gauge factor – method of usage of resistance strain gauge

Module-IV	**Mechatronics Systems**	**10 Hrs**

Mechatronics systems- Elements of mechatronics system, mechatronics design process, system - measurement systems, control systems, programmable logic controllers, case studies of mechatronic systems

Module-V	Actuating Systems:	8Hrs

Hydraulic and pneumatic actuating systems - fluid systems, hydraulic systems, and pneumatic systems, components, control valves. mechanical actuating systems and electrical actuating systems – basic principles and elements.

Textbooks:

1. R.K. Jain, "Engineering Metrology", Khanna Publishers.
2. BeckWith, Marangoni, Linehard, " Mechanical Measurements", 6th edition,PHI / PE.
3.

Reference Books:

1. W. Bolton , "Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg.", 4th Edition, Pearson, 2012.
2. IC Guptha,"Engineering Metrology ",Danpath Rai Publications.
3. Doeblin Earnest. O. Adaptation by Manik and Dhanesh,"Measurement Systems: Application and Design", Tata Mc Graw Hill Publications.

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ELECTRIC VEHICLES
(Open Elective-IV)
(Common to all Except EEE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0232Ta	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

- Understand to Provide good foundation on hybrid and electrical vehicles.
- Understand To address the underlying concepts and methods behind power transmission in hybrid and electrical vehicles
- Familiarize energy storage systems for electrical and hybrid transportation
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles.

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand the working of hybrid and electric vehicles
- Apply a suitable drive scheme for developing an hybrid and electric vehicles depending on resources
- Develop the electric propulsion unit and its control for application of electric vehicles.
- Understand the proper energy storage systems for vehicle applications
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles

Syllabus		Total Hours:50
Module–I	**Electric Vehicle Propulsion and Energy Sources**	**10 Hrs**

Introduction to electric vehicles, vehicle mechanics - kinetics and dynamics, roadway fundamentals propulsion system design - force velocity characteristics, calculation of tractive power and energy required, electric vehicle power source - battery capacity, state of charge and discharge, specific energy, specific power, Ragone plot. battery modeling - run time battery model, first principle model, battery management system- soc measurement, battery cell balancing. Traction batteries - nickel metal hydride battery, Li-Ion, Lipolymer battery.

Module–II	**Electric Vehicle Power Plant and Drives**	**10Hrs**

Introduction electric vehicle power plants. Induction machines, permanent magnet machines, switch reluctance machines. Power electronic converters-DC/DC converters - buck boost converter, isolated DC/DC converter. Two quadrant chopper and switching modes. AC drives PWM, current control method. Switch reluctance machine drives - voltage control, current control.

Module–III	**Hybrid And Electric Drive Trains**	**9Hrs**

Introduction hybrid electric vehicles, history and social importance, impact of modern drive trains in energy supplies. Hybrid traction and electric traction. Hybrid and electric drive train topologies. Power flow control and energy efficiency analysis, configuration and control of DC motor drives and induction motor drives, permanent magnet motor drives, switch reluctance motor drives, drive system efficiency.

Module–IV	Electric and Hybrid Vehicles - Case Studies	9 Hrs
Parallel hybrid, series hybrid -charge sustaining, charge depleting. Hybrid vehicle case study – Toyota Prius, Honda Insight, Chevrolet Volt. 42 V system for traction applications. Lightly hybridized vehicles and low voltage systems. Electric vehicle case study - GM EV1, Nissan Leaf, Mitsubishi Miev. Hybrid electric heavy-duty vehicles, fuel cell heavy duty vehicles.		
Module–V	**Electric And Hybrid Vehicle Design**	**10Hrs**
Introduction to hybrid vehicle design. Matching the electric machine and the internal combustion engine. Sizing of propulsion motor, power electronics, drive system. Selection of energy storage technology, communications, supporting subsystem. Energy management strategies in hybrid and electric vehicles - energy management strategies- classification, comparison, implementation.		

Text Books:

1. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", 2nd edition, CRC Press, 2003.
2. Amir Khajepour, M. Saber Fallah, AvestaGoodarzi, "Electric and Hybrid Vehicles: Technologies, Modeling and Control - A Mechatronic Approach", illustrated edition, John Wiley & Sons, 2014.

Reference Books:

1. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004.
2. James Larminie, John Lowry, "Electric Vehicle Technology", Explained, Wiley, 2003.
3. John G. Hayes, G. Abas Goodarzi, "Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles", 1st edition, WileyBlackwell, 2018.

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INDUSTRIAL ELECTRONICS
Common to **(EEE,CSE, AI&ML, IT, CS, DS)**

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0433T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- Describe semi-conductor devices (such as PN junction diode & Transistor) and their switching characteristics.
- Understand the characteristics of AC to DC converters.
- Understand about the practical applications Electronics in industries.
- Describe the ultrasonic and its application.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the semi-conductor devices and their switching characteristics.
- Apply the Ultrasonic waves with different applications.
- Understand the working of Transistor and its different configurations.
- Analyze the thermal effects of ultrasonic, soldering and welding by ultrasonic, ultrasonic Drying in the industry; interpret the characteristics of AC to DC converters.
- Develop the practical applications Electronics in industries.
- Apply the process of Resistance welding, Induction heating and Dielectric heating in the industry.

Syllabus		Total Hours:48
Module-I	**Scope of industrial Electronics**	**10 Hrs**

Scope of industrial Electronics, Semiconductors, Merits of semiconductors, crystalline structure, Intrinsic semiconductors, Extrinsic semiconductors, current flow in semiconductor, Open circuited p-n junction, Diode resistance, Zener diode, Photo conductors and junction photo diodes, Photo voltaic effect, Light emitting diodes(LED).

Module-II	**Junction Transistor**	**9 Hrs**

Introduction, The junction transistor, Conventions for polarities of voltages and currents, Open circuited transistor, Transistor biased in the active region, Current components in transistors, Currents in a transistor, Emitter efficiency, Transport factor and transistor-α, Dynamic emitter resistance, Transistor as an amplifier, Transistor construction, Letter symbols for semiconductor Devices, Characteristic curves of junction transistor in common configuration, static characteristic curves of PNP junction transistor in common emitter configuration, The transistor in common collector Configuration.

Module-III	**AC to DC converters**	**10 Hrs**

AC to DC converters- Introduction, Classification of Rectifiers, Half wave Rectifiers, Full wave Rectifiers, Comparison of Half wave and full wave rectifiers, Bridge Rectifiers, Bridge Rectifier meter, Voltage multiplying Rectifier circuits, Capacitor filter, LC Filter, Metal Rectifiers, Regulated Power Supplies, Classification of Voltage Regulators, Short period Accuracy of Regulators, Long period.Accuracy of Voltage Regulator, Principle of automatic voltage Regulator, Simple D.C. Voltage stabilizer using Zener diode, D.C. Voltage Regulators, Series Voltage Regulators, Complete

series voltage regulator circuit, Simple series voltage regulator.

Module-IV	Resistance welding controls	10 Hrs

Resistance welding controls: Introduction, Resistance welding process, Basic Circuit for A.C. resistance welding, Types of Resistance welding, electronic welding control used in Resistance welding, Energy storage welding. Induction heating: Principle of induction heating, Theory of Induction heating merits of induction heating, Application of induction heating, High frequency power source of induction heating. Dielectric heating: Principle of dielectric heating, theory of dielectric heating, dielectric properties of typical materials, electrodes used in dielectric heating, method of coupling of electrodes to the R.F. generator, Thermal losses in Dielectric heating, Applications.

Module-V	Ultrasonics	9 Hrs

Ultrasonics: Introduction, Generation of Ultrasonic waves, Application of Ultrasonic waves, Ultrasonic stroboscope, ultrasonic as means of communication, ultrasonic flaw detection, Optical image on non-homogeneities, ultrasonic study of structure of matter, Dispersive study of structure of matter, Dispersive and colloidal effect of Ultrasonic, Coagulating action of Ultrasonic, separation of mixtures by ultrasonic waves, cutting and machining of hard materials by ultrasonic vibrations, Degassing of liquids by ultrasonic waves, Physio-chemical effects of ultrasonics, chemical effects of ultrasonics, Thermal effects of ultrasonics, soldering and welding by ultrasonics, Ultrasonic Drying

Text Books:

1. Fundamentals of Industrial Electronics, Bogdan M Wilamowski, J David irwin, 2nd Edition, 2011.
2. Industrial and Power Electronics – G. K. Mithal and Maneesha Gupta, Khanna Publishers, 19th Ed., 2003.

References:

1. Integrated Electronics – J. Millman and C.C Halkias, McGraw Hill, 1972.
2. Electronic Devices and circuits – Theodore. H. Bogart, Pearson Education, 6thEdn., 2003.
3. Integrated Circuits and Semiconductor Devices – Deboo and Burroughs, ISE

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CONSTRUCTION MANAGEMENT
(ME, CSE, AI&ML, CS, DS, ECE, EEE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0152T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- To make the student familiar with various construction activities, preparing construction schedule and maintaining documents and records of those activities
- To teach the students about various terms and technologies involved in earthwork of construction activities
- To make the students familiar with concepts involved in project management like bar charts and milestone charts
- To teach the students the concepts of time estimates involved in CPM and PERT , float and slack, critical path calculations

Course Outcomes (CO):

On completion of this course, student will be able to

- Identify the various construction activities like preparing construction schedule and maintaining documents and records of those activities
- Understand the concepts and techniques involved in earthwork activities
- To understand about the emerging infectious diseases and aids their management
- Understand the steps involved in developing a project scheduling and management and the application of bar charts and milestone charts.
- Understand the various elements of a network diagram like event, activity and dummy.
- Understand the concepts of calculation of time estimates of CPM and PERT

Syllabus		Total Hours:48
Module-I	**FUNDAMENTALS OF CONSTRUCTION TECHNOLOGY**	**9 Hrs**

Definitions and Discussion – Construction Activities –Construction Processes -Construction Works – Construction Estimating – Construction Schedule – Productivity and Mechanized Construction – Construction Documents – Construction Records – Quality – Safety – Codes and Regulations.

Module-II	EARTHWORK	9 Hrs

Classification of Soils – Project Site – Development – Setting Out - Mechanized Excavation – Groundwater Control – Trenchless (No-dig) Technology – Grading – Dredging.Rock Excavation – Basic Mechanics of Breakage – Blasting Theory – Drillability of Rocks – Kinds of Drilling – Selection of the Drilling Method and Equipment – Explosives – Blasting Patterns and Firing Sequence – Smooth Blasting – Environmental Effect of Blasting

Module-III	PROJECT MANAGEMENT AND BAR CHARTS AND MILESTONE CHARTS	10 Hrs
Project planning – Scheduling – Controlling – Role of decision in project management – Techniques for analyzing alternatives Operation research – Methods of planning and programming problems – Development of bar chart – Illustrative examples – Shortcomings of bar charts and remedial measures – Milestone charts		
Module-IV	**ELEMENTS OF NETWORK AND DEVELOPMENT OF NETWORK**	**10 Hrs**
Introduction – Event – Activity – Dummy – Network rules – Graphical guidelines for network – Common partial situations in network – Numbering the events – Cycles Problems.		
Module-V	**PERT AND CPM**	**10Hrs**
Time estimates – Frequency distribution – Mean, variance and standard deviation-Expected time Problems -Earliest expected time – Formulation for TE - Latest allowable occurrence time – Formulation for TL - Combined tabular computations for TE and TL problems.Introduction - Slack – Critical path-Illustrative examples Problems.		

Text Books:

1. Construction project management by Jha ,Pearsonpublications, New Delhi 2nd Edition 2015
2. Construction Technology by SubirK.Sarkar and SubhajitSaraswati – Oxford Higher EducationUniv.Press, Delhi 2008 edition

Reference Books:

1. Project Planning and Control with PERT and CPM by Dr.B.C.Punmia, K.K.Khandelwal, Lakshmi Publications New Delhi 2022 editionDelhi
2. Optimal design of water distribution networks P.R.Bhave, Narosa Publishing house 2003.
3. Total Project management, the Indian context- by : P.K.JOY- Mac Millan Publishers India Limited.

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INTRODUCTION TO ROBOTICS					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0331Tc	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PEC**

Course Objectives:

The objectives of this course are Identify robots and its peripherals for satisfactory operation and control of robots for industrial and non-industrial applications.

Course Outcomes (CO):

After the completion of the course students will able to

1. List and explain the basic elements of industrial robots
2. Analyze robot kinematics and its control methods.
3. Classify the various sensors used in robots for better performance.
4. Summarize various industrial and non-industrial applications of robots

Syllabus		**Total Hours:48**
Module-I	**ROBOT BASICS**	**10 Hrs**
Automation and Robotics: Robot-Basic concepts, Need, Law, History, Anatomy, specifications. Robot configurations-cartesian, cylinder, polar and articulate. Robot wrist mechanism, Precision, accuracy, repeatability, work and volume of robot.		
Module-II	**ROBOT ELEMENTS**	**10 Hrs**
End effectors-Classification- Types of Mechanical actuation, Gripper design, Robot drive system Types, Position and velocity feedback devices-Robot joints and links-Types, Motion interpolation		
Module-III	**ROBOT KINEMATICS AND CONTROL**	**9 Hrs**
Robot kinematics – Basics of direct and inverse kinematics, Robot trajectories, 2D and 3D Transformation-Scaling, Rotation, Translation Homogeneous transformation. Control of robot manipulators – Point to point, Continuous Path Control, Robot programming		
Module-IV	**ROBOT SENSORS**	**9 Hrs**
Sensors in robot – Touch sensors -Tactile sensor – Proximity and range sensors. Force sensor-Light sensors, Pressure sensors, Introduction to Machine Vision and Artificial Intelligence.		
Module-V	**ROBOT APPLICATIONS**	**10 Hrs**
Industrial applications of robots-Medical, Household, Entertainment, Space, Underwater, Defense, Disaster management. Applications, Micro and Nanorobots, Future Applications.		

Text Books:

1. Mikell P. Groover, Mitchell Weiss, Roger N Nagel, Nicholas G Odrey, “Industrial Robotics Technology,
2. Programming and Applications”, Tata –McGraw Hill Pub. Co., 2008.

Reference Books:

1. Deb.S.R and Sankha Deb, "Robotics Technology and Flexible Automation", Tata McGraw Hill Publishing Company Limited, 2010.
2. Klafter.R.D, Chmielewski.T.A, and Noggin’s., “Robot Engineering: An Integrated Approach”’, Prentice Hall of India Pvt. Ltd., 1994.
3. Fu.K.S, Gonzalez.R.C&Lee.C.S.G, “Robotics control, sensing, vision and intelligence”, Tata-McGraw Hill Pub. Co., 2008
4. Yu. “Industrial Robotics”, MIR Publishers Moscow, 1985

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MOBILEAPPLICATIONDEVELOPMENT

(Skill Advanced Course)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0537	1: 0:2:0	2	CIE: 30 SEE:70	3 Hours	SC

Course Objectives:

This course will enable students :

- To understand fundamentals of android operating systems.
- Illustrate the various components, layouts and views in creating android applications
- To understand fundamentals of android programming

Course Outcomes(CO):

On completion of this course, student will be able to:

- Define Android OS, gradle, Android Studio.
- Construct mobile application on physical device and emulator
- Develop mobile applications with various widgets
- Design mobile applications with various layouts
- Build mobile application along with Media
- Design and develop menus in mobile applications

Syllabus	Total Hours:48

Introduction to Android: Introduction**,** Understanding the Android Software Stack, installing the Android, Creating Android Virtual Devices, Creating the First Android Project, Using the Android Emulator, The Android Debug Bridge(ADB), Launching Android Applications on a Handset

Experiment-1: Set Up Mobile Development Environment using Android

Experiment-2: Create "Hello World" Application

1. Create a new Android Project
2. Run "Hello World" on the Emulator
3. On a Physical Device

Basic Widgets: Overview of the Android Project Files, Understanding Activities, Role of the Android Manifest File, Event Handling, Displaying Messages Through Toast, Using the Edit Text Control, Choosing Options with Checkbox, Choosing Mutually Exclusive Items Using Radio Buttons

Experiment-3: Create an application using Text Edit control

Experiment-4: Create an application by choosing Options with Checkbox

Experiment-5: Create an application by choosing Mutually Exclusive Items Using Radio Buttons

Layouts: Introduction to Layouts, Linear Layout, Relative Layout, Using Image View, Frame Layout, Table Layout

Experiment-6: Design an application using Relative Layout

Experiment-7: Design an application using Frame Layout

Selection widgets: Using List View, Using the Spinner control

Experiment-8: Create an application by choosing Options with List View

Experiment-9: Create an application by choosing Options with Spinner

Utilizing Media: Switching States with Toggle Buttons, Creating an Images Switcher Application, Playing Audio, Playing Video

Experiment-10: Create an application to play an Audio clip

Experiment-11: Create an application to play the Video clip

Building Menus: Creating Interface Menus, Types of menus, Creating Menus Through XML

Experiment-12: Create an application to display a Menu

Text Books:

1. Android Programming by B.M Harwani, Pearson Education, 2013.

Reference Books:

1. Professional Android 4 applications development, Reto Meier, Wiley India, 2012.
2. Beginning Android 4 applications development, Wei- Meng Lee, Wiley India,2013

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