

SRI VASAVI ENGINEERING COLLEGE (Autonomous)

(Permanent Affiliation to JNTUK, Kakinada), PEDATADEPALLI, TADEPALLIGUDEM-534 101



Department of Computer Science and Engineering

B.Tech CSE(Artificial Intelligence)

&

B.Tech(Artificial Intelligence& Machine Learning)

SEMESTER - I (FIRST YEAR)

S.No.	Course Code	Name of the Course		L	T	P	C
1	V20MAT01	Linear Algebra and Differential Equations	BSC	3	0	0	3
2	V20MAT09	Descriptive Statistics	BSC	3	0	0	3
3	V20ENT01	English for Professional Enhancement	HSS	3	0	0	3
4	V20AIL01	Computer Engineering Workshop	ESC	1	0	4	3
5	V20CST01	Programming in 'C' for problem Solving	ESC	3	0	0	3
6	V20ENL01	Hone Your Communication Skills Lab -I	HSS	0	0	3	1.5
7	V20AIL02	Statistical Visualization using R Lab	ESC	0	0	3	1.5
8	V20CSL01	Programming Lab in 'C' for problem Solving	ESC	0	0	3	1.5
Total:				13	0	13	19.5

Total Contact Hours: 26

Total Credits: 19.5

SEMESTER - II (FIRST YEAR)

S.No.	Course Code	Name of the Course		L	T	P	C
1	V20MAT10	Integral Transformations and Vector Calculus	BSC	3	0	0	3
2	V20CST02	Python Programming	ESC	3	0	0	3
3	V20ECT01	Switching Theory and Logic Design	ESC	3	0	0	3
4	V20CST04	Data Structures	ESC	3	0	0	3
5	V20AIT01	Introduction to Artificial Intelligence	ESC	3	0	0	3
6	V20CSL02	Python Programming Lab	ESC	0	0	3	1.5
7	V20CSL04	Data Structures Lab	ESC	0	0	3	1.5
8	V20ENL02	Hone Your Communication Skills Lab -II	HSC	0	0	3	1.5
9	V20CHT02	Environmental Science	MNC	2	0	0	0
Total:				17	0	09	19.5

Total Contact Hours: 26

Total Credits: 19.5

SEMESTER-III (SECOND YEAR)

S.No.	Course Code	Name of the Course		L	T	P	C
1	V20MBT51	Managerial Economics and Financial Analysis	HSS	3	0	0	3
2	V20MAT11	Probability Theory	BSC	3	0	0	3
3	V20MAT07	Mathematical Foundation of Computer Science	BSC	3	0	0	3
4	V20AIT02	Advanced Python Programming	PCC	3	0	0	3
5	V20AIT03	Database Management Systems	PCC	3	0	0	3
6	V20AIL03	Advanced Python Programming Lab	PCC	0	0	3	1.5
7	V20AIL04	Linux Shell Scripting Lab	PCC	0	0	3	1.5
8	V20AIL05	Database Management Systems Lab.	PCC	0	0	3	1.5
9	V20CSP01	Community Service Project	CSP	0	0	8	4
10	V20SOC01	Skill Oriented Course-I*	SO	1	0	2	2
11	V20ENT02	Professional Communication Skills -I	MNC	2	0	0	0
Total:				18	0	11	25.5

Total Contact Hours: 37**Total Credits: 25.5****SEMESTER - IV (SECOND YEAR)**

S.No.	Course Code	Name of the Course		L	T	P	C
1	V20AIT04	Computer Organization and Architecture	PCC	3	0	0	3
2	V20AIT05	Design and Analysis of Algorithms	PCC	3	0	0	3
3	V20AIT06	Java Programming	PCC	3	0	0	3
4	V20AIT07	Operating Systems	PCC	3	0	0	3
5	V20AIT08	Artificial Intelligence and its Applications	PCC	3	0	0	3
6	V20AIL06	Java Programming Lab	PCC	0	0	3	1.5
7	V20AIL07	Operating Systems Lab	PCC	0	0	3	1.5
8	V20AIL08	Artificial Intelligence Lab	PCC	0	0	3	1.5
9	V20SOC02	Skill Oriented Course-II*	SO	1	0	0	2
10	V20ENT03	Professional Communication Skills -II	MNC	2	0	0	0
Total:				18	0	11	21.5

Total Contact Hours: 29**Total Credits: 21.5**

* The Student need to select one Skill Oriented Course from the given pool of courses.

V SEMESTER (THIRD YEAR)

S.No.	Course Code	Name of the Course		L	T	P	C
1	V20AIT09	Data Engineering	PCC	3	0	0	3
2	V20AIT10	Machine Learning	PCC	3	0	0	3
3	V20AIT11	Web Technologies	PCC	3	0	0	3
4		Open Elective -I / Job Oriented Elective-I	OEC	3	0	0	3
			JOE	0	0	6	
5	Professional Elective-I		PEC	3	0	0	3
	V20AITPE01	i) Cryptography & Network Security					
	V20AITPE02	ii) Principles of Programming Languages					
	V20AITPE03	iii) Hadoop & Big Data					
	V20AITPE04	iv) Automata and Compiler Design					
6	V20AIL09	Machine Learning Lab	PCC	0	0	3	1.5
7	V20AIL10	Web Technologies Lab	PCC	0	0	3	1.5
9	V20SOC03	Skill Oriented Course-III* (Soft Skills)	SOC / SS	1	0	2	2
10	V20AIP01	Mini Project / Internship	Internship	0	0	3	1.5
11	V20ENT04	Professional Communication Skills -III	MNC	2	0	0	0
Total:				15	0	17	21.5

Total Contact Hours: 32

Total Credits: 21.5

VI SEMESTER (THIRD YEAR)

S.No.	Course Code	Name of the Course		L	T	P	C
1	V20AIT12	Computer Networks	PCC	3	0	0	3
2	V20AIT13	Object Oriented Software Engineering	PCC	3	0	0	3
3	V20AIT14	Deep Learning	PCC	3	0	0	3
4		Open Elective -II / Job Oriented Elective-II	OEC	3	0	0	3
			JOE	0	0	6	
5	Professional Elective-II		PEC	3	0	0	3
	V20AITPE05	i) Cyber Security					
	V20AITPE06	ii) Cloud Computing					
	V20AITPE07	iii) Data Science					
	V20AITPE08	iv) Social Networks and Semantic Web					
6	V20AIL11	Computer Networks Lab	PCC	0	0	3	1.5
7	V20AIL12	Object Oriented Software Engineering Lab	PCC	0	0	3	1.5
8	V20AIL13	Deep Learning Lab	PCC	0	0	3	1.5
9	V20SOC04	Skill Oriented Course-IV*	SOC	1	0	2	2
10	V20CEMC02	Professional Ethics & Human Values	MNC	2	0	0	0
Total:				15	0	17	21.5

Total Contact Hours: 32

Total Credits: 21.5

**The Student need to select one Skill Oriented Course from the given pool of courses.*

VII SEMESTER (FOURTH YEAR)

S.No.	Course Code	Name of the Course	L	T	P	C	
1	Professional Elective-III		PEC	3	0	0	3
	V20AITPE09	i) Ethical Hacking					
	V20AITPE10	ii) Information Retrieval System					
	V20AITPE11	iii) Natural Language Processing					
	V20AITPE12	iv) Software Testing Methodologies					
2	Professional Elective-IV		PEC	3	0	0	3
	V20AITPE13	i) Distributed Systems					
	V20AITPE14	ii) NoSQL Databases					
	V20AITPE15	iii) Computer Vision using OpenCV					
	V20AITPE16	iv) Design Patterns					
3	Professional Elective-V		PEC	3	0	0	3
	V20AITPE17	i) Blockchain Technologies					
	V20AITPE18	ii) Scripting Languages					
	V20AITPE19	iii) Business Analytics					
	V20AITPE20	iv) Software Project Management					
4		Open Elective -III / Job Oriented Elective -III	OEC	3	0	0	3
			JOE	0	0	6	
5		Open Elective -IV / Job Oriented Elective -IV	OEC	3	0	0	3
			JOE	0	0	6	
6	V20MBT52	Management Science	HSS	3	0	0	3
7	V20SOC05	Skill Oriented Course-V*	SOC	1	0	2	2
8	V20AIP02	Mini Project /Internship	Internship	0	0	6	3
Total:				16	0	14	23

Total Contact Hours: 30

Total Credits: 23

**The Student need to select one Skill Oriented Course from the given pool of courses.*

VIII SEMESTER (FOURTH YEAR)

S.No.	Code	Name of the Course	L	T	P	C	
1	V20AIP03	Internship/ Industrial Training /Practical training	PRO	0	0	4	2
2	V20AIP04	Major Project (6 Months)	PRO	0	0	12	6
Total:				0	0	16	8

Total Contact Hours: 16

Total Credits: 8

POOL OF SKILL ORIENTED COURSES

From the below list of Skill Oriented Courses students may opt any one course for each semester, without repetition .

S.No.	Name of the Course
1.	Mobile Application Development
2.	Mean Stack Technologies
3.	Secure DevOps
4.	AWS Cloud Computing
5.	SDG -Web Development
6.	Web Development using Django
7.	Game Development using Buildbox
8.	Game Programming
9.	.NET Framework
10.	CCNA IT Essentials
11.	Augmented Reality and Virtual Reality
12.	Go Programming
13.	Applications of Python using NumPy & Pandas
14.	Ethical Hacking
Any advanced courses offered by industries / Professional bodies / APSSDC can be appended in future	

List of Job Oriented Elective Courses

S.No.	Course Code	Name of the Course
1.	V20AITJE01	Master Coding and Competitive Programming - Part-1
2.	V20AITJE02	Master Coding and Competitive Programming - Part-2
3.	V20AITJE03	DevOps
4.	V20AITJE04	Java Full Stack Technologies
5.	V20AITJE05	Web Application Development Using Django

NOTE: All the Job oriented can be theory / Lab Course.

List of Open Elective Courses offered by other Branches:-

Civil Engineering:- <ul style="list-style-type: none">➤ Repair and Rehabilitation of Structures.➤ Ground Improvement Techniques.➤ Environmental Pollution and Control.➤ Building Materials and Construction.➤ Remote Sensing and GIS.➤ Solid Waste Management.➤ Disaster Management.➤ Water Quality and Conservation Systems.	Electrical & Electronics Engineering:- <ul style="list-style-type: none">➤ Non-Conventional Energy Sources.➤ Basics of Control systems.➤ Principles of Electric Power Conversion.➤ Programmable Logic Controller and Applications.➤ Energy Storage Systems.➤ Soft Computing Techniques.➤ Electric Vehicles.➤ Indian Electricity Act, 2003.➤ Power Systems for Data Centers.➤ Concepts of Power System Engineering.➤ Fundamentals of Smart Grid Technologies.➤ Distribution Automation.
Mechanical Engineering:- <ul style="list-style-type: none">➤ Basic Mechanical Engineering.➤ Green Engineering Systems.➤ Computational Fluid Dynamics.➤ Rapid Prototyping.➤ Computer Aided Design.➤ Mechatronics.	Electronics & Communication Engineering:- <ul style="list-style-type: none">➤ Internet of Things.➤ Communication Systems.➤ Principles of Image Processing.➤ Medical Electronics.➤ Principles of Wireless Communications.➤ Basics of VLSI Design.➤ Concepts of Embedded Systems.

SYLLABUS

Semester	I	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20MAT01
Name of the Course	Linear Algebra and Differential Equations					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Apply matrix technique to solve system of linear equations **(K3)**
CO2: Find Eigen values and Eigen vectors **(K3)**
CO3: Solve the ordinary differential equations of first order & first degree **(K3)**
CO4: Solve the linear differential equations of higher order with constant coefficients. **(K3)**
CO5: Find maxima and minima of functions of two variables. **(K3)**

UNIT-I: System of linear equations: Rank-Echelon form-Normal form – Solution of linear systems – Gauss elimination – Gauss Jordan- Gauss Jacobi and Gauss Seidal methods.

UNIT-II: Eigen values, Eigen vectors and Cayley-Hamilton theorem: Eigenvalues - Eigen vectors– Properties – Cayley-Hamilton theorem (without proof) - Inverse and powers of a matrix by using Cayley-Hamilton theorem.

UNIT-III: Differential equations of first order and first degree: Linear- Bernoulli - Exact-Reducible to exact differential equations -Newton’s Law of cooling-Law of natural growth and decay-Orthogonal Trajectories.

UNIT- IV:Linear differential equations of higher order:

Linear non homogeneous differential equations of higher order with constant coefficients involving RHS term of the type e^{ax} , $\sin ax$, $\cos ax$, polynomials in x , $e^{ax}V(x)$, $xV(x)$ - method of variation of parameters.

UNIT- V: Partial differentiation: Introduction to partial differentiation-Total derivative-Functional dependence-Jacobian.-maxima and minima of functions of two variables (without constraints) and Lagrange’s method (with constraints).

Text Books

1. B.S.Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. N.P.Bali, Engineering Mathematics, Lakshmi Publications.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India
2. Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press
3. Srimanta Pal, Subodh C. Bhunia, Engineering Mathematics, Oxford University Press.
4. Dass H.K., Rajnish Verma. Er., Higher Engineering Mathematics, S. Chand Co. Pvt.Ltd, Delhi.

Semester	I	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20MAT09
Name of the Course	Descriptive Statistics					
Branch	Common to B.Tech CSE(AI) and B.Tech(AI & ML)					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Discuss about statistical methods (K2)
- CO2:** Find measures of central tendency and dispersion for real data sets. (K3)
- CO3:** find the correlation and regression (K3)
- CO4:** Apply method of least square to find a best fit curve to an experimental data (K3)
- CO5:** find the probability using various rules (K3)

Unit-I: Introduction to Statistical Methods: Introduction to statistics, definition and importance of statistics, application and limitation of statistics, statistics and computers, sampling and sample design, -types of sampling, merits and limitation of sampling, classification of data- formation of a discrete and continuous frequency distribution. Diagrammatic and graphical presentation (Bar and pie).

Unit-II: Measures of central tendency and dispersion: Measures of Central Tendency: Mean, Median, Mode.
Measures of Dispersion: Variance, Standard deviation, Skewness and Kurtosis

Unit-III: Bivariate data: Definition, scatter diagram, Simple correlation, Partial and Multiple correlations (3 Variable only), Rank correlation. Simple linear regression.

Unit-IV: Curve fitting : Curve fitting by the method of Least squares- Fitting of straight line, parabola exponential and power curves.

Unit-V: Basic Probability: Introduction, random experiments, sample space, events and algebra of events. Definition of probability, conditional probability, addition and multiplication laws of probability, independent events- application. Baye's theorem and its applications

Text Books:

1. **S.P.Gupta**, (2014): statistical methods 43rd Edition, sultan chand& sons.
2. **Goon A.M., Gupta M.K. and Dasgupta B.** Fundamentals of Statistics, 5th Edition, The World press, Kolkata

References Books:

1. **S. Ross**, "A First Course in Probability", Pearson Education India, 2002.
2. **Dr.T.S.R.Murthy**, Probability and Statistics for Engineers, BS Publications.
3. **T. Veerarajan**, "Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.
4. **S.C.Gupta**, (2014): statistical methods 43rd Edition, sultan chand& sons.
5. **Miller & Freund's**, Probability & Statistics for Engineers – Eighth Edition, Richard. A. Johnson.

Semester	I	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20ENT01
Name of the Course	English for Professional Enhancement					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Identify the central theme of the text, use cohesive items for coherence in a paragraph, recognize nouns and basic sentence structures. (K2)
- CO2:** Restate the central idea of the letter by using appropriate vocabulary. Gain mastery over articles and prepositions. (K2)
- CO3:** Find the success formula after reading the text in detail to answer questions. Use appropriate tense and concord, find suitable vocabulary and format to draft letters and e-mails. (K3)
- CO4:** Employ reading skills to comprehend the given biography. Interpret visual information .Use quantifiers appropriately and get acquainted with formal drafting (K3)
- CO5:** Appraise the delivered lecture and text, recognize the contextual vocabulary and prepare poster presentations. (K4)

UNIT-I :A DRAWER FULL OF HAPPINESS (From Infotech English, Maruthi Publications)

Vocabulary: GRE Vocabulary , Antonyms and Synonyms, Word Applications, Verbal Reasoning and Sequencing of Words. **Grammar:** Nouns: Types of Nouns: Proper Noun, common noun, collective noun, material noun, abstract noun **Listening:** Listening to short audio texts and identifying the topic, context and specific pieces of information to answer a series of questions both in speaking and writing. **Speaking:** Self-Introduction and Introducing others. Asking and answering general questions on topics such as home, family, work, studies and interests.

Reading: Skimming text to get the main idea. Scanning to look for specific pieces of information.

Writing: Paragraph Writing

Non- Detailed : The Post Office by Rabindranath Tagore (Macmillan India)

UNIT-II: NEHRU'S LETTER TO HIS DAUGHTER INDIRA ON HER BIRTHDAY

(From Infotech English, Maruthi Publications).

Vocabulary: GRE Vocabulary, Antonyms and Synonyms

Grammar: Articles, Prepositions

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts both in speaking and writing.

Speaking: Discussion in pairs/ small groups on specific topics. Functional English: Greeting and Leave Taking.

Reading: Identifying sequence of ideas; Recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Identifying the main ideas, Rephrasing and Summarizing them .

Non- Detailed : The Post Office by Rabindranath Tagore (Macmillan India)

UNIT-III: STEPHEN HAWKING - POSITIVITY 'BENCHMARK' (From InfotechEnglish,Maruthi Publications).

Vocabulary: GRE Vocabulary

Grammar: Verbs, Tenses, Concord: Subject - Verb Agreement.

Listening: Listening for global comprehension and summarizing what is listened to both in speaking and writing **Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed. Functional English: Complaining and Apologizing.

Reading: Reading a text in detail by making basic inferences –recognizing, and interpreting specific context clues; strategies to use text clues for comprehension, critical reading.
Writing: Letter writing- types, format and principles of letter writing, E-mail Etiquette
Non- Detailed : The Post Office by Rabindranath Tagore (Macmillan India)

UNIT-IV: LIKE A TREE, UNBOWED : WANGARI MAATHAI - BIOGRAPHY

(From Infotech English, Maruthi Publications).

Vocabulary: GRE Vocabulary, Antonyms and Synonyms,

Grammar: Active& Passive Voice

Listening: Making predictions while listening to conversations/ transactional dialogues without video (only audio), listening to audio-visual texts.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - Asking for and Giving Information/Directions. Functional English: Asking for Permissions, Requesting, Inviting.

Reading: Studying the use of graphic elements in text to convey information.

Writing: Data Interpretation – Tree Diagram, Pie chart

Non- Detailed : The Post Office by Rabindranath Tagore (Macmillan India)

UNIT-V: STAY HUNGRY, STAY FOOLISH (From Infotech English, Maruthi Publications).

Vocabulary: GRE Vocabulary, Antonyms and Synonyms

Grammar: Identifying and Correcting Common Errors in Grammar and Usage (articles, prepositions, tenses, subject-verb agreement), Reported Speech.

Listening: Identifying key Terms, Understanding Concepts and Interpreting the Concepts both in speaking and writing.

Speaking: Formal oral presentations on topics from academic contexts. Functional English: Suggesting/Opinion giving.

Writing: Poster Presentation.

Non- Detailed : The Post Office by Rabindranath Tagore (Macmillan India)

Books Prescribed

“Infotech English”, Maruthi Publications. (Detailed)

“The post Office” by Rabindranath Tagore, Macmillan India(Non -Detailed)

Reference books:

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge,2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading and Writing Student’s Book Pack (B1) Macmillan Educational.
4. The Official Cambridge Guide to IELTS, for Academic and General Training.(2015)
5. Practical English Usage, Michael Swan, OUP ,1995.

******Note:** The Lessons and GRE Vocabulary has been taken from Infotech English by Maruthi Publications
Non-detailed Text : Post Office by Rabindranath Tagore (Rupa Publications).

Semester	I	L	T	P	C	COURSE CODE
Regulation	V20	1	0	4	3	V20AIL01
Name of the Course	Computer Engineering Workshop					
Branch	Common to B.Tech CSE(AI) and B.Tech(AI & ML)					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1:Identify, assemble and update the components of a computer. (K2)

CO2:Practice disassembling and assembling components and execution of computer applications, services and systems. (K3)

CO3:Make use of tools for converting pdf to word and vice versa. (K6)

CO4:Develop presentation, documents and small applications using productivity tools such as word processor, presentation tools, spreadsheets, HTML, LaTeX. (K3)

LIST OF EXPERIMENTS

Note: Faculty to consolidate the workshop manuals using the textbook and references

Task 1: Identification of the peripherals of a computer - Prepare a report containing the block diagram of the computer along with the configuration of each component and its functionality. Describe about various I/O Devices and its usage.

Task 2: Practicing disassembling and assembling components of a PC

Task 3: Installation of Device Drivers, MS Windows, Linux Operating systems and Disk Partitioning, dual booting with Windows and Linux

Task 4: Introduction to Memory and Storage Devices, I/O Port, Assemblers, Compilers, Interpreters, Linkers and Loaders.

Task 5: Demonstration of Hardware and Software Troubleshooting

Task 6: Surfing the Web using Web Browsers, Awareness of various threats on the Internet and its solutions, Search engines and usage of various search engines, Need of anti-virus, Installation of anti-virus, configuring personal firewall and windows update.

(Students should get connected to their Local Area Network and access the Internet. In the process they should configure the TCP/IP setting and demonstrate how to access the websites and email. Students customize their web browsers using bookmarks, search toolbars and pop up blockers)

Productivity Tools:

Task 7: basic HTML tags, Introduction to HTML5 and its tags, Introduction to CSS3 and its properties. Preparation of a simple website/ homepage,

Assignment: Develop your home page using HTML Consisting of your photo, name, address and education details as a table and your skill set as a list.

Features to be covered:- Layouts, Inserting text objects, Editing text objects, Inserting Tables, Working with menu objects, Inserting pages, Hyper linking, Renaming, deleting, modifying pages, etc.,

Task 8: Demonstration and Practice of various features of Microsoft Word

Assignment: 1. Create a project certificate.

2. Creating a news letter

Features to be covered:-Formatting Fonts, Paragraphs, Text effects, Spacing, Borders and Colors, Header and Footer, Date and Time option, tables, Images, Bullets and Numbering, Table of Content, Newspaper columns, Drawing toolbar and Word Art and Mail Merge in word etc.,

Task 9: Demonstration and Practice of various features Microsoft Excel

Assignment: 1. Creating a scheduler

2. Calculating GPA

3. Calculating Total, average of marks in various subjects and ranks of students based on marks.

Features to be covered:- Format Cells, Summation, auto fill, Formatting Text, Cell Referencing, Formulae in excel, Charts, Renaming and Inserting worksheets, etc.,

Task 10: Demonstration and Practice of various features Microsoft Power Point

Features to be covered:- Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Hyperlinks Tables and Charts, Master Layouts, Types of views, Inserting – Background, textures, Design Templates, etc.,

Task 11: Demonstration and Practice of various features LaTeX – document preparation, presentation (Features covered in Task 9 and Task 11 need to be explored in LaTeX)

Task 12: Tools for converting word to pdf and pdf to word

Task 13: Internet of Things (IoT): IoT fundamentals, applications, protocols, communication models, architecture, IoT devices.

Reference Books:

- 1 Computer Fundamentals, Anita Goel, Pearson India Education, 2017
- 2 PC Hardware Trouble Shooting Made Easy, TMH
- 3 Upgrading and Repairing PCs, 18th Edition, Scott Mueller, QUE, Pearson, 2008
- 4 *LaTeX Companion – Leslie Lamport, PHI/Pearson*
- 5 Introducing HTML5, Bruce Lawson, Remy Sharp, 2nd Edition, Pearson, 2012
- 6 Teach yourself HTML in 24 hours, By Techmedia
- 7 HTML 5 and CSS 3.0 to the Real World by Alexis Goldstein, Sitepoint publication.
- 8 Internet of Things, Technologies, Applications, Challenges and Solutions, B K Tripathy, J Anuradha, CRC Press
- 9 Comdex Information Technology Course Tool Kit, Vikas Gupta, Wiley Dreamtech.
- 10 *IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme, CISCO Press, Pearson Education.*
- 11 Essential Computer and IT Fundamentals for Engineering and Science Students, Dr. N. B. Venkateswarlu, S. Chand Publishers.

Semester	I	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20CST01
Name of the Course	Programming in 'C' for problem Solving					
Branch	Common to B.Tech CSE(AI) and B.Tech(AI & ML)					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Describe various problem solving strategies such as Algorithms and Flowcharts. **(K2)**
CO2: Develop various programming constructs using Control Structures. **(K3)**
CO3: Construct Programs using modular programming approach. **(K3)**
CO4: Illustrate the usage of Arrays, String and pointers. **(K3)**
CO5: Construct Programs using Structures, Unions and Files. **(K3)**

UNIT-I: Problem solving concepts: Algorithms, Flow-charts, Types of Programming Languages, Compiler, Assembler and Linker, Testing and Debugging a program. **Introduction to C Programming:** Overview and importance of C, C Program Structure, Creation and Compilation of C Programs, Identifiers, Variables, Data types, Constants, Declarations, **Input and output statements:** Input and output functions..

UNIT-II: Operators: Arithmetic, relational and logical operators, increment and decrement operators, conditional operator, assignment operator, bitwise operators, special operators, expressions, Precedence, Associativity, Order of evaluation, Type conversion, Programming Examples. **Control Structures:** Conditional statements - If-else, Switch-case constructs, Loops - while, do-while, for.

UNIT-III: Functions: Top down approach of problem solving, standard library functions, user defined functions, parameter passing - call by value, call by reference, return statement, passing arrays as parameters to functions, recursion. **Storage Classes:** Scope and extent, Storage Classes - auto, extern, static and register.

Understanding pointers: Accessing the address of a variable, declaring pointer variables, initialization of pointer variables, accessing a variable through its pointer, pointer arithmetic.

UNIT-IV: Arrays: Single-Dimensional Arrays, multi-Dimensional Arrays, initialization and accessing individual elements. **Strings** in C- Concepts, string handling functions. **Pointer and arrays, pointers and character strings, array of pointers.** **Dynamic Memory Allocation:** calloc(), malloc() and free()

UNIT-V: Structures: Defining, declaring, initialization, accessing, comparing, operations on individual members, array of structures, structures within structures, structures and functions, bit fields, Programming Examples. **Unions:** Definition – difference between structures and unions – declaring and accessing unions. **Pointers and structures – self-referential structures.**

File Processing: Creating and Opening a file, file opening modes, closing a file, input/output operations on files, error handling during I/O operations, random access to files, Command line arguments. Programming Examples.

Text Books:

1. Programming in ANSI C by E Balagursamy, McGraw Hill, 8th Edition.

Reference Books:

1. Let Us C, Yashavant Kanetkar, BPB Publications, 15th Edition
2. Programming in C, Reema Thareja, Oxford.
3. Programming with C, Second edition, Byron S Gottfried, Tata McGrawhill
4. Problem Solving and Programm design in C, Hanly J R & Koffman E.B, Pearson Education, 2009.
5. Programming in C, Pradip Dey, Manas Ghosh, Oxford University Press, 2007.
6. Problem Solving Using C: Structured Programming Techniques, Yuksel Uckan.
7. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE.
8. Computer Programming in C – Kerninghan & Ritchie, PHI
9. C: The Complete Reference: Herbert Schildt, Osborne/Mcgraw Hill, Inc.

Semester	I	L	T	P	C	COURSE CODE
Regulation	V20	0	0	3	1.5	V20ENL01
Name of the Course	Hone your Communication Skills Lab-I					
Branch	Common to All					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Identify suitable expressions to greet people, say good bye to them, introduce one another, listen to consonants. (K2)

CO2: Select suitable words to invite someone, accept or decline invitations, listen to..., identify and produce vowel sounds. (K2)

CO3: Choose suitable expressions to seek/refuse permissions, to apologize and listen to word accent. (K3)

CO4: Find apt expressions to give suggestions, express opinions, use appropriate words to give commands and requests. (K3)

CO5: Practise listening to dialogues, role-plays using common vocabulary used in dialogues. (K3)

Unit I: Hello, I'm

- Greeting people
- Saying goodbye to people
- Introducing yourself to someone/someone to someone else
- Listening and Identifying Consonants

Unit II: I Would Love to.... but,

- Inviting someone
- Accepting or declining invitations
- Complaining about something
- Listening to, Identifying and Producing Vowel Sounds

Unit-3 With Your Permission I would like to.....

- Seeking Permission
- Granting/refusing permissions
- Apologising
- Listening to syllables and Word Accent and practise.

Unit-4 Why don't we....?

- Making Suggestions
- Agreeing/disagreeing with a suggestion
- Expressing Opinions
- Giving Commands/instructions
- Requesting someone for something

Unit-5 Dialogues

- The norms of dialogues
- Common vocabulary used in dialogues
- Carrying on a dialogue
- Listening to dialogue.

Book Prescribed:

- **Strengthen Your Steps - A multimodal course in communication skills (Maruthi Publications)**

Books for Further Reference

1. Better English Pronunciation (J.D.O'Connor), Cambridge University.
2. English Conversation Practice (A Practical Guide to improve Conversational Skills), Sterling Publishers.
3. Exercise in spoken English, Parts-I-III.CIFEL, Hyderabad, Oxford University Press.

Semester	I	L	T	P	C	COURSE CODE
Regulation	V20	0	0	3	1.5	V20AIL02
Name of the Course	Statistical Visualization using R Lab					
Branch	Common to B.Tech CSE(AI) and B.Tech(AI & ML)					

Syllabus Details

Course Outcomes: At the end of the Course student will be able to:

- CO1:** Employ math and simulation in R. **(K2)**
CO2: Demonstrate various types of data structures in R. **(K3)**
CO3: Apply appropriate control structures to solve a particular Programming problem. **(K3)**
CO4: Use R to graphically visualize data and results of statistical calculations. **(K3)**

LIST OF EXPERIMENTS

1. Demonstrate the basic math functions in R
2. Demonstrate Vector operations in R
3. Demonstrate Matrix operations in R
4. Demonstrate Array operations in R
5. Demonstrate Dataframes in R
6. Demonstrate Lists in R
7. Illustrate the following controls statements in R
 - a. if and else
 - b. ifelse
 - c. switch
8. Demonstrate for and while loops in R
9. Demonstrate importing and exporting data using R
10. Illustrate the descriptive statistics using summary() in R
11. Demonstrate the following statistical distribution functions in R:
 - a. Normal Distribution
 - b. Binomial Distribution
 - c. Poisson Distribution
 - d. Chi Square Distribution
12. Illustrate the following basic graphics in R:
 - a. Bar plots
 - b. Pie Charts
 - c. Histograms
 - d. Kernel density plots
 - e. Boxplots
 - f. Dotplots
13. Illustrate the Correlation and Covariance analysis using R
14. Illustrate the different types of t-tests using R
15. Illustrate the ANOVA test using R

Text Books:

1. R for Everyone, Jared P Lander, Pearson
2. R in Action, Rob I Kabacoff, Manning

Reference Book:

1. The Art of R Programming, Norman Matloff, No Starch Press

Semester	I	L	T	P	C	COURSE CODE
Regulation	V20	0	0	3	1.5	V20CSL01
Name of the Course	Programming Lab in 'C' for problem Solving					
Branch	Common to All					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Demonstrate problem solving techniques using Control Structures. **(K3)**
CO2: Construct Programmes using the concepts of Arrays, Strings and Pointers. **(K3)**
CO3: Apply the concepts of Functions, Structures and Unions. **(K3)**
CO4: Use various file processing operations to develop real-time applications. **(K4)**

LIST OF EXPERIMENTS

Tutorial 1: Problem solving using computers.

Lab1: Familiarization with programming environment.

Tutorial 2: Variable types and type conversions.

Lab 2: Simple computational problems using arithmetic expressions.

Tutorial 3: Branching and logical expressions.

Lab 3: Problems involving if-then-else structures switch – case.

Tutorial 4: Loops, while and for loops.

Lab 4: Iterative problems e.g. sum of series.

Tutorial 5: Functions call by value, call by reference

Lab 5: Simple functions.

Tutorial 6: Recursion, structure of recursive calls.

Lab 6: Recursive functions.

Tutorial 7: Pointers.

Lab 7: Programming with pointers.

Tutorial 8: 1D Arrays: searching, sorting.

Lab 8: 1D Array manipulation.

Tutorial 9: 2D arrays.

Lab 9: Matrix problems.

Tutorial 10: String handling.

Lab 10: String handling functions.

Tutorial 11: Structures, unions and dynamic memory allocation.

Lab 11: Structures & unions.

Tutorial 12: File handling, command line arguments.

Lab 12: File operations.

Text Books:

1. Programming in Ansi C by E Balagursamy, McGraw Hill, Eight Edition.

Reference Books:

1. Mastering C, K.R. Venugopal and S.R. Prasad, TMH Publishers.
2. Computer Programming in C, V. Rajaraman, PHI.
3. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
4. C- The Complete Reference, Herbert Schildt, Osborne/Mcgraw Hill, Inc.
5. Programming with C, Byron S Gottfried, Second edition, Tata McGrawhill.
6. Programming in C, ReemaThareja, Oxford.
7. Problem Solving and Program design in C, Hanly J R &Koffman E.B, Pearson Education, 2009
8. Programming and Problem Solving Using C, ISRD Group, Tata McGraw Hill,2008

Semester	II	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20MAT10
Name of the Course	Integral Transformations and Vector Calculus					
Branch	Common to B.Tech CSE(AI) and B.Tech(AI & ML)					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: find the Fourier series of periodic signals (K3)

CO2: find the Fourier transforms of given function (K3)

CO3: find multiple integrals and improper integrals (K3)

CO4: calculate gradient of a scalar function, divergence and curl of a vector function.(K3)

CO5: apply the knowledge of vector integral concepts to find characteristics of vector fields (K3)

UNIT – I: Fourier series: Fourier series – Determination of Fourier Coefficients – Fourier series – even and odd functions – Fourier series in an arbitrary interval – Half –range sine and cosine series.

UNIT –II: Fourier Transforms: Fourier Integral Theorem (only statement) – Fourier sine and cosine Integrals – Fourier Transform – sine and cosine Transforms – Properties – Inverse Transforms.

UNIT III: Multiple Integrals: Definition of Improper integrals - Double and triple integrals – Change of variables – Change of order of integration.

UNIT IV: Vector Differentiation: Vector differential operator - Gradient- Divergence- Curl - Laplacian and second order operators -Vector identities.

UNIT V: Vector Integration: Line integral: Work done – Potential function – Surface and volume integrals - Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) and related problems.

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. N.P.Bali, Engineering Mathematics, Lakshmi Publications.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-
2. Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press
3. V.Ravindranath and P.Vijayalakshmi, Mathematical Methods, Himalaya Publishing House. India
4. Srimanta Pal, SubodhC.Bhunia, Engineering Mathematics, Oxford University Press.
5. Dass H.K., RajnishVerma. Er., Higher Engineering Mathematics, S. Chand Co. Pvt. Ltd, Delhi.

Semester	II	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20CST02
Name of the Course	Python Programming					
Branch	Common to B.Tech CSE(AI) and B.Tech(AI & ML)					

Syllabus Details

Course Outcomes: Upon completion of the course, students will be able to

- CO1:** Illustrate basic concepts of Python Programming. **(K2)**
- CO2:** Describe control structures in python. **(K2)**
- CO3:** Construct python programs using structured data types. **(K3)**
- CO4:** Demonstrate functions and packages **(K3)**
- CO5:** Develop programs on Files, Exception handling and OOPs Concepts. **(K3)**

UNIT-I: Introduction to Python, Data Types & Operators: Basics of python programming: Features of python – History of Python - Python installation and execution - Data types – Identifiers - variables – type conversions- Literals, Constants – Numbers – Strings. I/O statements. Operators and expressions, operator precedence – expression evaluation.

UNIT-II: Control Structures: Decision Control statements: conditional (if), alternative (if-else), chained conditional (if-elif-else); **Iteration:** while loop, for loop, nested for loop, range function, break, continue and pass statements.

UNIT-III: Structured Data Types: Lists: list operations, list slices, list methods, cloning lists, list parameters. **Tuples:** tuple assignment, tuple as return value. **Set:** Set Creation, Set Operations. **Dictionaries:** Creation, operations; comprehension, operations on strings.

UNIT-IV: Functions & modules: Introduction - Function Declaration & Definition - Function Call – Variable Scope and Lifetime - The return statement - More on Defining Functions - Lambda Functions or Anonymous Functions - Documentation Strings - Modules – Packages.

UNIT-V: Files & Exception Handling: Introduction - Types of files - Text files - reading and writing files; Errors and exceptions handling.

OOPS concepts Classes, Methods, Constructor, Inheritance, Overriding Methods, Data hiding, TKINTER.

Text Books:

1. “Python Programming using problem solving Approach” Reema Thareja, Oxford University Press – 2017.
2. Python with Machine Learning by “A. Krishna Mohan, Karunakar & T. Murali Mohan” by S. Chand Publisher-2018.

Reference Books:

1. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist“, 2nd edition, Updated for Python 3, Shroff / O’Reilly Publishers, 2016 (<http://greenteapress.com/wp/think-python>)
2. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3. John V Guttag, —Introduction to Computation and Programming Using Python“, Revised and expanded Edition, MIT Press, 2013.

Semester	II	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20ECT01
Name of the Course	Switching Theory and Logic Design					
Branch	Common to EEE, ECE, ECT, CSE ,CST, CSE(AI) and AI&ML					

Syllabus Details

Course Outcomes: At the end of the Course student will be able to:

CO1: Explain the different types of number Systems, number conversions, codes and logic Gates. **(K2)**

CO2: Apply the concepts of Boolean algebra and use the knowledge of K-maps and tabular method for minimization of Boolean expressions. **(K3)**

CO3: Construct the higher order modules from their lower order structures of various M combinational logic circuits. **(K3)**

CO4: Explain the concept of various flip flops. **(K2)**

CO5: Develop various sequential circuits like registers, counters and various Finite State Machine Models. **(K3)**

UNIT– I: Number Systems & Codes: Representation of numbers of different radix, conversion from one radix to another radix, r and (r-1)'s compliment of signed members. Basic logic operations -NOT, OR, AND, Universal building blocks, EX-OR, EX-NOR – Gates.

Binary Codes:BCD,Excess-3,Graycode,2421,84-2-1,error detection,error correction codes - Hamming Code

UNIT– II: Minimization Techniques : Boolean theorems, principle of complementation & duality, De-morgan theorems, minimization of logic functions using Boolean theorems, Standard SOP and POS, Forms, NAND-NAND and NOR-NOR realizations, minimization of switching functions using K-Map up to 5 variables, tabular minimization.

UNIT– III: Combinational Logic Circuits Design :Half adder, full adder, half subtractor, full subtractor, Ripple Carry adder and subtractor, 4 bit binary adder-subtractor circuit, BCD adder circuit, Excess 3 adder circuit, Design of decoder, demultiplexer, 7 segment decoder, Implementation of higher order circuits using lower order circuits for MUX, DEMUX, DECODER, realization of Boolean functions using decoders and multiplexers, priority encoder.

UNIT– IV: Sequential Circuits –I : Classification of sequential circuits (synchronous and asynchronous); basic flip-flops, truth tables and excitation tables (Nand RS latch, nor RS latch,RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals). Asynchronous Inputs(Preset and Clear), Race around condition, Master Slave JK Flip flop, Conversion from one flip-flop to another flip-flop.

UNIT– V: Sequential Circuits –II : Design of ripple counters, design of synchronous counters, Johnson counter, ring counter. Design of registers-Buffer register, control buffer register, shift register, bi-directional shift register, universal shift register. **Finite State Machine:** Introduction to Mealy and Moore Finite state Machines

Text Books

1. Digital Design by M. Morris Mano, Michael D. Ciletti, PEA.
2. Fundamentals of Logic Design, 5/e Roth, Cengage.
3. Modern Digital Electronics by RP Jain, TMH

Reference Books

1. An Engineering Approach to Digital Design, William I. Fletcher, Pearson edition.
2. Switching Theory and Logic Design by A. Anand Kumar
3. Switching & Finite Automata Theory, 2nd Edition, Zvi Kohavi, TMH, 1978.

Semester	II	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20CST04
Name of the Course	Data Structures					
Branch	Common to B.Tech CSE(AI) and B.Tech(AI & ML)					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Illustrate the time and space complexities for searching and sorting algorithms. **(K2)**
CO2: Demonstrate linked lists and their applications. **(K3)**
CO3: Demonstrate linear data structure. **(K3)**
CO4: Illustrate basic operations on binary trees. **(K3)**
CO5: Demonstrate Graphs and their applications. **(K3)**

Unit-I: Introduction, searching and sorting: Introduction to Data Structures, Types of Data Structures, Performance Analysis: Space complexity, time complexity, asymptotic notation. **Searching:** Linear, Binary and Fibonacci search. **Sorting:** Bubble sort, Selection sort, Insertion sort, radix sort, quick sort, and merge sort.

Hashing: Introduction, Key Terms and Issues, Hash Functions, Collision Resolution Strategies.

Unit-II: Single linked list: Representation of node, operations on single linked list, **Double linked list:** Representation of node, operations on double linked list. **Circular linked List:** Representation of node and its operations.

Unit-III: Stacks: Definition, Stack ADT, array representation, linked list representation, Towers of Hanoi, infix to postfix conversion, expression evaluation. **Queues:** Definition, Queue ADT, Array representation, linked list representation, operations on queues, Applications of Queues, Circular Queue.

Unit-IV: Trees: Introduction: Terminology, representation of trees, **Binary Trees:** abstract data type, Properties of binary trees, binary tree representation, **Tree Traversals:** Inorder, Preorder, Postorder. **Binary search trees:** Definition, searching BST, insert into BST, delete from a BST, Height of a BST, Introduction to Binary Heaps.

Unit-V: Graph: Introduction, definition, types of Graphs, Graph Representation, operations. **Graph Traversal Techniques:** Breadth First Search, Depth First Search. **Spanning Trees:** minimum cost spanning tree, Prim's and Kruskal's algorithms, Single source shortest Path and all pair shortest path algorithms.

Text Books:

1. Data Structures, algorithms and applications in C, SartajSahni, Universities press, Second Edition.
2. Fundamentals of Data Structures in C, Ellis Horowitz, SartajSahni and Dinesh Mehta, 2nd Edition, Universities Press (India) Pvt. Ltd.

Reference Books:

1. Hashing: Data Structures using C++ by Varsha H Patil, Oxford publications.
2. An Introduction to Data Structures with Application, Jean-Paul Tremblay, Paul Sorenson, Second Edition.
3. Fundamentals of Data Structures and algorithms by C V Sastry, RakeshNayak, Ch. Raja Ramesh, IK Publications, new Delhi.
4. Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
5. Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education.

Semester	II	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AIT01
Name of the Course	Introduction to Artificial Intelligence					
Branch	Common to B.Tech CSE(AI) and B.Tech(AI & ML)					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Discuss the concepts of AI Foundation. (K2)
CO2: Illustrate the basics of Machine Learning. (K2)
CO3: Explain various Classification Techniques. (K2)
CO4: Illustrate the working of Recommendation System. (K2)
CO5: Describe the applications of AI and ML. (K2)

UNIT-I: Introduction: What is AI? Foundations of AI: Philosophy, Mathematics, Economics, Neuroscience, Psychology, Computer Engineering; The History of AI, The State of the Art, Agents and Environments.

UNIT-II: Machine learning: Introduction, Learning: Machine Learning, Types of Machine Learning, Supervised Learning: Classification, Regression, The Machine Learning Process, Testing Machine Learning Algorithms, Some Basic Statistics.

UNIT-III: Classification: General Approach to Classification, Probabilistic Classifier: Bayes Classifier, Non-Probabilistic Classifier: KNN Classifier, Decision Tree, Assessing Performance of a Classifier: Accuracy, Loss, Confusion Matrix.

UNIT-IV: Recommendation Systems: A Model for recommendation Systems: The utility matrix, long tail, Applications of Recommendation Systems; Content-Based Recommendations: Item Profiles, Discovering Features of Documents, Obtaining Item Features from Tags, Representing Item Profiles, User Profiles, Recommending Items Users based on Content.

UNIT-V: Applications of AI and ML: Anomaly Detection, Bio Medical Applications, Natural Language Processing, Chatbots, Computer Vision.

Textbooks:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Ed., Pearson Education. *(Unit I)*
2. Machine Learning: An Algorithmic Perspective, Stephen Marsland, 2nd Ed., CRC Press. *(Unit II,III)*
3. Mining Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeff Ullman, 3rd Ed., Stanford University. *(Unit IV)*
4. Machine Learning and its Applications, Peter Wlodarczak, CRC Press. *(Unit V)*
5. Getting Started with Artificial Intelligence: A Practical Guide to Building Enterprise Applications, Tom Markiewicz and Josh Zheng, 1st Ed., O'Reilly. *(Unit V)*.

Semester	II	L	T	P	C	COURSE CODE
Regulation	V20	0	0	3	1.5	V20CSL02
Name of the Course	Python Programming Lab					
Branch	Common to CSE,CST,CSE(AI) and B.Tech(AI & ML)					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Demonstrate Basic Python Programs. **(K3)**
- CO2:** Construct control structures in python **(K3)**
- CO3:** Demonstrate functions and packages. **(K3)**
- CO4:** Construct python programs using structured data types. **(K3)**
- CO5:** Construct programs using Text Files and exception handling. **(K3)**

LIST OF EXPERIMENTS

Exercise 1 - Basics

- a) A sample Python Script using command prompt, Python Command Line and IDLE
- b) A program to purposefully raise an Indentation Error and correct it

Exercise 2 - Operations

- a) A program to compute distance between two points taking input from the user (Pythagorean Theorem)
- b) A program on add.py that takes 2 numbers as command line arguments and prints its sum.

Exercise - 3 Control Flow

- a) A Program to implement for checking whether the given number is a even number or not.
- b) A program to construct reverse the digits of a given number and add it to the original, If the sum is not a palindrome repeat this procedure.
- c) A program using a while loop that asks the user for a number, and prints a countdown from that number to zero.

Exercise 4 - Control Flow – Continued

- a) A program to construct the following pattern, using a nested for loop.

```

*
* *
* * *
* * * *
* * * * *
* * * *
* * *
* *
*

```
- b) By considering the terms in the Fibonacci sequence whose values do not exceed four million, find the sum of the even-valued terms.

Exercise - 5 Structured Data types

- a) A program to count the number of strings where the string length is 2 or more and the first and last character are same from a given list of strings.
- b) a program to develop unzip a list of tuples into individual lists and convert them into dictionary.

Exercise – 6 Structured Data types Continued

- a) A program to count the numbers of characters in the string and store them in a dictionary data structure

b) A program to use split and join methods in the string and trace a birthday with a dictionary data structure.

Exercise - 7 – Problem Solving using Functions

- a) Find mean, median, mode for the given set of numbers passed as arguments to a function
- b) Develop a function nearly_equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on b.
- c) Develop a Recursive Function to find the Factorial of a given number.
- d) Develop function to compute gcd, lcm of two numbers. Each function shouldn't exceed one line.

Exercise - 8– Modules

- a) Install packages requests, flask and explore them using (pip)
- b) A program to implement a script that imports requests and fetch content from the page. Eg. (Wiki)
- c) Develop a simple script that serves a simple HTTPResponse and a simple HTML Page

Exercise - 9 Files

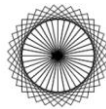
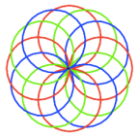
- a) A program to count frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file?
- b) A program to compute the number of characters, words and lines in a file.

Exercise - 10 OOP

- a) Class variables and instance variable and illustration of self-variable
 - i) Robot
 - ii) ATM Machine

Exercise - 11 GUI, Graphics

1. Develop a GUI for an Expression
2. A program to implement the following figures using turtle



Text Books:

1. “Python Programming using problem solving Approach” ReemaThareja, Oxford University Press – 2017.
2. Python with Machine Learning by “A.Krishna Mohan, Karunakar&T.Murali Mohan” by S. Chand Publisher-2018.

Semester	II	L	T	P	C	COURSE CODE
Regulation	V20	0	0	3	1.5	V20CSL04
Name of the Course	Data Structures Lab					
Branch	Common to CSE,CST,CSE(AI) and B.Tech(AI & ML)					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Construct Programs on Sorting and Searching Techniques. **(K3)**

CO2: Illustrate various operations on Linked Lists. **(K3)**

CO3: Develop Programs on Stacks, Queues and their Applications. **(K3)**

CO4: Develop various operations on Trees and Graphs **(K3)**

LIST OF EXPERIMENTS

1. Practice following Sorting Techniques
(A) Selection Sort (B) Quick Sort (C) Merge Sort
2. Practice following Searching Methods
(A) Linear Search (B) Binary Search.
3. Develop program for Single Linked List and its Operations. (Create, Insert, Delete, Display)
4. Develop program for Double Linked List and its Operations.
5. Construct Stack along with their operations using Arrays.
6. Construct Queue along with their operations using Arrays.
7. Develop Circular Queue using Arrays.
8. Construct Queue along with their operations using Single Linked List.
9. Construct Binary Search Tree and Its Operations using double linked list.
10. Demonstrate Depth First Search and Breadth First Search Algorithm.
11. Develop Minimum Spanning Tree using Prim's Algorithm.
12. Develop Minimum Spanning Tree Kruskal's Algorithm.

Add on Experiments:

1. Construct stack along with their operations using Single Linked List.
2. Implement Topological Sort.

Text books:

1. Data Structures, algorithms and applications in C++, Sartaj Sahni, Universities press, Second Edition.
2. Fundamentals of Data Structures in C++, Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, 2nd Edition, Universities Press (India) Pvt. Ltd.

Reference Books:

1. An Introduction to Data Structures with Application, Jean-Paul Tremblay, Paul Sorenson, Second Edition.
2. Fundamentals of Data Structures and algorithms by C V Sastry, Rakesh Nayak, Ch. Raja Ramesh, IK Publications, new Delhi.
3. Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
4. Problem solving with C++, The OOP, Fourth edition, W. Savitch, Pearson education.

Semester	II	L	T	P	C	COURSE CODE
Regulation	V20	0	0	3	1.5	V20ENL02
Name of the Course	Hone your Communication Skills Lab-II					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:**Collect suitable expressions and vocabulary to participate in JAM. Identify root words. (K1)
CO2:Prepare, face and perform well in interviews with required etiquette. (K3)
 Use appropriate telephone etiquette to succeed in telephonic interviews (K3)
CO3:Show team spirit and communicative skills in group discussion. (K3)
CO4:Arrange ideas and prepare to give presentations in a professional manner. (K3)
CO5:Debate rationally and cogently while putting forth the ideas. (K4)

UNIT-I:JAM Session & Root Words

- Preparation for JAM Session
- Participation in JAM
- Root words from Word power made easy by Norman Lewis

UNIT-II: Interviews

- Guidelines for facing interviews
- Three R's of interviews
- Practice Activity (Mock Interviews)
- Root words from Word power made easy by Norman Lewis
- Telephone Etiquette
- Preparing for telephonic interviews
- Acing interviews
- Practice Activity (Mock Interviews)
- Root words from Word power made easy by Norman Lewis

UNIT-III: Group Discussions

- Tips to participate in Group Discussion
- Practice Activity
- Root words from Word power made easy by Norman Lewis

UNIT-IV: Presentation and Public Speaking

- Three P's of Presentation
- Do's and Don'ts in a Power-point Presentation
- Oral Presentations
- Introduction to Public Speaking
- Strategies for successful Public Speaking
- Practice Activity

UNIT-V:Debate

- Introduction to Debate
- Parts of a Debate
- Guidelines to participate in a Debate
- Practice Activity

Book Prescribed:

Strengthen Your Steps - A multimodal course in communication skills (Maruthi Publications)

Books for further Reference:

1. English Language Communication Skills, Lab Manual cum Workbook (with CD),Cengage Learning.
2. The Students Companion –Wilfred D. Best (New Edition) – Harper,CollinsPublishers,2012.
3. Hewings, Martin. Cambridge Academic English (B2).CUP, 2012. 4. Lewis, Norman. Word Power Made Easy, GoyalSaab,Publications

Semester	II	L	T	P	C	COURSE CODE
Regulation	V20	2	0	0	0	V20CHT02
Name of the Course	Environmental Studies					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Recognize the importance of environment and eco system services. **(K2)**
CO2: Identify the characteristic features, uses and impact of overutilization of natural resources **(K2)**
CO3: Explain biodiversity, biodiversity services and conservation of biodiversity **(K2)**
CO4: Report the causes and impacts of various pollutions. **(K2)**
CO5: Illustrate social and global environmental issues; sustainable development practices. **(K2)**

UNIT-I: MULTIDISCIPLINARY NATURE OF ENVIRONMENT & ECOSYSTEM: Definition, Scope and importance of environment, Types of environment, Multidisciplinary nature of Environmental Studies, Components of environment. Ecosystem- Concept of an Ecosystem, Structure and function of an Ecosystem, Food chain & food web, Ecological Pyramids, Structure and function of Forest, Desert, Pond and Marine ecosystem.

UNIT-II: NATURAL RESOURCES: Forest Resources: Uses, Overexploitation, Deforestation. Water resources: Aquifers, Dams and benefits, Conflicts over water. Mineral resources: Uses, Overexploitation, Environmental impact of extraction and use of mineral resources. Land resources: Degradation, Soil erosion and desertification, Landslides. Renewable Energy resources: Solar energy, Geo thermal energy, Tidal Energy.

UNIT-III: BIODIVERSITY AND ITS CONSERVATION: Definition, Levels of Biodiversity, Values of Biodiversity, Hotspots of Biodiversity, Threats to Biodiversity, Endangered and Endemic species of India, In-situ and Ex-situ Conservation.

UNIT-IV: ENVIRONMENTAL POLLUTION : Definition of pollution, Air pollution- Types of Air pollutants, Effects and control measures; Water pollution- Causes, Effects and control measures; Soil pollution; Biomedical waste; Industrial waste- Process of waste management, Sanitary land fill, Incineration, 3R strategy; E- Waste and its management.

UNIT-V: SOCIAL AND GLOBAL ENVIRONMENTAL ISSUES & ACTS : Women Education, Value education, Role of information technology on environment and human health, Acid rains, Global warming, Ozone layer depletion. Population growth. Importance of environmental legislation, Environmental Protection Act, Air Act (Prevention and control of pollution), Water Act.

Text Books:

1. Environmental Studies, Fourth Edition, Anubha Kaushik, C P Kaushik, New Age International Publishers.
2. A Textbook of Environmental Studies, Shashi Chawla, TMH, New Delhi.
3. Fundamentals of Environmental Studies, DD Mishra, S Chand & Co. Ltd.
4. Textbook of Environmental Science, DR M. Anjireddy, B.S Publications, Hyderabad.

Semester	III	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20MBT51
Name of the Course	Managerial Economics and Financial Analysis					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Understand the basic concepts of managerial economics, demand, elasticity of demand and methods of demand forecasting. **(K2)**
- CO2:** Interpret production concept, least cost combinations and various costs concepts in decision making. **(K3)**
- CO3:** Differentiate various Markets and Pricing methods along with Business Cycles. **(K2)**
- CO4:** Prepare financial statements and its analysis. **(K3)**
- CO5:** Assess various investment project proposals with the help of Capital Budgeting techniques for decision making. **(K3)**

UNIT-I: Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics and Scope-Managerial Economics and its relation with other subjects-Concept of Demand-Types-Determinants-Law of Demand its Exceptions-Elasticity of Demand-Types and Measurement- Demand forecasting and its Measuring Methods.

UNIT-II: Production and Cost Analysis: Production function-Iso-quants and Iso-cost-Law of Variable proportions-Cobb-Douglas Production function-Economies of Scale-Cost Concepts- Opportunity Cost-Fixed vs Variable Costs-Explicit Costs vs Implicit Costs- Cost Volume Profit analysis- Determination of Break-Even Point- BEP Chart (Simple Problems).

UNIT-III: Introduction To Markets, Pricing Policies & forms of Organizations and Business Cycles: Market Structures: Perfect Competition, Monopoly, Monopolistic and Oligopoly – Features – Price, Out-put Determination – Methods of Pricing: Evolution of Business Forms - Features of Sole Trader – Partnership – Joint Stock Company – State/Public Enterprises. Business Cycles – Meaning and Features – Phases of Business Cycle.

UNIT-IV: Introduction to Accounting & Financing Analysis: Introduction to Double Entry System – Preparation of Financial Statements- Trading Account, Profit & Loss Account and Balance Sheet - Ratio Analysis – (Simple Problems).

UNIT-V: Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Need for Capital Budgeting-Techniques of Capital Budgeting-Traditional and Modern Methods.

Text Books

1. Dr. N. AppaRao, Dr. P. Vijay Kumar: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi – 2011
2. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2011
3. Prof. J.V. Prabhakararao, Prof. P. Venkatarao. 'Managerial Economics and Financial Analysis', Ravindra Publication.

References:

1. Dr. B. Kuberudu and Dr. T. V. Ramana: Managerial Economics & Financial Analysis, Himalaya Publishing House, 2014.
2. V. Maheswari: Managerial Economics, Sultan Chand. 2014
3. Suma Damodaran: Managerial Economics, Oxford 2011.
4. Vanitha Agarwal: Managerial Economics, Pearson Publications 2011.
5. Sanjay Dhameja: Financial Accounting for Managers, Pearson
6. Maheswari: Financial Accounting, Vikas Publications.
7. S. A. Siddiqui & A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age International Publishers, 2012
8. Ramesh Singh, Indian Economy, 7th Edn., TMH 2015
9. Pankaj Tandon A Text Book of Microeconomic Theory, Sage Publishers, 2015
10. Shailaja Gajjala and Usha Munipalle, Universities press, 2012.

Semester	III	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20MAT11
Name of the Course	Probability Theory					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Find the statistical parameters of given function. **(K3)**
CO2: Apply probability distribution to real time problems. **(K3)**
CO3: Create good estimators to various parameters **(K3)**
CO4: Apply the principles of Statistical Inference to practical problems on large samples. **(K3)**
CO5: Apply the principles of Statistical Inference to practical problems on small samples. **(K3)**

UNIT-I: Random Variables and expectation: Random Variables: Discrete and continuous - Probability function – density and distribution function, Expectation of a Random Variable, Moments, Chebychev's Inequality (Without proof).

UNIT -II: Probability Distributions: Probability distributions: Binomial, Poisson and Normal - Evaluation of statistical parameters: Mean, Variance and their properties, Introduction to Exponential, Gamma and Weibull distributions.

UNIT -III: Sampling Distribution and Estimation: Introduction –Sampling distribution of means with known and unknown standard deviation.

Estimation: Criteria of a good estimator, point and interval estimators for means and proportions.

UNIT -IV: Tests of Hypothesis: Introduction-Type-I, Type-II Errors, Maximum Error, one-tail, two-tail tests, **Test of significance:** Large sample test for single proportion, difference of proportions, single mean, difference of means.

UNIT -V: Tests of significance: Test of significance: Small sample test for single mean, difference of means and test of ratio of variances (F-Test) - Chi-square test for goodness of fit and independence of attributes.

Text Books:

1. **B. V. Ramana**, A text Book of Engineering Mathematics, Tata McGraw Hill.
2. **Miller & Freund's**, Probability & Statistics for Engineers – Eighth Edition, Richard. A. Johnson

References Books:

1. **S. Ross**, “A First Course in Probability”, Pearson Education India, 2002.
2. **Dr.T.S.R.Murthy**, Probability and Statistics for Engineers, BS Publications.
3. **T. Veerarajan**, “Engineering Mathematics”, Tata McGraw-Hill, New Delhi, 2010.

Semester	III	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20MAT07
Name of the Course	Mathematical Foundation of Computer Science					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Demonstrate the concepts associated with propositions and mathematical logic. **(K3)**
- CO2:** Demonstrate the basic concepts associated with relations, functions and their applications. **(K3)**
- CO3:** Solve recurrence relations using various methods. **(K3)**
- CO4:** Apply techniques of graphs for real-time problems. **(K3)**
- CO5:** Construct minimal spanning tree by using different algorithms. **(K3)**

UNIT-I : Mathematical Logic: Statements and Notation , Connectives, Well Formed Formulas ,Truth tables, Tautologies, Equivalence of formulas, Tautological Implications, Normal forms, Theory of inference for Statement Calculus, Indirect Method of Proof. Predicate calculus-Predicates, quantifiers, universe of discourse.

UNIT-II: Set Theory and Relations: Operations on Sets, Principle of Inclusion and Exclusion, Relations, Properties of Binary Relations in a set, Transitive Closure, Relation Matrix and Digraph, Equivalence, Partial Ordering Relations, Hasse Diagrams, Lattice and its Properties, Functions, Bijective Functions, Composition of Functions.

UNIT-III: Recurrence relations: Generating Function of Sequences, Calculating Coefficient of generating functions, Recurrence relations, solving recurrence relation by substitution and Generating functions, the method of Characteristic roots, Solution of Inhomogeneous Recurrence Relation.

UNIT-IV: Graph Theory:Basic Concepts of graph, Representing graphs, Sub graphs, Isomorphic graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Planar graphs, Graph Coloring, Chromatic Number. (Theorems without proofs).

UNIT-V: Trees: Spanning Trees, minimal Spanning Trees, BFS, DFS, Kruskal's Algorithm, Prim's Algorithm, Binary trees, Planar Graphs.

Text Books:

1. Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P. Manohar, 1st Edition, Tata McGraw Hill.
2. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H.Rosen, 7th Edition, Tata McGraw Hill.
3. Discrete Mathematics for Computer Scientists and Mathematicians, J. L. Mott, A. Kandel, T.P. Baker, 2nd Edition, Prentice Hall of India.

Reference Books:

1. Elements of Discrete Mathematics -A Computer Oriented Approach, C. L. Liu and D. P. Mohapatra, 3rd Edition, Tata McGraw Hill.
2. Discrete Mathematics with Combinatorics and Graph Theory, Santha, 1st Edition Cengage Learning.

Semester	III	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AIT02
Name of the Course	Advanced Python Programming					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Demonstrate Regular Expressions and Database Connectivity. **(K3)**
CO2: Develop GUI interfaces using widgets. **(K3)**
CO3: Demonstrate statistical analysis using Numpy. **(K3)**
CO4: Demonstrate data analysis using pandas. **(K3)**
CO5: Develop different types of charts using matplotlib. **(K3)**

UNIT-I: Regular Expressions: Sequence Characters, Quantifiers, Special Characters.

Database Connectivity: Advantages of a DBMS over files, Installation of MYSQL DB Software, using MYSQL from Python, retrieve, insert, delete, update operations on tables.

UNIT-II: Graphical User Interface: GUI in python, The root window, fonts and colors, working with containers, canvas, frame, widgets, Button widgets, Arranging widgets in the frame, Label widget, message widget, Text widget, scrollbar Widget, Check button Widget, Radio button widget, entry widget, listbox widget.

UNIT-III: Working with Arrays using Numpy : Introduction to Numpy, Functions for generating sequences , Aggregate functions , Generating Random Numbers using Numpy , Zeros, ones, eyes and Full , Indexing , Slicing , Scalar with an Array operations , Array with an Array Operations. Joining Arrays , Splitting arrays , Variance , covariance , correlation.

UNIT-IV: Data Analysis using Pandas: Introduction , Creating Pandas series , Indexing, iloc, slicing and Boolean index , sorting , statistical Analysis , and string functions , creating data frames , dealing with rows , iterating a pandas data frame- data frame methods (Head, tail and describe), sorting , statistical Analysis , and string functions , Reading of formatted files, Handling Missing values.

UNIT-V: Data Visualization: Introduction , plot function , plotting lines and curves, Additional Arguments, The bar Chart ,box plot , frequency plots and Histogram , the pie chart.

Text Books:

1. Core Python Programming Dr. R NageswaraRaoDreamtech publications.
2. Problem solving and python programming fundametals and application: Numpy, Pandas and Matplotlib. HarshaBhasin.

Semester	III	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AIT03
Name of the Course	Database Management Systems					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Describe Database systems, various Data models and Database architecture. (K2)
CO2: Develop various real time applications using Relational algebra and Relational calculus. (K3)
CO3: Apply various Normalization techniques to refine schema. (K3)
CO4: Explain Transaction management and Concurrency control. (K2)
CO5: Illustrate various Database indexing techniques. (K2)

UNIT-I: An Overview of Database Systems: Managing data, File systems verses DBMS, Advantages of DBMS, Data models, Levels of abstraction in a DBMS, Data independence, Structure of a DBMS, Client/Server Architecture, E.F.Codd Rules.

Database Design: Database design and ER Diagrams, Entities, Attributes, Entity sets, Relationships and Relationship sets, Conceptual design with ER Models.

UNIT-II: Relational Model: Integrity constraints over relations, Key constraints, Foreign key constraints, General constraints, Enforcing integrity constraints, Querying relational data

Relational Algebra: Selection and Projection, set operation, renaming, Joins, Division, Introduction to Views, destroying/altering Tables and Views. **Relational Calculus:** Tuple Relational Calculus, Domain Relational Calculus.

UNIT-III: SQL Queries, Constraints and Triggers: The Form of Basic SQL Query, Union, Intersect, Except, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and active data bases. **Schema Refinement (Normalization):** Problems caused by redundancy, Decompositions, purpose of Normalization, Schema refinement, Concept of functional dependency, Normal forms based on functional dependency (1NF, 2NF and 3NF), Concept of Surrogate key, Boyce-Codd Normal Form (BCNF), Lossless Join and Dependency preserving decomposition, Fourth Normal Form(4NF).

UNIT-IV: Transaction Management: Transaction, Properties of Transactions, Transaction Log, and Transaction management with SQL commit, rollback and savepoint. **Concurrency Control:** Concurrency Control for Lost updates, Uncommitted data, Inconsistent retrievals and the Scheduler.

Concurrency Control with Locking Methods : Lock granularity, Lock types, Two phase locking for ensuring serializability, Deadlocks, Concurrency control with Time stamp ordering, Transaction recovery.

UNIT-V: Storage and Indexing: Overview of Storages and Indexing, Data on external storage, File organization and indexing, Clustered indexing, Primary and secondary indexes, Index data structures, Hash based indexing, Tree based indexing, Comparison of file organization

Text Books:

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition TATA McGraw Hill.
2. An Introduction to Database Systems, C.J Date, A.Kannan, S.JSwamynathan 8th Edition, Pearson Education

Reference Books:

1. Database Systems-Design, Implementation and Management, Peter Rob & Carlos Coronel 7th Edition, Course Technology Inc.
2. Fundamentals of Database Systems, RamezElmasri, Shamkant B. Navathe ,7th Edition, Pearson Education.
3. Database Systems - The Complete Book, Hector Garcia- Molina, Jeffry D Ullman, Jennifer Widom, 2nd Edition, Pearson.

Semester	III	L	T	P	C	COURSE CODE
Regulation	V20	0	0	3	1.5	V20AIL03
Name of the Course	Advanced Python Programming Lab					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Develop Python Programs using regular expressions and Database. **(K3)**
CO2: Develop programs using GUI. **(K3)**
CO3: Construct programs using Numpy Arrays. **(K3)**
CO4: Develop python programs using pandas. **(K3)**
CO5: Develop charts using matplotlib. **(K3)**

LIST OF EXPERIMENTS

1. Regular expressions & Database:

- a) Develop a python program to create regular expression to replace a string with a new string.
- b) Develop a python program to create regular expression to retrieve all the words starting with 'a' in a given string and other create other regular expression to retrieve all the words with size 5.
- c) Develop a Python Program to create a regular expression to search for string using search() , findall() , match().
- d) Create a python program to connect MYSQL database and perform operations viz. retrieve, insert, delete and update.

2. GUI:

- a) Develop a Python Program to draw different shapes on canvas.
- b) Develop a Python Program to create a push button and bind it with an event handler function using command option.
- c) Develop a Python Program to design a simple calculator.
- d) Develop a Python Program to create check boxes and display the content of selected boxes.
- e) Develop a Python Program using GUI to retrieve a row from a MYSQL database table.

2. Numpy

- a. Develop a Python Program to split arrays using numpy module.
- b. Develop a Python Program to test all aggregate functions in numpy module
- c. Develop a Python Program to generate a matrix of random numbers within range and print its Transpose.
- d. Develop a Python Program that calculates variance, co variance, correlation by taking a sample statistical data.
- e. Develop a python program to find rank, determinant, and trace of an array.
- f. Develop a python program to find eigenvalues of matrices.
- g. Develop a python program to find matrix and vector products (dot, inner, outer, product), matrix exponentiation.
- h. Develop a python program to solve a linear matrix equation, or system of linear scalar equations.

3. Pandas

- a. Develop a python program to implement Pandas Series with labels, dictionary and Numpy.
- b. Develop a program to creating a Pandas DataFrame using dictionary and two dimensional array.
- c. Develop a program which make use of following Pandas methods
 - i) describe()
 - ii) head()
 - iii) tail()
- d. Develop a python program to perform insert, delete row operations on data frame.
- e. Develop a python program of groupby() method.
- f. Demonstrate pandas Merging, Joining and Concatenating.
- g. Creating data frames from csv and excel files.

4. Pandas Library: Visualization

- a. Develop a program which use pandas inbuilt visualization to plot following graphs:
 - i. Bar plots
 - ii. Histograms
 - iii. Line plots
 - iv. Scatter plots

Text Books:

1. Core Python Programming Dr. R NageswaraRaoDreamtech publications.
2. Problem solving and python programming fundametals and application: Numpy, Pandas and Matplotlib.HarshaBhasin.

Semester	III	L	T	P	C	COURSE CODE
Regulation	V20	0	0	0	1.5	V20AIL04
Name of the Course	Linux Shell Scripting Lab					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Demonstrate the basic knowledge of Linux commands and utilities by using Linux shell environment. **(K3)**
- CO2:** Experiment with the Concept of shell Programming on Files and Directories. **(K3)**
- CO3:** Experiment with the Concept of shell Programming on File Permissions. **(K3)**
- CO4:** Experiment with the Concept of shell Programming on Conditional Statements. **(K3)**
- CO5:** Experiment with the Concept of shell Programming on Looping Statements. **(K3)**

LIST OF EXPERIMENTS

1. Experiment the following Unix Commands:
 - a) **General Purpose Utilities:** cal, date, man, who.
 - b) **Directory Handling Commands:** pwd, cd, mkdir, rmdir.
 - c) **File Handling Utilities:** cat, cp, ls, rm, nl, wc
 - d) **Displaying Commands:** head, tail
 - e) **Filters:** cmp, comm, diff, sort, uniq
 - f) **Disk Utilities:** du, df
2. Develop a Shell Program to Display all the words which are entered as command line arguments.
3. Develop a shell script that Changes Permissions of files in PWD as rwx for users.
4. Develop a shell script to print the list of all sub directories in the current directory.
5. Develop a Shell Program which receives any year from the keyboard and determine whether the year is leap year or not. If no argument is supplied the current year should be assumed.
6. Develop a shell script which takes two file names as arguments-If their contents are same then delete the second file.
7. Develop a shell script to print the given number in the reversed order.
8. Develop a shell script to print first 25 Fibonacci numbers.
9. Develop a shell script to print the Prime numbers between the specified range.
10. Develop a shell script to delete all lines containing the word 'unix' in the files supplied as arguments.
11. Develop a shell script Menu driven program which has the following options.
 - i) contents of /etc/passwd
 - ii) list of users who have currently logged in.
 - iii) present working directory.
 - iv) exit.

Text Books:

1. UNIX and Shell Programming: A Textbook, Behrouz A. Forouzan | Richard F. Gilberg, Cengage Learning.
2. UNIX: Concepts and Applications, Sumithaba Das, 4th Edition, Tata McGrawHill.
3. Unix & Shell Programming, M.G.Venkatesh Murthy, Pearson Education.
4. UNIX shells by example, 4th Edition Ellie Quigley, Pearson Education.

Semester	III	L	T	P	C	COURSE CODE
Regulation	V20	0	0	3	1.5	V20AIL05
Name of the Course	Data Base Management System Lab					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- | | | |
|-------------|---|-------------|
| CO1: | Construct SQL queries to perform different database operations. | (K3) |
| CO2: | Experiment with various constraints and Database Indexing Techniques. | (K3) |
| CO3: | Construct PL/SQL Cursors and Exceptions | (K3) |
| CO4: | Develop PL/SQL Functions, Procedures and Packages | (K3) |
| CO5: | Apply basic operations on collections of Mongo DB database | (K3) |

LIST OF EXPERIMENTS

SQL:

1. Construct SQL queries to facilitate acquaintance of Built-In Functions, String Functions, Numeric Functions, Date Functions and Conversion Functions.
2. Construct SQL queries using Operators.
3. Construct SQL queries to Retrieve and Change Data: Select, Insert, Delete and Update
4. Construct SQL queries using Group By, Order By, and Having Clauses.
5. Construct SQL queries on Controlling data: commit, rollback and savepoint
6. Construct report using SQL*PLUS
7. Construct SQL queries for Creating, Dropping and Altering Tables, Views and Constraints
8. Construct SQL queries on Joins and Correlated Subqueries
9. Demonstrate Index, Sequence and Synonym.
10. Demonstrate Controlling access, locking rows for update and security features.

PL/SQL

11. Demonstrate Basic Variables, Anchored Declarations, and Usage of Assignment Operation Using PL SQL block
12. Demonstrate Bind and Substitution Variables using PL SQL block
13. Demonstrate Control Structures in PL SQL
14. Demonstrate Cursors, Exception and Composite Data Types in PL SQL.
15. Demonstrate Procedures, Functions, and Packages in PLSQL.

Textbooks:

1. Oracle Database 11g The Complete Reference by Oracle Press, Kevin Loney
2. Database Systems Using Oracle, Nilesh Shah, 2nd Edition, PHI.
3. Introduction to SQL, Rick FVander Lans, 4th Edition, Pearson Education.

Reference Books:

1. Oracle PL/SQL Interactive Workbook, B. Rosenzweig and E. Silvestrova, 2nd Edition, Pearson Education. SQL & PL/SQL for Oracle 10g, BlackBook, Dr. P.S. Deshpande, DreamTech.

Semester	III	L	T	P	C	COURSE CODE
Regulation	V20	0	3	0	MNC	V20ENT02
Name of the Course	Professional Communication Skills - I					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Use vocabulary in regular chores of life with accuracy, make meaningful sentences, and describe people and their traits vividly. **(K3)**
- CO2:** Distinguish between places of pilgrimage and holiday spots; describe incidents, things and process; and frame questions, statements and expressions. **(K4)**
- CO3:** Demonstrate their knowledge of idioms which are similar to those of native speakers while speaking and writing and use phrases clearly and precisely to articulate their views that compare and contrast indianisms with native expressions and avoid common errors. **(K3)**
- CO4:** Employ the vocabulary of netizens with ease and walk through the letters and emails for effective official correspondence and infer the accurate meaning of the homophones that are often confusing. **(K3)**
- CO5:** Summarize their profile; introduce themselves as well as others by incorporating their accomplishments and Sketch stories and anecdotes in an interesting and engaging manner that arouses curiosity of the audience. **(K5)**

UNIT – I: BUILDING VOCABULARY FOR DAILY ACTIVITIES

NAMES: Things- Kitchen Utensils – Occupation- tools – spices- vegetables –flowers - sciences of study – Professions. Framing Questions – statements – expressions related to the Vocabulary taught.

PEOPLE: Describing people -Physical characteristics,-Mental attributes – various professions Framing Questions – statements – expressions related to the Vocabulary taught.

ACTIVITY: Related to the topics learnt in Unit – 1

UNIT – II: BUILDING VOCABULARY FOR PLACES, THINGS & PROCESS

PLACES: Describing favorite place – famous place- Places of Pilgrimage.

THINGS: Describing a thing- Describe an incident or an event.

PROCESS: Describe a process –Recipe – experiment –Entrance test application.

Framing Questions – statements – expressions related to the Vocabulary taught.

ACTIVITY: Related to the topics learnt in Unit – II.

UNIT – III:

NATIVE EXPRESSIONS – Idioms and Phrases – in day to day activities for different occasions - Usage written & spoken –

PHRASES with as—as expressions – used to compare & contrast

COMMON MISTAKES- in spoken & written

INDIANISMS- Most often used expressions – accepted in India – found place in Dictionary

ACTIVITY: Related to the topics learnt in Unit – III

UNIT –IV:

NET VOCABULARY: Acronyms and abbreviations that are most often used

HOMOPHONES : Words often confused – Spelling & Pronunciation

Letter Writing : Formal& Informal- Letters for all occasions

Email Writing : Business mails – project status mails – informative mails

ACTIVITY : Related to the topics learnt in Unit – IV

UNIT -V

SELF-INTRODUCTION: Basic information - Academic and personal - interests– strengths and weaknesses – goal.

PROFILE BUILDING: Resume writing – CV Building – Types

STORYTELLING WITH CREATIVITY: Reading and Narrating a story – narrating anecdotes

ACTIVITY :Related to the topics learnt in Unit – V.

Reference Books:

- Lewis Norman, Word Power Made Easy (2008). Goyal Publishers & Distributors Pvt. Ltd.
- Sunita Mishra & C. Muralikrishna, Communication Skills for Engineers (2006). Dorling Kindersley (India) Pvt. Ltd., licensees of Pearson Education in South Asia.
- Chaturvedi PD & Chaturvedi Mukesh, Business Communication (2006). Dorling Kindersley (India) Pvt. Ltd., licensees of Pearson Education in South Asia.
- Joshi Manik, Popular English Idioms and Phrases: English Idiomatic Expressions (2013).
- Joshi Manik, Homonyms, Homophones and Homographs: Vocabulary Building (2014).
- Gupta S.C. A Handbook for Letter Writing (2018). Arihant Publishers
- Lisa McGrimmon, The Resume Writing Guide: A Step-by-Step Workbook for Creating a Winning Resume (2013). CareerChoiceGuide; 2nd edition.
- Sawhney, Clifford. Improve your Word Power (2013). V&S Publishers

Web References: (NET Vocabulary)

- <https://www.grammarly.com/blog/texting-abbreviations/>
- <https://www.slicktext.com/blog/2019/02/text-abbreviations-guide/>
- <https://www.webopedia.com/reference/text-abbreviations/>

Semester	IV	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AIT04
Name of the Course	Computer Organization and Architecture					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Illustrate Basic structure of Computers, Instruction types and their addressing modes. (K2)
CO2: Describe the different modes of Input / Output transfer. (K2)
CO3: Illustrate different types of Memory. (K2)
CO4: Describe the different types of Control Unit techniques. (K2)
CO5: Explain the Concepts of Pipelining and Parallel Processing (K2)

UNIT-I: Introduction: Functional Units, Basic Operational Concepts, Bus Structures.

Instruction Sequencing and Addressing Modes: Instructions and Instruction Sequencing, Addressing modes, Basic Input/output Operations.

UNIT-II: Input/output Organization: Accessing Input/output devices, Interrupts- Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access, Buses-Synchronous and Asynchronous.

UNIT-III: Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative memory, Cache Memory. (Morris Mano)

UNIT-IV: Processing Unit: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control, Microprogrammed Control-Microinstructions, Microprogram Sequencing.

UNIT-V: Pipelining: Basic Concepts, Data Hazards, Instruction Hazards.

Parallelism: Parallel processing challenges – Flynn’s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

Text Books:

1. Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 5th Edition, McGraw Hill Education. Computer System Architecture, M. Morris Mano, 3rd Edition, Pearson Education.
2. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.

Reference Books:

1. Computer Organization and Architecture, William Stallings, 10th Edition, Pearson Education.
2. Computer Architecture and Organization, John P. Hayes, 3rd Edition, McGraw Hill Education.

Semester	IV	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AIT05
Name of the Course	Design and Analysis of Algorithms					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Demonstrate asymptotic notation and divide and conquer technique. **(K3)**
CO2: Use greedy technique to solve various problems. **(K3)**
CO3: Demonstrate dynamic programming technique to various problems. **(K3)**
CO4: Develop algorithms using backtracking technique. **(K3)**
CO5: Demonstrate branch and bound technique to various problems. **(K3)**

UNIT-I: Introduction: What is an Algorithm, Algorithm Specification-Pseudo code Conventions Recursive Algorithms, Performance Analysis-Space Complexity, Time Complexity, Asymptotic Notation, Practical Complexities, Performance Measurement.

Divide and Conquer: General Method, Binary Search, Finding the Maximum and Minimum, Merge Sort, Quick Sort-Performance Measurement.

UNIT-II: The Greedy Method: The General Method, Knapsack Problem, Job Sequencing with Deadlines, Minimum-cost Spanning Trees-Prim's Algorithm, Kruskal's Algorithms, Optimal Merge Patterns, Single Source Shortest Paths.

UNIT-III: Dynamic Programming: All Pairs Shortest Paths, Single Source Shortest paths General Weights, Explain Optimal Binary Search Trees, String Edition, 0/1 Knapsack, Reliability Design.

UNIT-IV: Backtracking: The General Method, 8-Queens Problem, Sum of Subsets, Graph Coloring, and Hamiltonian Cycles.

UNIT-V: Branch and Bound: The Method-Least cost (LC) Search, The 15-Puzzle: an Example, Control Abstraction for LC-Search, Bounding, FIFO Branch-and-Bound, LC Branch and Bound, 0/1 Knapsack Problem-LC Branch-and Bound Solution, FIFO Branch-and-Bound Solution, Traveling Salesperson. Basic Concepts of NP-hard and NP-complete problems.

Text Books:

1. Fundamentals of computer algorithms E. Horowitz S. Sahni, University Press.

Reference Books:

1. Introduction to Algorithms Thomas H. Cormen, PHI Learning.
2. The Design and Analysis of Computer Algorithms, Alfred V. Aho, John E. Hopcroft, Jeffrey D.Ullman.
3. Fundamentals of Data Structures and algorithms by C V Sastry, RakeshNayak, Ch. Raja Ramesh, Distributed by WILEY publications, New Delhi.
4. Algorithm Design, Jon Kleinberg, Pearson.

Semester	IV	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AIT06
Name of the Course	Java Programming					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Describe Java Virtual Machine and Type casting. **(K2)**
CO2: Demonstrate Concepts like Constructors, Arrays, Nested Classes and Command Line Arguments. **(K3)**
CO3: Implement Concepts of Inheritance and Exception Handling. **(K3)**
CO4: Develop programs on Multi-Threading and Files. **(K3)**
CO5: Demonstrate java Collection Classes. **(K3)**

UNIT-I: Introduction to Java: Introduction to Object Oriented Paradigm, Concepts of OOP, Applications of OOP, History of Java, Java Features, JVM, Program Structure. Variables, Primitive Data Types, Constants, String class, Primitive type conversion and Casting, Control Structures.

UNIT-II: Classes and Objects: Classes and objects, Class declaration, Creating objects, Methods, Constructors and Constructor Overloading, Importance of Static Keyword and Examples, this Keyword, Arrays, Command Line Arguments, Nested Classes, Garbage Collector.

UNIT-III: Inheritance and Exception Handling: Inheritance, super Keyword, final Keyword, Method Overriding and Abstract Class. Interfaces, Creating Packages, Using Packages, Importance of Class path. Exception Handling, Importance of try, catch, throw, throws and finally Block.

UNIT-IV: Multithreading and Files: Introduction, Thread Lifecycle, Creation of Threads, Thread Priorities, Thread Synchronization, Communication between Threads. Reading Data from Files and Writing Data to Files, Random Access Files.

UNIT-V: Java Collections Framework: collections overview, collection classes: ArrayList, LinkedList, HashSet, Linked HashSet, TreeSet, HashMap. Accessing a Collection: Iterator and for-each.

Text Books:

1. Java Programming, E. Balagurusamy, 4th Edition, TMH.
2. The complete Reference Java, 8th Edition, Herbert Schildt, TMH.
3. Introduction to java programming, Y Daniel Liang, 7 Edition, Pearson.

Reference books:

1. Core Java: An Integrated Approach, R Nageswara Rao, 7th Edition, Dream Tech.
2. Head First Java, Kathy Sierra and Bert Bates, 2nd Edition O'reilly.

Semester	IV	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AIT07
Name of the Course	Operating Systems					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Describe Operating System Services and System Calls. **(K2)**
- CO2:** Illustrate Process Management Concepts and CPU Scheduling Algorithms. **(K3)**
- CO3:** Demonstrate Process Synchronization primitives and Process Deadlocks. **(K3)**
- CO4:** Illustrate Memory Management Techniques and Page Replacement Algorithms. **(K3)**
- CO5:** Describe File System Concepts and Mass Storage Structures. **(K2)**

UNIT-I: Introduction: Operating-System Structure, Operating-System Services, User and Operating System Interface, System Calls, Types of System Calls.

UNIT-II: Process Management: Process Concept, Process Scheduling, Operations on Processes, Inter process Communication. **Threads:** Overview, Multithreading Models
CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms.

UNIT-III: Process Synchronization: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors. **Deadlocks:** System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

UNIT-IV: Memory Management: Main Memory: Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.
Virtual Memory: Introduction, Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing.

UNIT-V: Storage Management: Overview of Mass-Storage Structure, Disk Scheduling, File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Allocation Methods.

Text Book:

1. Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 9th Edition, John Wiley and Sons Inc., 2012.

Reference Books:

1. Operating Systems – Internals and Design Principles, William Stallings, 7th Edition, Prentice Hall, 2012 .
2. Modern Operating Systems, Andrew S. Tanenbaum, Third Edition, Addison Wesley, 2007.

Semester	IV	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AIT08
Name of the Course	Artificial Intelligence & its applications					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- | | |
|---|------|
| CO1: Discuss Problem Solving Agents and Environment. | (K2) |
| CO2: Identify Search Strategies for Non Deterministic and Unknown Environments. | (K2) |
| CO3: Illustrate Adversarial Search for Game Playing. | (K2) |
| CO4: Discuss Reasoning approaches. | (K2) |
| CO5: Illustrate Knowledge Representation approaches. | (K2) |

UNIT I: Intelligent Agents: Agents and Environments, **Good Behaviour:** The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Solving Problems by Searching: Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions.

UNIT II: Beyond Classical Search: Local Search Algorithms and Optimization Problems, Local Search in Continuous Spaces, Search with Non Deterministic Actions, Searching with Partial Observations, Online Search Agents and Unknown Environments.

UNIT III: Adversarial Search : Games, Optimal Decisions in Games, Alpha–Beta Pruning, Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-of-the-Art Game Programs, Alternative Approaches.

UNIT IV: Reasoning and Inference: Propositional Logic, Propositional Theorem Proving, Syntax and Semantics of First-Order Logic, Using First-Order Logic, Forward Chaining, Backward Chaining, Resolution.

UNIT V: Knowledge Representation: Representations and Mappings, Approaches to Knowledge Representation-Simple Relational Knowledge, Inheritable Knowledge, Inferential Knowledge, Procedural Knowledge, Issues in Knowledge Representation, The Frame Problem.

Text Books:

1. Artificial Intelligence : A Modern Approach, Stuart J. Russell and Peter Norvig, 3rd Edition, Prentice Hall
2. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivashankar B Nair, 3rd Edition, Tata McGraw-Hill

Reference Books:

1. Artificial Intelligence, George F Luger, Pearson Education Publications
2. Artificial Intelligence, Saroj Kaushik, 1st Edition, Cengage Learning.

Semester	IV	L	T	P	C	COURSE CODE
Regulation	V20	0	0	3	1.5	V20AIL06
Name of the Course	Java Programming Lab					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Demonstrate Programs on Classes, Objects, Constructors and Arrays. **(K3)**

CO2: Demonstrate Inheritance and Exception Handling. **(K3)**

CO3: Implement programs on Multi-Threading and File Handling. **(K3)**

CO4: Implement programs using java collections. **(K3)**

LIST OF EXPERIMENTS

1. Develop programs on Control Structures and Type Conversions in java.
2. Develop programs using various String handling functions
3. Construct programs using the following concepts:
 - (a) Classes & Objects b) Usage of static c) Constructors
4. Construct programs using the following concepts.
 - (a) Arrays b) Nested Classes c) Command Line Arguments
5. Construct programs using the following concepts.
 - (a) Inheritance b) Usage of super c) Method Overriding
6. Construct programs using the following concepts.
 - (a) Usage of final b) Abstract class c) Interfaces
7. Implement the programs using the concepts
 - (a) Packages b) Exception Handling.
8. Implement the programs on Multi-Threading.
 - (a) Multiple Threads on Single Object b) Thread Deadlock
9. Construct a program that shows Inter-thread Communication
10. Construct programs to perform read and write operations on files.
 - (a) Sequential Files b) Random Access files
11. Construct program using Array List and perform following operations
 - a) Insert b) update c) search d) display
12. Construct program using Linked List and perform following operations
 - a) Insert b) update c) search d) display
13. Construct a java program to iterate elements of HashSet using iterator and for Each.

Text Books:

1. The complete Reference Java, 8th Edition, Herbert Schildt, TMH.
2. Introduction to java programming, Y Daniel Liang, 7 Edition, Pearson.

Semester	IV	L	T	P	C	COURSE CODE
Regulation	V20	0	0	3	1.5	V20AIL07
Name of the Course	Operating Systems Lab					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Illustrate CPU scheduling algorithms **(K3)**
CO2: Apply Bankers Algorithm for Deadlock Avoidance and Deadlock Prevention **(K3)**
CO3: Use Page replacement algorithms for memory management **(K3)**

LIST OF EXPERIMENTS

1. Demonstrate the following CPU scheduling algorithms:
 - a) FCFS
 - b) SJF
 - c) Round Robin
 - d) Priority
2. Illustrate : fork (), wait (), exec() and exit () system calls.
3. Demonstrate Producer and Consumer problem using Semaphores.
4. Demonstrate Bankers Algorithm for Deadlock Avoidance.
5. Demonstrate Bankers Algorithm for Deadlock Detection.
6. Demonstrate the following page replacement algorithms:
 - a) FIFO b) LRU c) LFU
7. Demonstrate the following File allocation strategies:
 - a) Sequenced b) Indexed c) Linked

Reference Books:

1. Operating System Concepts, Abraham Silberschatz, ,Peter Baer Galvin, Greg Gagne, 9th Edition, John Wiley and Sons Inc., 2012
2. Operating Systems – Internals and Design Principles, William Stallings, 7th Edition, Prentice Hall, 2012
3. Modern Operating Systems, Andrew S. Tanenbaum, Third Edition, Addison Wesley,2007

Semester	IV	L	T	P	C	COURSE CODE
Regulation	V20	0	0	3	1.5	V20AIL08
Name of the Course	Artificial Intelligence Lab					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After successful completion of the Course, the student will be able to:

- CO1:** Demonstrate uninformed search techniques. **(K3)**
CO2: Demonstrate heuristic search techniques. **(K3)**
CO3: Solve real world problems by searching. **(K3)**
CO4: Develop AI agent for Gaming and AI-powered chatbot. **(K3)**

List of Experiments (Using Python Programming)

1. Solve Water Jug problem using BFS algorithm.
2. Solve Water Jug problem using DFS algorithm.
3. Demonstrate Hill Climbing Algorithm.
4. Demonstrate A* Algorithm.
5. Solve the n-queens problem using backtracking.
6. Solve Travelling Salesman Problem using backtracking
7. Develop Tic-Tac-Toe game
8. Solve 8-Puzzle problem
9. Develop a Simple Chatbot.

Reference Books:

1. Artificial Intelligence : A Modern Approach, Stuart J. Russell and Peter Norvig, 3rd Edition, Prentice Hall.
2. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivashankar B Nair, 3rd Edition, Tata McGraw-Hill.
3. Artificial Intelligence with Python, Alberto Artasanchez, Prateek Joshi, 2nd Edition, Packt Publishing.

Semester	IV Sem	L	T	P	C	COURSE CODE
Regulation	V20	-	2+2	-	MNC	V20ENT03
Name of the Course	Professional Communication Skills - II					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After successful completion of the Course, the student will be able to:

CO1 Demonstrate grammatical competence, analyze noun and pronoun dispositions, classify various kinds of verbs, adjectives and adverbs and identify errors in sentences; distinguish the subtle meanings of various words in different contexts, recognize similar words as well as words with contrast meanings and use them appropriately. **(K3)**

CO2 Organize individual words into one whole sentence using new vocabulary and focus on the error analysis of prepositions and conjunctions, build conversations which befit the situations and develop pre-reading strategies to improve comprehension skills. Distinguish and acquire knowledge of using words of the same category in a sentence and learn new words that promote communicative finesse. Find errors in sentences where the modifiers are misplaced and put them at the appropriate place, use hit pair words and send an email that is concise and lucid. **(K3)**

CO3 Recognize the easiest and best possible way of solving problems in the area of Number and Letter Series, Analogy, Classification, Coding & Decoding Symbols, Ranking and Analytical Reasoning. **(K4)**

CO4 Investigate the different types of logics involved in Mirror and Water Images, Logical Reasoning & Arithmetic Reasoning. **(K4)**

CO5 Find the common traps in the questions and errors likely to be made from the concepts of Blood Relations, Directions, Average, Clock and Calendar, Data Sufficiency, Permutations-Combinations and Probability. **(K3)**

UNIT – I: ERROR ANALYSIS: Nouns & Pronouns – Singular & Plural – Kinds of Nouns & Pronouns- Collective Nouns - Personal and Reflexive Pronouns. Subject – Verb agreement. Adjectives – Adverbs – role of modifiers – place of Adjectives– Adverbs of frequency.

VOCABULARY : Word Power Made Easy Sessions 15- 30, Antonyms and Synonyms and One word substitutes

EXPANSION OF PROVERBS: Meaning – interpretation – explanation.

UNIT – II

ERROR ANALYSIS: Prepositions - kinds of prepositions –appropriate use - conjunctions –sub-ordinating– coordinating.

ROLE PLAY: Day to day situations - practical approach – real life experiences.

READING COMPREHENSION: Reading as a skill – quick reading - analyzing – answering - Skimming – scanning - summarizing – problem solving.

ERROR ANALYSIS: Parallel grammatical forms – same grammatical structures. Dangling modifiers – misplacement of modifiers – arrangement.

SENTENCE IMPROVEMENT: Better choice – error-free sentences – effective – syntax.

EMAIL WRITING: Format – method of exchanging – technicalities.

UNIT – III

Number And Letter Series, Coding & Decoding, Analogy, Classification Ranking. (K1)

Problems of how to find the next number in the series, Finding the missing number and related sums, Sums related to Classification, Sums related to letter series, Relation between number series and letter series, Finding odd one out from groups, Identify the rank in different places.

UNIT-IV

Problems On Ages& Numbers, Mirror And Water Images, Logical Reasoning & Arithmetic Reasoning.(K4)

Definition and concept of Venn Diagram – its applications. statements – Affirmations, Denials and Contradictions. Sums related to Ages & numbers. Problems on ages with different logics. Identifying the images of water and Mirror.

UNIT-V

Blood Relations, Directions, Average, Clock And Calendar, Data Sufficiency, Permutations-Combinations And Probability.(K3)

Deriving the formula to find the angle between hands for the given time, History of calendar-, Finding the day for the given date, Problems related to directions. Difference between words Permutation and Combinations – Various cases - Real Time Scenarios. Concept of Probability – - Conjunctions – Rules & Cases of Probability.

References

1. VermaShalini.Common Errors In English (2016).S Chand & Company
2. Sharon Weiner Green M.A&Ira K. Wolf Ph.D.Barron's GRE (2015). Barrons Educational Series
3. Paul D.S. Advanced English Grammar with Answers (2007) Published by Cambridge University Press..
4. Work book -1 on Aptitude Prepared by T & P cell, Sri Vasavi Engineering College.
5. Kundan& Tyra. Magical Book on Quicker Maths(20013). Published by Tyra &Kundan
6. Kundan&Tyra.Practice Book on Quicker Maths (2009). Published by Tyra &Kundan
7. R.S. Agarwal .Non Verbal Reasoning.Sultan Chand Publications

Web References

<https://www.indiabix.com/>

<https://www.campusgate.co.in/>

<https://www.questionpaper.org/>

Semester	V	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AIT09
Name of the Course	Data Engineering					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Describe Data Engineering lifecycle. **(K2)**
- CO2:** Explain Data architecture and data generation. **(K2)**
- CO3:** Explain Data Engineering storage abstractions. **(K2)**
- CO4:** Illustrate Data ingestion process. **(K2)**
- CO5:** Discuss queries, modeling, transformation and serving. **(K2)**

UNIT-I: Data Engineering Described: Data Engineering Lifecycle, Evolution, Data Engineering and Data Science; Skills & Activities- Data Maturity and the Data Engineer, The Background and Skills of a Data Engineer, Data Engineers Inside an Organization.

The Data Engineering Life Cycle: The Data Lifecycle versus the Data Engineering Lifecycle, Storage, Ingestion, Transformation, Serving Data; Major Undercurrents across the Data Engineering Lifecycle.

UNIT-II: Designing Good Data Architecture: Enterprise Architecture, Data Architecture, Good Data Architecture, Principles of Good Data Architecture, Major Architecture Concepts, Examples and Types of Data Architecture, Who's Involved with Designing a Data Architecture.

Data Generation in Source Systems: Sources of Data, Source Systems, Source System Practical Details- Databases, APIs, Data Sharing, Third-Party Data Sources, Message Queues and Event-Streaming Platforms, Whom You'll Work With, Undercurrents and Their Impact on Source Systems.

UNIT-III: Storage: Raw Ingredients of Data Storage, Data Storage Systems- Single Machine Versus Distributed Storage, Eventual Versus Strong Consistency, File Storage, Block Storage, Object Storage, Cache and Memory-Based Storage Systems, The Hadoop Distributed File System, Streaming Storage, Data Engineering Storage Abstractions, Big Ideas and Trends in Storage- Data Catalog, Data Sharing, Schema, Separation of Compute from Storage, Data Storage Lifecycle and Data Retention, Single-Tenant Versus Multitenant Storage; Whom You'll Work With, Undercurrents.

UNIT-IV: Ingestion: What is Data Ingestion, Key Engineering Considerations, Batch Ingestion Considerations, Message and Stream Ingestion Considerations, Ways to Ingest Data- Direct Database Connection, Change Data Capture, APIs, Message Queues and Event-Streaming Platforms, Managed Data Connectors, Moving Data with Object Storage, EDI, Databases and File Export, Practical Issues with Common File Formats, Shell, SSH, SFTP and SCP, Web hooks, Web Interface, Web Scraping, Transfer Appliances for Data Migration, Data Sharing; Whom You'll Work With, Undercurrents.

UNIT-V: Queries, Modeling, and Transformation: Queries, Data Modeling, Transformations- Batch Transformations, Materialized Views, Federation, and Query Virtualization, Streaming Transformations and Processing; Whom You'll Work With, Undercurrents.

Serving Data for Analytics, Machine Learning: General Considerations for Serving Data, Analytics- Business, Operational, and Embedded; Machine Learning- What a Data Engineer Should Know About ML; Ways to Serve Data for Analytics and ML, Whom You'll Work With, Undercurrents.

Text Books:

1. Fundamentals of Data Engineering: Plan and Build Robust Data Systems, Joe Reis and Matt Housley, O'Reilly.

Reference Books:

1. Data Engineering with Python: Work with massive datasets to design data models and automate data pipelines using Python, Paul Crickard, Packt Publishing
2. Data Engineering Mining, Information and Intelligence, Edited by Yupo Chan, John R. Talburt, Terry M. Talley, ISBN 978-1-4419-0175-0 e-ISBN 978-1-4419-0176-7 DOI 10.1007/978-1-4419-0176-7 Springer New York Dordrecht Heidelberg London.

Semester	VI	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AIT10
Name of the Course	Machine Learning					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- | | |
|--|-------------|
| CO1: Describe Machine Learning Activities. | (K2) |
| CO2: Explain Feature Transformation and Feature Selection. | (K2) |
| CO3: Illustrate Supervised Learning and Unsupervised. | (K2) |
| CO4: Explain Semi-Supervised, Ensembling, and Reinforcement Learning. | (K2) |
| CO5: Describe Graphical Models and Sequential Data Modeling. | (K2) |

UNIT-I: Introduction: Human Learning vs. Machine Learning, Machine Learning Activities, Types of Data, Modelling & Evaluation- Predictive Models, Descriptive Models, Training a Model, Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model.

UNIT-II: Feature Engineering: Introduction, Feature Transformation- Feature Construction, Feature Extraction; Feature Selection- Issues in high-dimensional data, Key Drivers, Measures, Process, Approaches.

UNIT-III: Supervised Learning: Classification-Introduction, Model, Learning Steps, Algorithms-k-Nearest Neighbor, Decision Tree, Support Vector Machines. Regression- Introduction, Regression Algorithms-Simple Linear Regression, Multiple Linear Regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy.

Unsupervised Learning: Introduction, Unsupervised vs Supervised Learning, Applications, Clustering- K-Means, Spectral Clustering, Hierarchical Clustering.

UNIT-IV: Semi-supervised Learning: The Problem, Sampling Paradigm (Generative Models), The diagnostic paradigm. **Ensemble Learning:** Boosting: Adaboost, Stumping, Bagging, Random Forests.

Reinforcement Learning: Overview, Example, Markov Decision Processes, Q-Learning.

UNIT-V: Graphical Models: Bayesian Networks, Conditional Independence, Markov Random Fields, Inference in Graphical Models. **Sequential Data:** Markov Models, Hidden Markov Models, Linear Dynamical Systems.

Text Books:

1. Machine Learning, Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Pearson.
2. Machine Learning: An Algorithmic Perspective, Stephen Marsland, 2nd Edition, CRC Press.
3. Pattern Recognition and Machine Learning, Christopher M. Bishop, Springer.
4. Semi-Supervised Learning, Olivier Chapelle, Bernhard Schölkopf, Alexander Zien, The MIT Press.

Reference Books:

1. Machine Learning, Tom Mitchell, McGraw Hill.
2. Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Peter Flach, Cambridge University Press.
3. A First Course in Machine Learning, Simon Rogers & Mark Girolami, 2nd Edition, CRC Press.

Semester	V	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AIT11
Name of the Course	Web Technologies					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Illustrate the basic concepts of HTML, CSS and JavaScript. **(K2)**
CO2: Demonstrate an XML Document Structure, XSLT, XPath and XML parsers. **(K3)**
CO3: Demonstrate working with database using JDBC. **(K3)**
CO4: Build web applications using Servlets & JSP. **(K3)**
CO5: Illustrate the basic concepts of Node JS and Angular JS. **(K2)**

UNIT-I: HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Frames, Forms.

CSS: Cascading style sheets, Levels of Style Sheets, Style Specification Formats, Selector Forms.

JavaScript: Overview of JavaScript, General Syntactic Characteristics, Primitives Operations and Expressions, Screen output and Keyboard Input, Control Statements.

UNIT-II: Working with XML: Introduction, The syntax of XML, XML Document Structure, Document type Definition (DTD), Namespaces, XML schemas, XSLT, XPath, **XML Parsers** - DOM and SAX

UNIT-III: WORKING WITH DATABASE: Getting started with JDBC, Introduction to JDBC, Components of JDBC, JDBC Architecture, Types of Drivers, Working with JDBC APIs, Creating a Simple Application, Working with Prepared Statement, ResultSet, Transaction Management.

UNIT IV: Introduction to Servlets & JSP: Introduction to servlets, Life cycle of Servlet, Limitations of servlets, Java Server Pages: JSP Overview, Components of a JSP Page: Directives, comments, Expressions, Scriptlets, Declarations, implicit objects, Database Access, session tracking.

UNIT V: Fundamentals of NODE JS and Angular : Understanding Node.js, Installing Node.js, Working with Node Packages, Creating a Node.js Application, Understanding Angular, Modules, Directives, Data Binding, Dependency Injection, Services, Creating a Basic Angular Application.

Text Books:

1. Programming the World Wide Web, 7th Edition, Robert W Sebesta, Pearson, 2013.
2. Node.js, MongoDB and Angular Web Development, 2nd Edition, Brad Dayley, Brendan Dayley, Caleb Dayley, Pearson Education, 2018
3. JSP: The Complete reference, Phil Hanna, The McGraw-Hill Companies, 2001.
4. JDBC, Servlets, and JSP, New Edition, Santhosh Kumar K, Kogent Learning Solutions Inc, Dreamtech Press, 2018.

Reference Books:

1. Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
2. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning
3. Web Technologies, 1st Edition 7th impression, Uttam K Roy, Oxford, 2012.

Semester	V	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE01
Name of the Course	Cryptography and Network Security (Professional Elective-I)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Discuss fundamentals and mathematical support of Cryptography and Network Security. (K2)
CO2: Discuss symmetric and asymmetric cryptosystems. (K2)
CO3: Discuss about HASH functions & Digital Signatures to provide authentication and integrity. (K2)
CO4: Demonstrate various methods of Mutual trust and mail security. (K3)
CO5: Review the Network & Internet Security Scenarios. (K2)

UNIT-I: Overview: Security attacks, Services, Mechanisms, A model for network security, Symmetric cipher model. **Classical encryption techniques:** Substitution Techniques, Transposition Techniques.

Number Theory: Prime numbers, Fermat's theorem, Euler's Theorem, the Chinese Remainder Theorem.

UNIT-II: Block Cipher: Principles, DES, Strength of DES, AES, Block cipher Modes of Operations.

Public Key Cryptography: Principles, Public Key Crypto system, RSA Algorithm, Diffie Hellman Key Exchange.

UNIT-III: Cryptographic Hash Functions: Application of Cryptographic Hash Functions, Requirements & Security, SHA-512, Message Authentication Functions, Requirements, HMAC.

Digital Signatures: Properties, Attacks and Forgeries, Requirements, Digital Signature Standards, NIST Digital Signature Algorithm.

UNIT-IV: Key Management and Distribution: Symmetric Key Distribution Using Symmetric Encryption, Asymmetric Key Distribution Using Symmetric Encryption, Distribution of Public Keys, X.509 Certificates.

User Authentication: Remote User Authentication Principles, Kerberos. **Electronic Mail Security:** Pretty Good Privacy (PGP) And S/MIME.

UNIT-V: IP Security: Two modes, two security protocols Authentication Header, Encapsulating Security Payload. **Transport Level Security:** Secure Socket Layer (SSL) and Transport Layer Security (TLS). **HTTPS:** Connection Initiation Connection Closure.

Text Books:

1. William Stallings, "Cryptography and Network Security, Principles and Practices", Pearson Education, Sixth Edition.
2. Cryptography and Network Security, Behrouz A Forouzan, Debdeep Mukhopadhyay, (3e) McGrawHill.

Reference Books:

1. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security – Private Communication in a Public World" Pearson/PHI.

Semester	V	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE02
Name of the Course	Principles of Programming Languages (Professional Elective-I)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Describe syntax and semantics of programming languages. **(K2)**
CO2: Explain data types and basic statements of programming languages. **(K2)**
CO3: Design and implement subprogram constructs. **(K3)**
CO4: Discuss concurrency process using OOP. **(K2)**
CO5: Develop programs in Scheme, ML, and Prolog. **(K3)**

UNIT-I: Syntax and semantics: Evolution of programming languages, describing syntax, context, free grammars, attribute grammars, describing semantics, lexical analysis, parsing, recursive – decent bottom - up parsing

UNIT-II: Data, Data types, and basic statements: Names, variables, binding, type checking, scope, scope rules, lifetime and garbage collection, primitive data types, strings, array types, associative arrays, pointers and references, Arithmetic expressions, overloaded operators, type conversions, relational and boolean expressions, assignment statements, mixed mode assignments, control structures – selection, iterations, branching, guarded Statements

UNIT-III: Subprograms and implementations: Subprograms, design issues, local referencing, parameter passing, overloaded methods, generic methods, design issues for functions, semantics of call and return, implementing simple subprograms, stack and dynamic local variables, nested subprograms, blocks, dynamic scoping.

UNIT- IV: Object- orientation, concurrency, and event handling: Object – orientation, design issues for OOP languages, implementation of object, oriented constructs, concurrency, semaphores, Monitors, message passing, threads, statement level concurrency, exception handling.

UNIT- V: Functional programming languages: Introduction to lambda calculus, fundamentals of functional programming languages, Programming with Scheme, Programming with ML, Logic programming languages: Introduction to logic and logic programming, Programming with Prolog, multi - paradigm languages

Text Books:

1. Robert W. Sebesta, “Concepts of Programming Languages”, Tenth Edition, Addison Wesley, 2012.
2. Programming Languages, Principles & Paradigms, 2ed, Allen B Tucker, Robert E Noonan, TMH.

Reference Books:

1. R. Kent Dybvig, “The Scheme programming language”, Fourth Edition, MIT Press, 2009.
2. Jeffrey D. Ullman, “Elements of ML programming”, Second Edition, Prentice Hall, 1998.
3. Richard A. O’Keefe, “The craft of Prolog”, MIT Press, 2009.
4. W. F. Clocksin and C. S. Mellish, “Programming in Prolog: Using the ISO Standard”, 5th Edition, Springer, 2003.

Semester	V	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE03
Name of the Course	Hadoop & BigData(Professional Elective-I)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Discuss the challenges of Big Data using Hadoop. **(K2)**

CO2: Apply data modelling techniques to large data sets using map reduce programs. **(K3)**

CO3: Describe the Hadoop I/O classes. **(K2)**

CO4: Examine the use of Pig Framework to work with Big Data. **(K3)**

CO5: Develop a data analytical system using HIVE. **(K3)**

UNIT-I: Introduction to Big Data &Hadoop: What is Big Data, Why Big Data is Important, Data Storage and Analysis, Comparison with other systems. A brief history of Hadoop, MeetHadoop Data, Apache Hadoop and the Hadoop Ecosystem.

Working with Big Data & HDFS: Google File System, Hadoop Distributed File System (HDFS) –Building blocks of Hadoop (Namenode, Datanode, Secondary Namenode, JobTracker, TaskTracker).

UNIT-II: Introducing and Configuring Hadoop cluster: Local distributed mode, Pseudo-distributed mode, Fully Distributed mode, Configuring XML files.

Writing Map Reduce Programs: Analyzing the Data with Hadoop-Map Reduce, Basic programs of Hadoop Map Reduce, Driver code, Mapper code, Reducer code, Record Reader, Combiner functions. Map Reduce Types, Input Format class Hierarchy.

UNIT-III:Hadoop I/O: The Writable Interface, Writable Comparable and Comparators.

Writable Classes: Writable wrappers for Java primitives, Text & Bytes Writable, Null Writable, Object Writable and Generic Writable, Writable collections.

Implementing a Custom Writable: Implementing a Raw Comparator for speed, Custom comparators

UNIT-IV: Pig - Hadoop Programming Made Easier: Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin.

UNIT-V: Applying Structure to Hadoop Data with Hive: Saying Hello to Hive, Seeing How the Hive is Put Together, Getting Started with Apache Hive, Examining the Hive Clients, Working with Hive Data Types, Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works, Querying and Analyzing Data.

Text Books:

1. Hadoop: The Definitive Guide, Tom White, O'Reilly, 3rd Edition, 2012.
2. Hadoop in Action, Chuck Lam, MANNING Publ., 2016.
3. Hadoop for Dummies, Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk, Bruce Brown, Rafael Coss, 2014.

Reference Books:

1. Hadoop in Practice, Alex Holmes, MANNING Publ., 2014.
Hadoop Map Reduce Cookbook, SrinathPerera, ThilinaGunarathne, PACKT, 2013

Semester	V	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE04
Name of the Course	Automata and Compiler Design(Professional Elective-I)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Construct Finite Automata and Regular Expressions. **(K3)**
CO2: Describe the Compilation Process and Lexical Analysis. **(K2)**
CO3: Construct Topdown and Bottom up Parsing Techniques. **(K3)**
CO4: Produce Intermediate Code Generation and Runtime Environments. **(K3)**
CO5: Explain Code Optimization and Code Generation. **(K2)**

UNIT I: Formal Language and Regular Expressions: Alphabet, Strings, Language, Finite Automaton-Design of DFA, Design of NFA, Equivalence between NFA and DFA, Finite Automata with ϵ -Transition, Equivalence between NFA and ϵ -NFA. **Regular Expression:** Regular expressions Equivalence between Regular Expressions and Finite Automata, Chomsky Hierarchy.

UNIT II: Compiler: Definition, Structure of a compiler. **Lexical Analysis:** The Role of the Lexical Analyzer, Specification of Tokens, Recognition of Tokens and the Lexical-Analyzer Generator-Lex. **Context Free grammars:** Context free grammars, derivation, parse trees, Ambiguous Grammar, Writing a Grammar-Elimination of Left Recursion, Left Factoring.

UNIT III: Top Down Parsing: First and Follow, LL(1) Grammars, **Bottom-Up Parsing:** Bottom Up Parser Classification, Reductions, Handle Pruning, Shift-Reducing, Constructing SLR Parsing Tables, construction of CLR (1), LALR Parsing tables, Comparison of all Bottom Up approaches.

UNIT IV: Semantic Analysis: Syntax Directed Definitions, Evaluation Orders for SDD's

Intermediate Code Generation: Variants of Syntax Trees, Three-Address Code, Basic blocks and Flow graphs, Control Flow. **Run-Time Environments:** Storage Organization, Stack Allocation of Space, Heap Management

UNIT V: Code optimization: Machine Independent Optimization. The principle sources of Optimization, optimization of Basic blocks, peep hole Optimization, Introduction to Data flow Analysis.

Code generation: Issues in design of code generation, The target Language, Address in the target code, A Simple 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 Aho, Ullman, Ravisethi, Pearson Education.

Reference Books:

1. Louden: "Compiler Construction, Principles & Practice", 1st Edition, Thomson Press, 2006.
2. Tremblay J P, Sorenson G P: "The Theory & Practice of Compiler writing", 1st Edition, BSP Publication, 2010.
3. Theory of Computation, V. Kulkarni, Oxford University Press, 2013.

Semester	V	L	T	P	C	COURSE CODE
Regulation	V20	0	0	3	1.5	V20AIL09
Name of the Course	Machine Learning Lab					
Branch	Common to CAI & AIM					

Syllabus Details

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

- CO1:** Demonstrate advanced python libraries used in Machine Learning. **(K3)**
CO2: Demonstrate feature reduction process. **(K3)**
CO3: Implement probabilistic classifiers using Python Programming. **(K3)**
CO4: Construct non-probabilistic classifiers using Python Programming. **(K3)**
CO5: Demonstrate the process of clustering using the K-Means algorithm. **(K3)**

List of Experiments

1. Introduction to required python libraries such as Numpy, Pandas, Matplotlib and Scikit-learn.
2. Import, preprocess, and split the datasets using scikit-learn.
3. Demonstrate Feature Extraction on a sample dataset.
4. Demonstrate Feature Selection on a sample dataset.
5. Construct a classification model using the Bayes classifier using Python Programming.
6. Implement a Logistic Regression algorithm for binary classification using Python Programming.
7. Implement the KNN algorithm for classification and demonstrate the process of finding out optimal “K” value using Python Programming.
8. Construct an SVM classifier using python programming.
9. Demonstrate the process of the Decision Tree construction for classification problems using python programming.
10. Implement an Ensemble Learner using Random Forest Algorithm using python programming.
11. Implement an Ensemble Learner using Adaboost Algorithm using Python programming.
12. Demonstrate the K-Means algorithm for the given data set using Python programming.
13. Demonstrate sequential labeling on a given dataset using a Hidden Markov Model to predict the most likely sequence of labels for a given sequence of observations.

Text Books:

1. Introduction to Machine Learning with Python, Andreas C. Muller and Sarah Guido, First Edition, O’Reilly.

Reference Books:

1. Practical Machine Learning with Python, Dipanjan Sarkar, Raghav Bali and Tushar Sharma, First Edition, APress.

Semester	V	L	T	P	C	COURSE CODE
Regulation	V20	0	0	3	1.5	V20AIL10
Name of the Course	Web Technologies Lab					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Develop web pages using HTML, CSS and JavaScript. **(K3)**
CO2: Construct an XML document with DTD and XSD. **(K3)**
CO3: Develop Java applications to work with database using JDBC. **(K3)**
CO4: Develop Dynamic web applications using JSP. **(K3)**
CO5: Develop a Simple Node JS and Angular JS application. **(K3)**

LIST OF EXPERIMENTS

Exercise 1: Design HTML fundamental constructs.

- (i) Headings (ii) Links (iii) Paragraph (iv) Images (v) Tables

Exercise 2: Design HTML fundamental constructs.

- (i) Frames (ii) Forms and HTML controls

Exercise 3: Design Cascading style sheets

- (i) Internal (ii) External (iii) Inline

Exercise 4: Develop the Following programs using JavaScript

- (i) Check if a given number is even or odd using an If statement
(ii) Check if a given string is a Palindrome using Control Statements

Exercise 5: Write an XML file which will display the Book information which includes the following:

- (i) Title of the book (ii) Author Name (iii) ISBN number (iv) Publisher name
(v) Edition (vi) Price

(a) Write a Document Type Definition (DTD) to validate the above XML file.

(b) Write a XML Schema Definition (XSD).

Exercise 6: Create a simple JSP to print the current Date and Time.

Exercise 7: Develop JSP program calculates factorial values for an integer number, while the input is taken from an HTML form.

Exercise 8: Develop JSP program shows a Sample Order Form.

A Sample Order Form			
Item	Price	Quantity	Total Price
DVD	19.99	2	39.98
CD	12.99	9	116.91
Diskette	1.99	24	47.76

Exercise 9: Create JSP to insert, delete, and update the details of student into the database using JDBC connectivity.

Exercise 10: Design a simple Angular JS form.

Exercise 11: Design a simple Node JS application.

Reference Books:

1. Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
2. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning
3. Web Technologies, 1st Edition 7th impression, Uttam K Roy, Oxford, 2012.

Semester	V	L	T	P	C	COURSE CODE
Regulation	V20	2	0	0	0	V20ENT04
Name of the Course	Professional Communication Skills – III					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Distinguish the subtle meanings of various words in different contexts, recognize similar words as well as words with contrast meanings and use them appropriately. Express writer's tone and relevant ideas using different types of writing skills and prepare resume to showcase skills and accomplishments. Organize thoughts in the discussions and express views without reticence. Develop the ability to write different types of essays in a structured way, maintaining cohesion and logic. **(K4)**

CO2: Identify the central theme and arrange the scrambled sentences into a meaningful passage. Draft emails with appropriate subject-lines and relevant content. Compare different pairs of words, recognize the relationship between the head words and the options to siphon correct analogy Choose an appropriate word to make a sentence meaningful. Infer the meaning of the picture by thinking out of the box and speak without inhibitions and face interviews with aplomb. **(K2)**

CO3: Analyze appropriate methods of logical thinking on Ratio and Proportion, Partnership, LCM and HCF, Number System, Areas & Volumes. **(K4)**

CO4: Demonstrate problem solving skills through the concepts of Percentages, Profit and loss, Simple Interest & Compound Interest and Allegation. **(K3)**

CO5: Calculate the end results of Cubes, Dice and Data Analysis, Time & Work, Time & Distance, Race & Games. **(K4)**

UNIT – I: VOCABULARY– MODEL RESUMES & SPEAKING

500 words (PIC-VOC) -Meaning – contextual Usage - Prefix – Suffix – Root words. Resume writing- Model Resume-Introducing different formats-Tailoring resume as per job description. Paragraph writing- Essay writing- Types of Essays- Strategies – Cause and effect signals – support signals – contrast signals. Watch a video and respond.

Group Discussion – Types of GD – Dos & Don'ts, JAM, Presentation Skills, Designing Advertisements.

UNIT – II: GRAMMAR, WRITING & SPEAKING SKILLS

Tenses – Simple – Continuous – perfect – perfect continuous - voice – Active & Passive -Para jumbles – Strategies – Directional words – central theme-Email writing– Types -- Dos and Don'ts- **VERBAL ABILITY- ANALOGIES- INTERVIEW SKILLS- CREATIVE THINKING ANALOGIES:** Strategies - Recognize common relationship types. Synonyms – Antonyms - Create a general sentence - Use the correct part of speech - Beware of homonyms. Equalizing the sentences- scrambled sentences. Interview Skills – Personal Interview – Skype Interview – Telephone Interview – Mock Interviews. Creative thinking – Picture Interpretation -Creative writing

UNIT – III: Ratio & Proportion, Partnership, LCM & HCF and Areas & Volumes

Introducing the concept of ratio in three different methods, a method to compute and compare two ratios – The effect of increase or decrease of a quantity on the ratio – The meaning of proportion and Problems related to Ratio and Proportion. Improve problem solving skills through Lcm & Hcf.

UNIT – IV: Percentages, Profit and Loss, Simple and Compound Interest, Allegation & Mixtures

Definition of Simple and Compound Interest. Formulas of Applications – Difference between Simple and Compound interest – Rate of Increase or Decrease Population – Expected values of Maturity. Calculate percentages on different situations, using in profit and loss. Identifying difference between Cost price, Selling Price and Marked Price, Finding Discounts, using the method of allegation.

UNIT – V: Time, Work and Distance, Cubes, Dice and Data Analysis

Men- Days -work –completion- Capability Ratio among Men, Women and Children – Application of time in Pipes and Cistern. Work Progress in positive and negative effects. Relation among Time, Speed and Distance – Concepts of Relative speed and Average Speed – Ideas about Boats and Streams and Races of Games. Calculate the end results of Cubes and Dice.

References:

1. Dr.Sujani Tata et al., Pic Voc (2015) – Published by Sri Vasavi Engineering College
2. Lewis Norman, Word Power Made Easy (2008). Goyal Publishers & Distributors Pvt. Ltd.
3. Dr.ShaliniVerma, ReeteshAnand, Word Power Made Handy(2017). S Chand Publications.
4. R S Aggarwal,Objective General English (2017). S Chand Publications.
5. Sunita Mishra &C.Muralikrishna, Communication Skills for Engineers (2006). Dorling Kindersley (India) Pvt. Ltd., licensees of Pearson Education in South Asia.
6. Charles W Hanson. Resume: Writing 2020 The Ultimate Guide to Writing a Resume that Lands YOU the Job! (2019).
7. Raymond Murphy. Essential Grammar in Use (1985).Cambridge University Press
8. Seely John. The Oxford Guide to Writing & Speaking (2004). Oxford University Press.
9. Jain,T.S. & Gupta. , 2010, Interviews and Group Discussions, Upkar’s Publications.
10. Training & Placement cell, 2020, Workbook -1 on Aptitude, Sri Vasavi Engineering College.
11. M Tyra, 2013, Magical Book on Quicker maths, BSC Publications.
12. K Kundan& M Tyra, 2009, Practice Book on Quicker Maths, BSC Publications.
13. Dr. RS. Agarwal , 2017, Quantitative Aptitude, Sultan Chand Publications
14. Dr. RS. Agarwal, 2017, A modern approach to verbal & on verbal reasoning, Sultan Chand Publications.

Web References:

1. <https://www.indiabix.com/>
2. <https://www.campusgate.co.in/>
3. <https://www.questionpaper.org/>

Semester	VI	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AIT12
Name of the Course	Computer Networks					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Discuss fundamental of network concepts and Reference Models. **(K2)**
CO2: Discuss Communication media and switching techniques. **(K2)**
CO3: Demonstrate Error control and Data link layer protocols. **(K3)**
CO4: Apply Routing algorithms and congestion control algorithms. **(K3)**
CO5: Discuss Transport layer protocols and Application layer protocols. **(K2)**

UNIT I: Introduction: Reference models: The OSI Reference Model, the TCP/IP Reference Model, Examples of Networks: Novell Networks, Arpanet, Internet, Network Topologies: WAN, LAN, MAN.

UNIT II: Physical Layer: Transmission Media, Multiplexing: FDM, WDM and TDMLAN Technologies, introduction to switching: Circuit Switched Networks, Datagram Networks, and Virtual Circuit Networks.

UNIT-III: Data link layer: Design issues, Framing, Flow control, error control, error detection - Parity bit, CRC, Checksum, error correction- Hamming code. MAC: ALOHA, CSMA. Elementary Data Link Layer protocols: simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel. Sliding window protocol: One bit, Go back N, Selective repeat- Stop and wait protocol, HDLC, point to point protocol (PPP). Piggybacking.

UNIT-IV: Network Layer : Network layer design issues- Algorithm shortest path routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical routing, Broad cast, Multi cast Routing algorithms- Congestion control and algorithms, Internet Protocol (IP) Addresses, Subnet masking. Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

UNIT-V: Transport Layer: Services, Primitives and sockets, Elements of transport protocols, Internet Transport protocols (TCP, UDP, RPC, RTTP/RTP, RTCP) Segment headers, Primitives, Control, Congestion control.

Application layer: DNS, SMTP, POP, FTP, HTTP Presentation formatting. Network security: Cryptography, DES Public key and RSA private key cryptography Algorithms.

Text Books:

1. Computer Networks—Andrew S Tanenbaum, 4th Edition. Pearson Education/PHI
2. Data Communications and Networks—Behrouz A. Forouzan. Third Edition TMH

Reference Books:

1. An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education
2. Understanding communications and Networks, 3rd Edition, W. A. Shay, Thomson.

Semester	VI	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AIT13
Name of the Course	Object Oriented Software Engineering					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Describe Software process and different life cycle models. **(K2)**
CO2: Discuss Project Planning, and organization. **(K2)**
CO3: Apply OO concepts along with their applicability contexts. **(K3)**
CO4: Demonstrate object oriented analysis and design. **(K3)**
CO5: Describe Implementation, Integration and Maintenance phases. **(K2)**

UNIT I: Introduction to Classical software Engineering: Introduction to OO Paradigm. Different phases in structured paradigm and OO Paradigm. Software Process and different life cycle models and corresponding strengths and weaknesses.

UNIT II: Planning and Estimation: Estimation of Duration and Cost, COCOMO components of software. Project Management plan. Planning Object-Oriented Projects. Project Organization & communication concepts and their activities.

UNIT III: Modules to objects: Cohesion and Coupling, Data Encapsulation and Information hiding aspects of Objects. Inheritance, Polymorphism and Dynamic Binding aspects. Cohesion and coupling of objects. Reusability, Portability and Interoperability aspects. Introduction to testing, with focus on Utility, Reliability, Robustness, Performance, Correctness.

UNIT IV: Requirement phase: Rapid Prototyping method, Specification phase, Specification Document, Formal methods of developing specification document, Examples of other semi - formal methods of using Finite-State- Machines, Petri nets and E- Language.

Analysis phase: Use case Modeling, Class Modeling, Dynamic Modeling, Testing during OO Analysis.

UNIT V: Design phase: Data oriented design, Object Oriented design, and Formal techniques for detailed design. Challenges in design phase. **IIIIM Phases:** Implementation, Integration and maintenance phases, OOSE aspects in these phases.

Text Books:

1. Object oriented and Classical Software Engineering, 7/e, Stephen R. Schach, TMH
2. Object oriented and classical software Engineering, Timothy Lethbridge, Robert Laganriere, TMH, 2nd Edition.

Reference Books:

1. Component-based software engineering: 7th International symposium, **CBSE 2004**, IvicaCrnkovic, Springer.

Semester	VI	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AIT14
Name of the Course	Deep Learning					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Describe the fundamentals of deep learning. **(K2)**
CO2: Illustrate the working of deep feed forward neural networks. **(K2)**
CO3: Discuss regularization and optimization techniques used in deep neural networks. **(K2)**
CO4: Illustrate the working of convolution neural networks. **(K2)**
CO5: Explain about recurrent and recursive neural networks. **(K2)**

UNIT-I: Introduction: Historical Trends in Deep Learning, The Many Names and Changing Fortunes of Neural Networks, Increasing Dataset Sizes, Increasing Model Sizes, Increasing Accuracy, Complexity and Real-World Impact.

UNIT-II: Deep Feed forward Networks: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back Propagation and Other Differentiation Algorithms.

UNIT-III: Regularization for Deep Learning: Parameter Norm Penalties, Early Stopping, Dropout; **Optimization for Training Deep Models:** How Learning Differs from Pure Optimization, Challenges, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Optimization Strategies and Meta-Algorithms.

UNIT-IV: Convolution Networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of Basic Convolution Functions, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuroscientific Basis for Convolutional Networks, Convolutional Networks and the History of Deep Learning.

UNIT-V: Sequence Modeling- Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, LSTM and Other Gated RNNs, Explicit Memory.

Textbooks:

1. Deep Learning, Ian Goodfellow, Yoshua Bengio, and Aaron Courville, MIT Press.

Reference Books:

1. Neural Networks and Deep Learning, Charu C. Aggarwal, Springer.
2. Fundamentals of Deep Learning, Nikhil Buduma, 1st Edition, O'Reilly.

Semester	VI	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE05
Name of the Course	Cyber Security (Professional Elective-II)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Describe about Cybercrimes. **(K2)**
- CO2:** Explain Cyber criminals and their attacks. **(K2)**
- CO3:** Illustrate Cybercrimes and security in mobile devices **(K2)**
- CO4:** Discuss about the Tools and methods used to overcome Cybercrimes. **(K2)**
- CO5:** Discuss about Cyber Laws, IT Acts and Computer Forensics . **(K2)**

UNIT I: Introduction to Cybercrime: Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security Who are Cybercriminals? , Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens.

UNIT II: Cyber offenses: How Criminals Plan Them –Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack VectorCloud Computing.

UNIT III: Cybercrime Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/CellPhones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT IV: Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoSAttacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. **Phishing and Identity Theft:** Introduction, Phishing, Identity Theft (ID Theft).

UNIT V: Cybercrimes and Cyber security: The Legal Perspectives, Introduction, Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment.

Understanding Computer Forensics: Introduction, Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Anti-forensics.

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, NinaGodbole, SunitBelapure, 1stedition, Wiley.

Reference Books:

1. Principles of Information Security, MichealE.Whitman and Herbert J.Mattord, 4th edition, Cengage Learning.
2. Information Security the complete reference, Mark Rhodes, Ousley, 2ndedition, MGH.

Semester	VI	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE06
Name of the Course	Cloud Computing(Professional Elective-II)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Explain the basic concepts of cloud computing. (K2)
CO2: Describe the Virtualization and Migration concepts of Cloud. (K2)
CO3: Explain the Cloud Application Design methodologies. (K2)
CO4: Illustrate the Security aspects of Cloud. (K2)
CO5: Illustrate the SLA Management aspects of Cloud. (K2)

UNIT-I: Introduction to Cloud Computing: Definition of Cloud Computing, Layers and Types Of Clouds, Desired Features of a Cloud, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks.

UNIT-II: Cloud Concepts & Technologies: Virtualization, Load Balancing, Replication, Software Defined Networking, Network Function Virtualization (NFV).

Migrating into a Cloud: The Seven-Step Model of Migration into a Cloud, Migration Risks and Mitigation

UNIT-III: Cloud Application Design: Design Considerations for Cloud Applications, Reference Architectures for Cloud Applications, Cloud Application Design Methodologies: SOA, Cloud Component Model, MVC, Data Storage Approaches.

UNIT-IV: Cloud Security: Cloud Security Architecture (CSA), Authentication, Authorization, Identity, Access Management, Data Security, Key Management.

UNIT-V: SLA Management in Cloud Computing: Service Level Agreements (SLA), Traditional Approaches to SLO Management, Types of SLA, Life Cycle of SLA, SLA Management in Cloud.

Text Books:

1. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg, Andrzej Goscinski, Wiley Publication.
2. Cloud Computing: A Hands-on Approach, Arshdeep Bahga, Vijay Madisetti, Universities Press.

Reference Books:

1. Cloud Computing – Web-Based Applications That Change the way you Work and Collaborate Online, Michael Miller, Pearson Education.
2. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, McGraw-Hill, (2010).

Semester	VI	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE07
Name of the Course	Data Science (Professional Elective-II)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Discuss the fundamental concepts of Data Science. (K2)
CO2: Illustrate Exploratory Data Analysis. (K2)
CO3: Explain the Concepts of Recommendation Engines. (K2)
CO4: Explain various Anomaly Detection Techniques. (K2)
CO5: Discuss Feature Selection techniques. (K2)

UNIT-I: Introduction: AI, Machine Learning and Data Science, What is Data Science? Case for Data Science, Data Science Classification, Data Science Algorithms.

Data Science Process: Prior Knowledge, Data Preparation, Modeling-Training and Testing Datasets, Learning Algorithms, Evaluation of the Model, Ensemble Modeling, Application, Knowledge.

UNIT-II: Data Exploration: Objectives of Data Exploration, Datasets- Types of Data, Descriptive Statistics-Univariate Exploration, Multivariate Exploration, Data Visualization, Roadmap for Data Exploration.

UNIT-III: Recommendation Engines: Need, Applications, Concepts, Types, Collaborative Filtering- Neighborhood-Based Methods, Matrix Factorization; Content-Based Filtering- Building an Item Profile, User Profile Computation, Implementation Steps, Hybrid Recommenders.

UNIT-IV: Anomaly Detection: Concepts - Causes of Outliers, Anomaly Detection Techniques; Distance-Based Outlier Detection- Working, Implementation Steps; Density-Based Outlier Detection- Working, Implementation Steps; Local Outlier Factor- Working, Implementation Steps.

UNIT-V: Feature Selection: Classifying Feature Selection Methods, Principal Component Analysis, Information Theory-Based Filtering, Chi-Square-Based Filtering, Wrapper-Type Feature Selection- Backward Elimination.

Textbook:

1. Data Science Concepts and Practice, Vijay Kotu, BalaDeshpande, 2nd Edition, Morgan Kaufmann Publishers.

Reference Books:

1. An Introduction to Data Science, Jeffrey S. Saltz, Jeffrey M. Stanton, Sage Publications.
2. The Art of Data Science, Roger D Peng, Elizabeth Matsui, Lean Publishing.
3. Data Science for Business, Foster Provost, Tom Fawcett, O'Reilly Media.

Semester	VI	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE08
Name of the Course	Social Networks and Semantic Web (Professional Elective-II)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Demonstrate knowledge by explaining the three different “named” generations of the web. **(K3)**
CO2: Construct a social network. **(K3)**
CO3: Relate knowledge representation methods for semantic web. **(K3)**
CO4: Describe web services and its Applications. **(K2)**
CO5: Develop “Linked Data” Applications using Semantic Web Technologies. **(K3)**

UNIT-I: The Semantic web: Limitations of the current Web, The semantic solution, Development of the Semantic Web, The emergence of the social web.

UNIT-II: Social Network Analysis: What is network analysis? Development of Social Network Analysis, Key concepts and measures in network analysis. Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities, Web-based networks.

UNIT-III: Knowledge Representation on the Semantic Web: Ontologies and their role in the Semantic Web, Ontology languages for the semantic Web.

Modeling and Aggregating Social Network Data: State of the art in network data representation, Ontological representation of Social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data.

UNIT-IV: Developing social semantic applications: Building Semantic Web applications with social network features, Flink- the social networks of the Semantic Web community, Open academia: distributed, semantic-based publication management.

UNIT-V: Evaluation of Web-Based Social Network Extraction: Differences between survey methods and electronic data extraction, context of the empirical study, Data collection, Preparing the data, optimizing goodness of fit, Comparison across methods and networks, Predicting the goodness of fit, Evaluation through analysis.

Text Books:

1. Social Networks and the Semantic Web, PeterMika, Springer,2007.
2. Semantic Web Technologies, Trends and Research in Ontology basedsystems, J.Davies,RudiStuder,PaulWarren,JohnWiley&Sons.

Reference Books:

1. Semantic Web and Semantic Web Services –Liyang Lu Chapman and Hall/CRC Publishers, (Taylor & Francis Group).
2. Information sharing on the semantic Web – HeinerStuckenschmidt; Frank Van Harmelen, Springer Publications.

Semester	VI	L	T	P	C	COURSE CODE
Regulation	V20	0	0	3	1.5	V20AIL11
Name of the Course	Computer Networks Lab					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Implement Error detection technique and Sliding window protocol. **(K3)**
CO2: Implement Routing and congestion control Algorithms. **(K3)**
CO3: Implement socket programming. **(K3)**

LIST OF EXPERIMENTS

(Implement using C/C++/Java/Python)

1. Study of basic network commands and Network configuration commands.
 - a) Ping
 - b) Tracert / Traceroute
 - c) Ipconfig / ifconfig
 - d) Hostname
 - e) Nslookup
 - f) Netstat
2. Construct Detecting error using CRC-CCITT.
3. Implementation of Bit Stuffing
4. Implementation of Character Stuffing
5. Implementation of stop and wait protocol.
6. Implementation of Dijkstra's algorithm
7. Implementation Distance vector algorithm
8. Implementation of Congestion control using leaky bucket algorithms
9. Implementation using Socket TCP both client and server programs.
10. Implementation using Socket UDP both client and server programs

Text Books:

1. Computer Networks—Andrew S. Tanenbaum, 4th Edition. Pearson Education/PHI.
2. Data Communications and Networks—Behrouz A. Forouzan. Third Edition TMH.

Reference Books:

1. An Engineering Approach to Computer Networks—S. Keshav, 2nd Edition, Pearson Education.
2. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson.

Semester	VI	L	T	P	C	COURSE CODE
Regulation	V20	0	0	3	1.5	V20AIL12
Name of the Course	Object Oriented Software Engineering Lab					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Develop Class diagrams. **(K3)**
CO2: Develop Use case diagrams. **(K3)**
CO3: Construct Interaction diagrams. **(K3)**
CO4: Develop State chart, Activity diagrams. **(K3)**
CO5: Develop Component and Deployment diagrams. **(K3)**

LIST OF EXPERIMENTS

1. Draw basic class diagrams to identify and describe key concepts like classes, and their relationships.
2. Draw Use Case diagrams for capturing and representing requirements of the system.
3. Draw sequence diagrams OR communication diagrams with advanced notation for system to show objects and their message exchanges.
4. Draw activity diagrams to display either business flows or like flow charts.
5. Develop State chart diagrams.
6. Draw component diagrams assuming that build the system reusing existing components along with a few new ones.
7. Draw deployment diagrams to model the runtime architecture of system.
8. Design Case study on Library Management System.
9. Design Case Study on Hospital Management System.
10. Design Case study-Railway Reservation System.

Text Books:

1. The Unified Modeling Language User Guide, Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.

Reference Books:

1. UML 2 Toolkit, Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, WILEY-Dreamtech India Pvt. Ltd.
2. Fundamentals of Object Oriented Design in UML, Meilir Page-Jones, Pearson Education.
3. Modeling Software Systems Using UML2, Pascal Roques, WILEY- Dreamtech India Pvt. Ltd.

Semester	VI	L	T	P	C	COURSE CODE
Regulation	V20	0	0	3	1.5	V20AIL13
Name of the Course	Deep Learning Lab					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:**Demonstrate feed-forward neural network using Tensorflow and Keras. **(K3)**
CO2:Construct a regression model using artificial neural network. **(K3)**
CO3:Construct a classification model using convolutional neural network. **(K3)**
CO4:Construct text classification model using neural network. **(K3)**
CO5:Demonstrate neural network with custom layers and custom training. **(K3)**

LIST OF EXPERIMENTS

1. Demonstrate the process of creating a simple feed-forward neural network for the Abalone dataset using Tensorflow and Keras libraries.
2. Demonstrate the process of saving and loading weights of the neural network constructed in experiment 1 manually and with checkpoints.
3. Construct a regression model for predicting the fuel efficiency of cars using the MPG dataset.
4. Develop a feed-forward neural network on the MNIST-Handwritten digits dataset.
5. Develop a convolutional neural network on the Fashion-MNIST dataset.
6. Develop and train the VGG-16 network to classify images of Cats & Dogs.
7. Develop a neural network with an Embedding layer for text classification.
8. Develop a text classification model using a neural network by using a pre-trained text embedding model “google/nlm-en-dim50/2” from TensorFlow Hub.
9. Demonstrate the creation of neural network with custom layers.
10. Construct a penguin classification model using the custom training option of TensorFlow.

Textbooks:

1. Deep Learning, Ian Goodfellow, YoshuaBengio, and Aaron Courville, MIT Press.
2. Machine Learning: An Algorithmic Perspective, Stephen Marsland, 2nd Edition, CRC Press.

Reference Books:

1. Neural Networks and Deep Learning, Charu C. Aggarwal, Springer.
2. Fundamentals of Deep Learning, Nikhil Buduma, 1st Edition, O’Reilly

Additional Resources:

1. <https://www.tensorflow.org/tutorials>
2. <https://keras.io/>

Semester	VI	L	T	P	C	COURSE CODE
Regulation	V20	2	0	0	0	V20CEMC02
Name of the Course	Professional Ethics & Human Values					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Discuss the importance of human values and their context. **(K2)**

CO2: Generalize the professional ethics and norms of engineering practice. **(K2)**

CO3: Review the contextual knowledge of engineering as social experimentation. **(K2)**

CO4: Identify the engineer's responsibility for Safety & Risks. **(K2)**

CO5: Clarify the professional rights & responsibilities at global level. **(K2)**

UNIT I: Human Values: Morals, Values and Ethics–Integrity–Work Ethics–Service Learning–Civic Virtue–Respect for others – Living Peacefully – Caring – Sharing –Honesty –Courage – Value time – Co-operation – Commitment –Empathy–Self-confidence–Spirituality–Character.

UNIT II: Engineering Ethics: The History of Ethics, Purposes for Engineering Ethics, Consensus and Controversy, Professional and Professionalism, Professional Roles to be played by an Engineer –Self Interest, Customs and Religion, Uses of Ethical Theories, Professional Ethics, Types of Inquiry in Engineering Ethics.

UNIT III: Engineering as Social Experimentation: Comparison with Standard Experiments –now ledge gained–Conscientiousness–Relevant Information–Learning from the Past–Engineers as Managers, Consultants, and Leaders–Accountability–Role of Codes–odes and Experimental Nature of Engineering.

UNIT IV: Engineers' Responsibility for Safety and Risk: Safety and Risk, Concept of Safety–Types of Risks–Voluntary v/s Involuntary Risk-Short term v/s long term Consequences, Delayed v/s Immediate Risk- Safety and the Engineer – Designing for Safety–Risk-Benefit Analysis-Accidents.

UNIT V: Engineers' Responsibilities, Rights & Global Issues: Collegiality, Senses of Loyalty, professionalism and Loyalty, Professional Rights & Responsibilities– confidential and proprietary information, Bribes/Gifts, Whistle Blowing. Globalization–Cross-culture Issues, Environmental Ethics, Computer Ethics, Weapons Development Ethics and Research Ethics, Intellectual Property Rights.

Text Books:

1. "Engineering Ethics and Human Values" by M. Govindarajan, S.Natarajan and V.S.Senthil Kumar-PHILearning Pvt.Ltd-2009.
2. "Professional Ethics and Morals" by Prof.A.R.Aryasri, Dharanikota Suyodhana-Maruthi Publications.
3. "Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran-Laxmi Publications.

References:

1. "Professional Ethics and Human Values" by Prof.D.R.Kiran.
2. "Indian Culture, Values and Professional Ethics" by PSRMurthy-BS Publication.
3. "Ethics in Engineering" by Mike W.Martin and Roland Schinzinger–TMH.

Semester	VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE09
Name of the Course	Ethical Hacking (Professional Elective-III)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Discuss ethical considerations of Hacking. **(K2)**
- CO2:** Assess an environment using Foot printing and Social Engineering methods. **(K3)**
- CO3:** Discuss various techniques and tools used in Network Scanning and characteristics in Enumeration phase. **(K3)**
- CO4:** Demonstrate techniques and tools used in System Hacking and different Malwares. **(K3)**
- CO5:** Illustrate countermeasures to Denial-Of-Service, Session Hijacking. **(K3)**

UNIT I: Introduction to Ethical Hacking, Ethics: Ethical Hacking Terminology, Different Types of Hacking Technologies, Different Phases Involved in Ethical Hacking and Stages of Ethical Hacking, Hacktivism, Types of Hacker Classes, Skills Required to Become an Ethical Hacker, Vulnerability Research, Ways to Conduct Ethical Hacking.

UNIT II: Foot printing and Social Engineering: Foot printing, Information Gathering Methodology, Competitive Intelligence ,DNS Enumeration Who is and ARIN Lookups, Types of DNS Records, Trace route, E-Mail Tracking ,Web Spiders , Social Engineering, Common Types Of Attacks, Insider Attacks, Identity Theft, Phishing Attacks, Online Scams, URL Obfuscation, Social-Engineering Countermeasures.

UNIT III: Scanning and Enumeration: Scanning, types of Scanning , CEH Scanning Methodology ,Ping Sweep Techniques, Nmap Command Switches, SYN, Stealth, XMAS, NULL, IDLE, and FIN Scans, TCP Communication Flag Types, War-Dialing Techniques, Banner Grabbing and OS Fingerprinting Techniques, Proxy Servers, Anonymizers, HTTP Tunneling Techniques, IP Spoofing Techniques , Enumeration, Null Sessions, SNMP Enumeration, Windows 2000 DNS Zone Transfer, Steps Involved in Performing Enumeration.

UNIT IV: System Hacking Understanding Password-Cracking Techniques, Password-Cracking Countermeasures, Understanding Different Types of Passwords, Password attacks: Passive Online Attacks, Active Online Attacks, Offline Attacks Non electronic Attacks, Understanding Key loggers and Other Spyware Technologies.

Trojans, Backdoors, Viruses, and Worms : Trojans and Backdoors, Types of Trojans, Wrapping, Countermeasure Techniques in Preventing Trojans, Viruses and Worms, Types of Viruses, Understand Antivirus Evasion Techniques, Understand Virus Detection Methods.

UNIT V: Sniffers :Protocols Susceptible to Sniffing, Active and Passive Sniffing, ARP Poisoning.

Denial of Service and Session Hijacking: Denial of Service, Types of DoS Attacks, DDoS Attacks, BOTs/BOTNETs, DoS/DDoS Countermeasures, Session Hijacking, Spoofing vs. Hijacking, Types of Session Hijacking, Steps in Performing Session Hijacking, Prevention of Session Hijacking.

Text Books:

1. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition.

Reference Books:

1. Hacking Exposed Web 2.0, by Rich Annings, HimanshuDwivedi, Zane Lackey, Tata McGraw Hill Edition.
2. Ethical Hacking & Network Defense, Michael T. Simpson, Cengage Learning
3. Hacking Exposed Windows, Joel Scambray, cissp, Stuart McClure, Cissp, Third Edition, Tata McGraw Hill Edition.
4. Hacking Exposed Window server 2003, Joel Scambray Stuart McClure, Tata McGraw Hill Edition.

Semester	VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE10
Name of the Course	Information Retrieval System (Professional Elective-III)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Identify the basic concepts of Information Retrieval and its System Capabilities. (K2)
CO2: Explain the data structures and retrieving documents. (K2)
CO3: Describe the difficulty of representing and retrieving documents. (K2)
CO4: Explain the latest technologies for describing and searching the web. (K2)
CO5: Illustrate searching procedure for user-text and Information System Evaluation. (K2)

UNIT I: Introduction: Definition, Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses.

Information Retrieval System Capabilities: Search, Browse, Miscellaneous Cataloging and Indexing: Objectives, Indexing Process, Automatic Indexing, Information Extraction.

UNIT II: Data Structures: Introduction, Stemming Algorithms, Inverted file structures, N-gram data structure, PAT data structure, Signature file structure, Hypertext data structure.

UNIT III: Automatic Indexing: Classes of automatic indexing, Statistical indexing, Natural language, Concept indexing, Hypertext linkages. **Document and Term Clustering:** Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters.

UNIT IV: User Search Techniques: 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, Cognition and perception, Information visualization technologies.

UNIT V: Text Search Algorithms: Introduction, Software text search algorithms, Hardware text search systems. **Information System Evaluation:** Introduction, Measures used in system evaluation, Measurement example – TREC results. **Learning to Rank:** Overview of learning to Rank for IR systems

Text Books:

1. Information Storage and Retrieval System: Theory and Implementation, Gerald J. Kowalski, Mark T. Maybury, 2nd edition, 2002, Kluwer Academic Press.

Reference Books:

1. Information Retrieval Data Structures and Algorithms, Frakes, W.B., Ricardo Baeza-Yates Prentice Hall.
2. Information Storage & Retrieval by Robert Korfhage – John Wiley & Sons, Wiley computer publisher, 1997.

Web References:

1. https://en.wikipedia.org/wiki/Learning_to_rank
2. [Learning to Rank for Information Retrieval By Tie-Yan Liu.](#)

Semester	VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE11
Name of the Course	Natural Language Processing (Professional Elective-III)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Illustrate Natural Language Processing tasks in syntax, semantics, and pragmatics. **(K2)**
CO2: Classify Morphology and Finite State Transducers, Markov Models and Entropy Models. **(K2)**
CO3: Explain about Statistical parsing and probabilistic CFGs. **(K2)**
CO4: Demonstrate semantic analysis. **(K2)**
CO5: Explain Discourse Analysis and Lexical Resources. **(K2)**

UNIT-I : Introduction: Natural Language Processing tasks in syntax, semantics, and pragmatics–Issues–Applications- The role of machine learning - Probability Basics–Information theory–Collocations-N-gram Language Models - Estimating parameters and smoothing – Evaluating language models.

UNIT-II : Morphology And Part Of Speech Tagging: Linguistic essentials - Lexical syntax- Morphology and Finite State Transducers - Part of speech Tagging - Rule-Based Part of Speech Tagging - Markov Models - Hidden Markov Models – Transformation based Models - Maximum Entropy Models. Conditional Random Fields.

UNIT-III :Syntax Parsing: Syntax Parsing - Grammar formalisms and treebanks - Parsing with Context Free Grammars ,Features and Unification-Statistical parsing and probabilistic CFGs(PCFGs)-Lexicalized PCFGs.

UNIT-IV :Semantic Analysis: Representing Meaning – Semantic Analysis - Lexical semantics –Word-sense disambiguation- Supervised – Dictionary based and Unsupervised Approaches - Compositional semantics- Semantic Role Labeling and Semantic Parsing – Discourse Analysis.

UNIT-V :Discourse Analysis and Lexical Resources: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brills Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC). NLP Applications: Named entity recognition and relation extraction- IE using sequence labeling-Machine Translation (MT) .

Text Books:

1. Daniel Jurafsky and James H. Martin Speech and Language Processing (2nd Edition), Prentice Hall; 2 edition,2008
2. Foundations of Statistical Natural Language Processing by Christopher D.Manning and HinrichSchuetze, MIT Press,1999
3. Steven Bird, Ewan Klein and Edward Loper Natural Language Processing with Python, O’Reilly Media; 1 edition,2009 Roland R. Hausser, Foundations of Computational Linguistics: Human-Computer Communication in Natural Language, Paperback, MIT Press,2011

Reference Books:

1. Pierre M. Nugues, An Introduction to Language Processing with Perl and Prolog: An Outline of Theories, Implementation, and Application with Special Consideration of English, French, and German (Cognitive Technologies) Softcover reprint,2010
2. James Allen, Natural Language Understanding, Addison Wesley; 2nd Edition 1994, NLTK – Natural Language ToolKit-<http://www.nltk.org/>

Semester	VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE12
Name of the Course	Software Testing Methodologies (Professional Elective-III)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Describe Software testing objectives and methodology. **(K2)**
CO2: Apply various Software testing techniques. **(K3)**
CO3: Discuss Static testing techniques for software testing. **(K2)**
CO4: Distinguish Software testing and debugging process. **(K2)**
CO5: Explain modern Software testing tools to Support software testing. **(K2)**

UNIT-I: Introduction to Software Testing: Evolution of software Testing, Myths and Facts, Goals of software Testing, Definitions of Testing, Model for Software Testing, Software Testing Terminology, Software Testing Life Cycle.

UNIT-II: Verification and Validation: Verification & Validation Activities, Verification, Verification of Requirements, Verification of High level and low level designs, How to verify code, Validation. **Dynamic Testing I:** Black Box testing techniques: Boundary Value Analysis, Equivalence Class Testing, Decision Table based Testing,

UNIT-III: Dynamic Testing II: White-Box Testing: Need of White-Box Testing, Logic coverage criteria, Basis path testing, Loop testing. **Static Testing:** Inspections, Structured Walkthroughs, Technical reviews.

UNIT-IV: Regression Testing: Progressive Vs Regressive Testing, Regression testability, Objectives of regression testing, When is Regression Testing done? Regression Testing Types, Regression testing techniques. **Debugging:** Debugging process, Techniques, correcting bugs.

UNIT-V: Software Quality Management: Software quality concept, Quality control and Quality Assurance, Software Quality metrics. **Automation and Testing Tools:** Need for automation, categorization of Testing tools, selection of testing tools, Overview of some commercial testing tools.

Text Books:

1. Software Testing, Principles and Practices, NareshChauhan, 9th Edition, Oxford Publisher.

Reference Books:

1. Software testing techniques - Boris Beizer, 2nd Edition, Dreamtech publisher.
2. Foundations of Software testing, Aditya P Mathur, 2nd ed, Pearson.
3. Software Testing- Yogesh Singh, CAMBRIDGE.

Semester	VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE13
Name of the Course	Distributed Systems(Professional Elective-IV)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Describe Distributed System Characterization, Time and Global States. **(K1)**

CO2: Discuss the Coordination and Agreement Algorithms. **(K2)**

CO3: Discuss the basic concepts of distributed systems and Characteristics of IPC protocols. **(K2)**

CO4: Explain the mechanisms such as Remote procedure call (RPC/RMI) and OSS. **(K2)**

CO5: Explain the mechanisms such as File Systems and Replications. **(K2)**

UNIT I: Characterization of Distributed Systems: Resource Sharing and the Web, Challenges. **System Models**-Architectural, Fundamental Models **Time and Global States:** Clocks Events and Process States, Synchronizing Physical Clocks, Logical Time and Logical Clocks, Global States-Snapshot algorithm, Distributed Debugging.

UNIT II: Coordination and Agreement: Distributed Mutual Exclusion-Central Server algorithm, Ring-Based algorithm, Maekawa's voting algorithm, Elections-Ring-Based algorithm, Bully algorithm, Multicast Communication, Consensus and Related Problems.

UNIT III: Inter process Communication: Introduction, The API for the Internet Protocols- The Characteristics of Inter process communication, Sockets, UDP Datagram Communication, TCP Stream Communication; External Data Representation and Marshalling; Client Server Communication; Group Communication, Case Study: MPI.

UNIT IV::Remote Invocation: Introduction, Request-reply protocols, Remote Procedure Call, Events and Notifications, **Case Study:** JAVA RMI.. **Operating System Support:** Introduction, The Operating System Layer, Protection, Processes and Threads –Address Space, Creation of a New Process, Threads.

UNIT V: Distributed File Systems: Introduction, File Service Architecture; Peer-to-Peer Systems: Introduction, Napster and its Legacy, Peer-to-Peer Middleware, Routing Overlays.

Case Study1: Sun Network File system. **Case Study 2:** The Andrew File System.

Transactions & Replications: Introduction, System Model and Group Communication, Concurrency Control in Distributed Transactions, Distributed Dead Locks, Transaction Recovery; Replication-Introduction, Passive (Primary) Replication, Active Replication.

Text Books:

1. "Distributed Systems- Concepts and Design", George Coulouris, Jean Dollimore, TimKindberg, Fourth Edition, Pearson Publication
2. "Distributed Computing, Principles, Algorithms and Systems", Ajay D Kshemkalyani, MukeshSignal, Cambridge.

Reference Books:

1. "Distributed Systems, Principles and Paradigms", Andrew S. Tanenbaum, Maarten Van Steen, 2d Edition, PHI.
2. "Distributed Systems, An Algorithm Approach," SukumarGhosh, Chapman &HalyCRC, Taylor &Fransis Group, 2007.

Semester	VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE14
Name of the Course	NOSQL Databases (Professional Elective-IV)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Discuss four types of NoSQL Databases (Document-oriented, Key/Value Pairs, Column oriented and Graph). **(K2)**

CO2: Illustrate Replication and sharding. **(K2)**

CO3: Explain NoSQL Key/Value databases using MongoDB. **(K2)**

CO4: Demonstrate Column- oriented NoSQL databases using Apache HBASE. **(K3)**

CO5: Explain Graph NoSQL databases using Neo4. **(K3)**

UNIT I: Introduction: Overview and History of NoSQL Databases Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points, Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases.

UNIT II: Replication and sharding, MapReduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.

UNIT III: NoSQL Key/Value databases using MongoDB, Document Databases, What Is a Document Database? Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, When Not to Use, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

UNIT IV: Column- oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, What Is a Column-Family Data Store? Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage, When Not to Use.

UNIT V: Graph NoSQL databases using Neo4, NoSQL database development tools and programming languages, Graph Databases, What Is a Graph Database? Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines, When Not to Use.

Textbooks:

1. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence ,1st Edition, 2012. Authors: Sadalage, P. & Fowler, Publication: Pearson Education.
2. The Definitive Guide to MongoDB: A complete guide to dealing with Big Data using MongoDB, 3rd Edition, December, 2015. Authors: Eelco Plegge, David Hows, Peter Membrey, Tim Hawkins, Apress Publishers

Reference Books:

1. Redmond, E. ,Wilson, Perkins: Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement Edition: 2nd Edition, 2018, O'Reilly Publishers.

Semester	VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE15
Name of the Course	Computer Vision using OpenCV (Professional Elective-IV)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Explain digital image acquisition. (K2)
CO2: Illustrate histogram generation and analysis for images. (K3)
CO3: Apply geometric transformations and detect edges in images. (K3)
CO4: Discover features and patterns in mages. (K3)
CO5: Discuss challenges in video processing. (K2)

UNIT I: Introduction: A Difficult Problem, The Vision System, Practical Application of Computer Vision, **Image Sources:** Cameras, Images, Color Images, Noise, Smoothing.

UNIT II: Histograms: 1D Histograms, 3D Histograms, Image Equalization, Histogram Comparison, Back Projection, k-means Clustering. **Binary Vision:** Thresholding, Detection Methods, Variations, Mathematical Morphology, Connectivity.

UNIT III: Geometric Transformations: Problem Specification & Algorithm, Affine Transformation, Perspective Transformations, Specification of More Complex Transformations, Interpolation, Modelling, and Removing Distortion. **Edges:** Detection- First & Second Derivatives, Multispectral; Contour Segmentation- Edge Representation, Border Detection, Extracting Line Segments; Hough Transform.

UNIT VI: Features: Corner Detection Techniques, SIFT, Other Detectors. **Recognition:** Template Matching, Chamfer Matching, Statistical Pattern Recognition, Cascade of Haar Classifiers, Performance.

UNIT V: Video: Moving Object Detection- Object of Interest, Common Problems, Difference Images, Background Models, Shadow Detection; Tracking-Exhaustive Search, Mean Shift, Dense & Feature Bases Optical Flow; Performance.

Text Books:

1. A Practical Introduction to Computer Vision With Opencv, Kenneth Dawson-Howe, 1st Edition, Wiley.

Reference Books:

1. Computer Vision: Algorithms and Applications, Richard Szeliski, Springer-Verlag London Limited.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education.

Semester	VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE16
Name of the Course	Design Patterns (Professional Elective-IV)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Describe the design patterns view and its applications. **(K2)**
CO2: Demonstrate Creational Patterns. **(K3)**
CO3: Construct Structural Patterns for a given Scenario. **(K3)**
CO4: Construct Behavioural Patterns for a given Scenario. **(K3)**
CO5: Examine various Case Studies in utilizing Software Architectures. **(K3)**

UNIT I: Introduction: What Is a Design Pattern?, Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns Solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern

UNIT II: Creational Patterns: Abstract factory, Builder, Factory method, Prototype, Singleton.

UNIT III: Structural Patterns: Adapter, Bridge, Composite, Decorator, Façade, Flyweight, and PROXY.

UNIT IV: Behavioural Patterns: Chain of responsibility, command, Interpreter, iterator, mediator, memento, observer, state, strategy, template method, visitor.

UNIT V: Case Studies A-7E – A case study in utilizing architectural structures, The World Wide Web - a case study in Interoperability, Air Traffic Control – a case study in designing for high availability, Celsius Tech – a case study in product line development.

Text Books:

1. Software Architecture in Practice, second edition, Len Bass, Paul Clements & Rick Kazman, Pearson Education, 2003.
2. Design Patterns, Erich Gamma, Pearson Education, 1995.

Reference Books:

1. Beyond Software architecture, Luke Hohmann, Addison wesley, 2003.
2. Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR, 2001
3. Software Design, David Budgen, second edition, Pearson education, 2003
4. Head First Design patterns, Eric Freeman & Elisabeth Freeman, O'REILLY, 2007.
5. Design Patterns in Java, Steven John Metsker & William C. Wake, Pearson education, 2006.

Semester	VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE17
Name of the Course	Blockchain Technologies (Professional Elective-V)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Discuss the Cryptographic primitives used in Blockchain. (K2)
CO2: Discuss about various technologies borrowed in Blockchain. (K2)
CO3: Illustrate various models for Blockchain. (K2)
CO4: Discuss about Ethereum. (K2)
CO5: Discuss about Hyperledger Fabric. (K2)

UNIT-I: Introduction: History of Bitcoin and origins of Blockchain, Fundamentals of Blockchain and key components, Permission and Permission-less platforms, Cryptography, SHA256 and ECDSA, Hashing and Encryption, Symmetric/ Asymmetric keys, Private and Public Keys.

UNIT-II: Technologies Borrowed in Blockchain: Technologies Borrowed in Blockchain–hash pointers-- Digital cash etc.-Bitcoin Blockchain-Wallet–Blocks Merkle Tree - hardness of mining - Transaction verifiability - Anonymity -forks - Double spending - Mathematical analysis of properties of Bitcoin - Bitcoin-the challenges and solutions.

UNIT-III: Consensus Mechanisms: Consensus Algorithms: Proof of Work(PoW) as random oracle-Formal treatment of consistency-Liveness and Fairness-Proof of Stake(PoS)based Chains -Hybrid models (PoW + PoS), Byzantine Models of fault tolerance.

UNIT-IV: Ethereum: Ethereum- Ethereum Virtual Machine(EVM)-Wallets for Ethereum-Solidity-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-Some attacks on smart contracts.

UNIT-V: Hyperledger Fabric: Hyperledger fabric- the plug and play platform and mechanisms in permissioned block chain - Beyond Cryptocurrency – applications of blockchain in cyber security- integrity of information-E-Governance and other contract enforcement mechanisms-Limitations of blockchain as a technology and myths vs reality of Blockchain technology.

Textbooks:

1. S.Shukla,M.Dhawan,S.Sharma,S.Venkatesan“BlockchainTechnology:CryptocurrencyandApplications”,OxfordUniversityPress2019.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller andStevenGoldfeder,”Bitcoinandcryptocurrencytechnologies:acomprehensiveintroduction”,PrincetonUniversityPress,2016.

Reference Books:

1. Joseph Bonneau et al, SoK: “Research perspectives and challenges forBitcoinandcryptocurrency”,IEEESymposiumonsecurityandPrivacy,2015
2. J.A.Garayetal,“Thebitcoinbackboneprotocolanalysisandapplications”,EUROCRYPT2015,Volume2.
3. R.Passetal,“AnalysisofBlockchainprotocolinAsynchronousnetworks”,EUROCRYPT2017.
4. Passetal,”Fruitchain-afairblockchain”,PODC2017.

Semester	VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE18
Name of the Course	Scripting Languages (Professional Elective-V)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Develop dynamic webpages and validate with java Script. **(K3)**
CO2: Discuss fundamentals of PHP. **(K2)**
CO3: Develop web applications using PHP. **(K3)**
CO4: Demonstrate Perl Programming concepts. **(K3)**
CO5: Illustrate AngularJS frame work. **(K2)**

UNIT – I: JavaScript: Overview of JavaScript, General Syntactic Characteristics, Primitives Operations and Expressions, Screen output and Keyboard Input, Control Statements, Object creation and Modification, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions, Events and Event Handling.
DHTML: Positioning Moving and Changing Elements.

UNIT – II: PHP Basics- Features, Embedding PHP Code in your Web pages, Outputting the data to the browser, Data types, Variables, Constants, expressions, string interpolation, control structures, Function, Creating a Function, Function Libraries, Arrays, strings and Regular Expressions.

UNIT - III: Advanced PHP Programming: PHP and Web Forms, Files, PHP Authentication and Methodologies - Database Based, Login Administration, Uploading Files with PHP, Sending Email using PHP.

UNIT – IV: Introduction to PERL and Scripting: Scripts and Programs, Origin of Scripting , Scripting Today, Characteristics of Scripting Languages, Uses for Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.

UNIT- V: AngularJS - Overview, environment Setup, MVC Architecture, Creating AngularJS Application, Directives, Expressions, Controllers, Filters, Tables, HTML DOM, Modules, Forms.

Text Books:

1. The World of Scripting Languages, David Barron, Wiley Publications.
2. A Journey to Angular Development, by Sukesh Marla, bpb publisher

Reference Books:

1. Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP, J.Lee and B.Ware (Addison Wesley) Pearson Education.
2. Perl by Example, E.Quigley, Pearson Education.
3. Programming Perl, Larry Wall T.Christiansen and J.Orwant, O'Reilly, SPD.
4. Tcl and the Tk Toolkit, Ousterhout, Pearson Education.
5. Pearl Power, J.P. Flynt, Cengage Learning.
6. Learn Angular in 24 Hours A Step-by-Step Approach, Lakshmi Kamala Thota.

Semester	VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE19
Name of the Course	Business Analytics (Professional Elective-V)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Describe the application of Data Analytics in Business Intelligence. **(K2)**
CO2: Explain the Business Decision-Making Process. **(K2)**
CO3: Illustrates the strategic value of implementing an enterprise data warehouse. **(K3)**
CO4: Apply Descriptive Analytics for Business Reporting. **(K3)**
CO5: Illustrate Predictive Analytics for Business Problem Solving. **(K3)**

UNIT I: Introduction: Computerized Decision Support in a Business Environment, Managerial Decision Making, Information Systems Support, An Early Framework, The Concept of Decision Support System (DSS), A Framework For Business Intelligence (BI), and Business Analytics Overview.

UNIT II: Foundations and Technologies for Decision Making: Introduction & Definitions, Decision-Making Process- The Intelligence Phase, The Design Phase, The Choice Phase, The Implementation Phase; How Decisions are Supported? DSS Capabilities, Classifications, Components.

UNIT III: Data Warehousing: Definitions & Concepts, Process, Architecture, Data Integration and the Extraction, Transformation, and Load (ETL) Processes, Development of Data Warehouse, Implementation Issues, Real-Time Data Warehousing, Administration, Security Issues and Future Trends.

UNIT VI: Descriptive Analytics: Business Reporting Definitions and Concepts, Data and Information Visualization, Different Types of Charts and Graphs, The Emergence of Data Visualization and Visual Analytics, Performance Dashboards, Business Performance Management, Performance Measurement, Balanced Scorecards, Six Sigma.

UNIT V: Predictive Analytics: Basic Concepts of Neural Networks, Developing Neural Network-Based Systems, Illuminating the Black Box of ANN with Sensitivity Analysis, Support Vector Machines, A Process-Based Approach to the Use of SVM, Nearest Neighbor Method for Prediction.

Text Books:

1. Business Intelligence and Analytics: Systems for Decision Support, Ramesh Sharda, DursunDelen, Efraim Turban, 10th Ed., Pearson.

Reference Books:

1. Business Intelligence and Data Mining, Dr.Anil Maheshwari, 2nd Ed., Business Expert Press. (Data Analytics: Made Accessible, Kindle).
2. Business Intelligence, Rajiv Sabherwal, Irma Becerra-Fernandez, Wiley.

Semester	VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITPE20
Name of the Course	Software Project Management (Professional Elective-V)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Describe Software Project Management Terminology. (K2)

CO2: Explain various Software development process Models and software Life cycle phases. (K2)

CO3: Illustrate various Effort Estimation Techniques and activity network models for Software Project Planning. (K3)

CO4: Demonstrate Risk Management Concepts and resource allocation. (K3)

CO5: Explain the importance of Project monitoring and control for accomplishing project goals and software Quality. (K2)

UNIT-I: Introduction to Software Project Management: Software Project versus other types of projects, Activities covered by Software Project Management, Categorizing projects ,Stakeholders, Objectives& goals, what is management. **Project Planning:** Step-wise planning, Identify Project Scope and objectives, Infrastructure, Project Products & deliverables, Project activities, Effort estimation.

UNIT-II: Project Approach: Build or buy, process models: waterfall model, Prototyping, Incremental delivery model, **Agile methods:** Extreme Programming, Atern method, selecting an appropriate process model. **Lifecycle phases:** Engineering and Production stages, Inception, Elaboration, Construction, Transition phases.

UNIT-III: Software effort estimation and Activity planning: Overview of Effort Estimation techniques, Function Point analysis, COCOMO. **Activity planning:** Objectives, Network planning models, forward pass and backward pass, Identify Critical path and activities.

UNIT-IV: Risk Management and Resource Allocation: Introduction, Risk and its categories, Identification, Assessment, Risk Planning and management, applying PERT technique.

Resource Allocation: Types of Resources, Identifying resource requirements, Resource scheduling.

UNIT-V: Project Monitoring and Control: Creating framework for monitoring& control, Collecting Data, Visualizing Progress, Cost monitoring, Earned value Analysis.

Software Quality: Defining Quality, Importance of quality, ISO 9126, Product QualityVs Process Quality management.

Process Capability Models: Capability Maturity Model, Enhancing software Quality.

Text Books:

1. Software Project Management, Bob Hughes & Mike Cotterell, 6 th edition, TATA Mcgraw-Hill
2. Software Project Management, WalkerRoyce 2nd edition, Pearson Education.

Reference Books:

1. Software Project Management in practice, PankajJalote, 9th edition, Pearson Education.
2. Software Project Management, Joel Henry, 3rd edition, Pearson Education.

Semester	V - VII	L	T	P	C	COURSE CODE
Regulation	V20	0	0	6	3	V20AITJE01
Name of the Course	Master Coding and Competitive Programming - Part-1 (Job Oriented Elective)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Apply Mathematical reasoning and number theory to solve real world problems in linear time. **(K3)**
CO2: Use of modular arithmetic, to solve complex problems in linear time , logarithmic. **(K3)**
CO3: Use of Prime Factorization and complex solve problems. **(K3)**
CO4: Analyse different techniques including sieve to find prime numbers and evaluate efficiency of these methods. **(K4)**
CO5: Experiment with Hashing and searching techniques to solve problems on Arrays in Linear time. **(K3)**

List of Experiments

1. Develop Programs to solve problems based on Mathematical logic, Reasoning and number theory
2. Develop programs using different techniques to find prime number
3. Develop programs using Sieve method and optimize Complexity of finding prime number
4. Develop Programs based on series, patterns
5. Develop programs on concept of Fibonacci series
6. Develop programs on strings including palindrome and anagram concepts
7. Develop programs to search pattern in a string
8. Develop programs for String Processing.

Text Books:

1. Java The Complete Reference - Eleventh Edition, Herbert Schildt, Oracle
2. Guide to Competitive Programming by Antti Laaksonen
3. Programming challenges by Steven S Skiena

Tools:

1. practice.geeksforgeeks.com
2. leetcode.com
3. codingninjas.com
4. Hackerrank.com
5. Interviewbit.com

Semester	V - VII	L	T	P	C	COURSE CODE
Regulation	V20	0	0	6	3	V20AITJE02
Name of the Course	Master Coding and Competitive Programming - Part-2 (Job Oriented Elective)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Apply Divide and Conquer algorithm technique to solve complex in logarithmic time. **(K3)**
- CO2:** Apply Greedy method to solve Optimization and decision making problems. **(K3)**
- CO3:** Apply Backtracking Algorithm technique to find combinatorial problems. **(K4)**
- CO4:** Experiment with Dynamic Programming Algorithm technique to solve Problems that uses Optimal substructures. **(K3)**
- CO5:** Develop programs using Linked List Graphs, DFS and BFS techniques. **(K3)**

List of Experiments

1. Develop Programs to solve problems based on Divide and Conquer Algorithm Technique.
2. Develop programs using two pointer and sliding window algorithms.
3. Problem Solving using Greedy Algorithm technique.
4. Problem Solving using Backtracking.
5. Develop programs using Dynamic Programming and Kadane Algorithm.
6. Develop programs using Linked List and its applications.
7. Develop programs using Graphs and Graph Searching Techniques.

Text Books:

1. Introduction to Algorithms, Second Edition, Thomas H. Cormen Charles E. Leiserson.
2. Data Structures and Algorithms Made Easy: Narasimha Karumanchi .
3. The Algorithm Design Manual, Springer series, Steven Skiena.

Tools:

1. practice.geeksforgeeks.com
2. leetcode.com
3. codingninjas.com
4. Hackerrank.com
5. Interviewbit.com

Semester	V - VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20AITJE03
Name of the Course	DevOps (Job Oriented Elective)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Discuss the traditional software development. **(K2)**
- CO2:** Discuss the concepts of rise of agile methodologies. **(K2)**
- CO3:** Discuss the concept of DevOps and Agile. **(K2)**
- CO4:** Demonstrate the purpose of DevOps. **(K3)**
- CO5:** Illustrate the Operations of CAMS. **(K2)**

UNIT-I: Traditional Software Development: The Advent of Software Engineering - Waterfall method - Developers vs IT Operations conflict.

UNIT-II: Rise of Agile Methodologies: Agile movement in 2000 - Agile Vs Waterfall Method - Iterative Agile Software Development - Individual and team interactions over processes and tools – Working software over - comprehensive documentation - Customer collaboration over contract negotiation - Responding to change over following a plan.

UNIT-III: Definition of DevOps: Introduction to DevOps - DevOps and Agile.

UNIT-IV: Purpose of DevOps: Minimum Viable Product - Application Deployment - Continuous Integration - Continuous Delivery.

UNIT-V: CAMS (Culture, Automation, Measurement And Sharing): CAMS – Culture - CAMS – Automation - CAMS – Measurement - CAMS – Sharing - Test-Driven Development - Configuration Management - Infrastructure Automation - Root Cause Analysis – Blamelessness - Organizational Learning.
Kubernetes- Integration with Docker, Containerized application Development.

Text Books:

1. The DevOps Handbook - Book by Gene Kim, Jez Humble, Patrick Debois, and Willis Willis.
2. Joakim Verona. Practical Devops, Second Edition. Ingram short title; 2nd edition (2018).
3. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications.

Reference Books:

1. What is DevOps? - by Mike Loukides.
2. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley.

Semester	V - VII	L	T	P	C	COURSE CODE
Regulation	V20	0	0	6	3	V20AITJE04
Name of the Course	Java Full Stack Technologies (Job Oriented Elective)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- | | |
|--|-------------|
| CO1: Demonstrate IDE tools Installation. | (K3) |
| CO2: Develop programs using servlets. | (K3) |
| CO3: Illustrate MVC architecture. | (K3) |
| CO4: Illustrate Spring MVC Framework. | (K3) |
| CO5: Demonstrate applications of Hibernate. | (K3) |

Exercise 1: Basic Installation of IDEs and Development Tools (use any one of the following IDEs).

The Student should know about installing IDEs (Integrated Development Environment) in the system such as IntelliJ, Eclipse, NetBeans, Macromedia Dream Viewer and Databases such as My-SQL, Oracle, SQL Server etc.

Additional Tasks:

- How we can import project files into IDEs.
- How we can import eclipse (Java IDE) projects.
- How to Create new project in IDEs.
- How to Save the Project using packages.
- How to Compile the Project or Program in IDE.
- How to Build the Project or Program in IDE.
- How to Debug the Errors in IDE.

Exercise 2: Understanding about Servlets: Create Example programs Using the below concepts

- Introduction to Servlets.
- Write Servlet application to print current date & time.
- Write Servlet program to link Html & Servlet Communication.
- Write Servlet program to Auto refresh a page.
- Demonstrate session tracking using small program.
- Write Servlet program to insert/delete/update the record into database.
- Write Servlet program to add cookie to selected value.

Exercise 3: Understanding about Model View Controller : Create Example programs Using the below concepts

- Introduction to MVC in java.
- Create sample program on Model Layer in MVC Using Java.
- Create sample program on View Layer in MVC Using Java
- Create sample program on Controller Layer in MVC Using Java
- Demonstrate MVC Deployment in java.
- Rules for MVC Mapping in Server Side.
- How to use Web Server for MVC Deployment.

Exercise 4: Understanding about Spring MVC Framework: Create Example programs Using the Below concepts

- Introduction to Spring MVC.
- Demonstrate the usage of Dispatcher Servlet in Spring MVC.
- Load the spring jar files or add dependencies in the case of Maven
- Create the controller class.
- Provide the entry of controller in the web.xml file.
- Define the bean in the separate XML file.
- Display the message in the JSP page.
- Start the server and deploy the project.

- Execute the application on webserver using Spring MVC.

Exercise 5: Understanding about Hibernate : Create Example programs Using the below concepts

- Introduction to Hibernate.
- What is ORM
- Demonstrate the components of Hibernate
- How to persist objects using Hibernate
- How to use map using XML and Annotations
- How to implement Inheritance in Hibernate
- Working with relationship between entities - association
- Transactions in Hibernate
- Querying with HQL (Hibernate Query Language)
- Various other forms of querying - Criteria, QBE etc.

Exercise 6: Understanding Some Debugging Tools in Java :The Student should know about how to debug the java codes using some debugging tools such as:

- NetBeans.
- Eclipse.
- IntelliJ IDEA.
- Visual Studio Code.

Reference Books:

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
2. Murach's Java Servlets and JSP, 3rd Edition by (Murach: Training & Reference) 3rd Edition.
3. Spring and Hibernate Paperback – 1 July 2017 by K. Santosh Kumar.
4. Full Stack Java Development with Spring MVC, Hibernate, jQuery, and Bootstrap by Mayur Ramgir, Wiley.

Semester	V - VII	L	T	P	C	COURSE CODE
Regulation	V20	0	0	6	3	V20AITJE05
Name of the Course	Web Application Development Using Django(Job Oriented Elective)					
Branch	Common to CAI & AIM					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Demonstrate Django Installation **(K3)**
- CO2:** Develop programs with Django Basics using database tables. **(K3)**
- CO3:** Develop Django Form Validations. **(K2)**
- CO4:** Construct a Blogging Platform. **(K3)**
- CO5:** Illustrate the concept of File Uploading and Managing Static Files. **(K3)**

Exercise 1: Setting up Django Development Environment

- How to Install Django.
- How to set up a Virtual Environment
- Create a new Django project
- Run the Development Server
- Verify the Installation

Exercise 2: Creating a Simple Django Application

- Create a new Django app within the project
- Define Models for the app
- Define Database Tables for the app
- Create Views
- Define user roles and permissions in Django
- Restrict Access to certain views or features based on user roles.
- Create Templates
- Display data from the database using Views/Templates

Exercise 3: Understanding about Django Forms and User Authentication: Create Example programs Using the below concepts

- Create a new registration form using built-in-authentication system.
- Create a new login form using built-in-authentication system.
- Validate User Input and handle form submissions
- Implement Login Functionality
- Password Management in Django
- Implement Logout Functionality
- Implement Session Management.

Exercise 4: Building a Blogging Platform: Create Example programs Using the below concepts

- Create models for Blog posts.
- Create Models for Comments
- Create Models for Categories
- Implement CRUD (Create, Read, Update, Delete) operations for Blog Posts.
- Add Functionality to allow users to comment on Blog Posts.

Exercise 5: Working with Media and File Uploads: Create Example programs Using the below concepts

- Implement File Handling.
- How to access File Storage API

- Upload files and handlers
- Create Custom File Handler
- Implement Media Files Management
- Implement Static File Management

Exercise 6: Deploying and Testing a Django Application: Create Example programs Using the below concepts

- Develop a Django Application for Deployment.
- Configuring Production Environment(e.g., Apache, Nginx, Gunicorn)
- Set up a database and configure the Django application
- Deploy Django applications on Popular Hosting Platforms (e.g., AWS, DigitalOcean and Heroku).
- Use Django's testing framework to run tests.
- Debug issues and errors using Django's built-in-debugging tools.
- Implement Media Files Management
- Implement Static File Management

Reference Books:

1. William Vincent, "Django for Beginners, Build Websites with Python & Django", Copyright 2018 William S. Vincent.
2. Daniel Roy Greenfeld and Audrey Roy Greenfeld, "Two Scoops of Django 3.x: Best Practices for the Django Web Framework".
3. Harry J.W. Percival, "Test-Driven Development with Python: Obey the Testing Goat: Using Django, Selenium and JavaScript", Paperback -2014.
4. "Python Django for Web Development", by Emenwa Global.

Semester	V - VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20CEOE01
Name of the Course	Repair and Rehabilitation of Structures (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Develop various maintenance and repair strategies. (K2)
CO2: Evaluate the existing buildings through field investigations. (K2)
CO3: Understand and use the different techniques for structural rehabilitation and various techniques of repair. (K2)
CO4: Understand the importance of advanced concretes mixes. (K2)
CO5: Understand the importance of high performance concretes. (K2)

UNIT I: Deterioration of Structures and diagnosis: Distress in Structures – Causes and Prevention. Mechanism of Damage – Types of Damage, Non Destructive Testing, Corrosion of Steel Reinforcement – Causes – Mechanism and Prevention. Damage of Structures due to Fire – Fire Rating of Structures – Inspection and Testing – Symptoms and Diagnosis of Distress – Damage assessment –

UNIT II: Materials for repair and rehabilitation: Admixtures- types of admixtures - purposes of using admixtures- chemical composition- Natural admixtures - Fibres- wraps- Glass and Carbon fibre wraps- Steel Plates

UNIT III: Strengthening and stabilization: Techniques- design considerations-Beam shear capacity strengthening - Shear Transfer strengthening-stress reduction techniques- Column strengthening-flexural strengthening - Connection stabilization and strengthening, Crack stabilization

UNIT IV: Special Concretes: Fibre reinforced concrete: Properties of constituent materials- Mechanical properties of fibre reinforced concrete- applications of fibre reinforced concretes-Light weight concrete-properties of light weight concrete- No fines concrete- design of light weight concrete- Flyash concrete - classification of flyash- Properties of flyash concrete

UNIT V: High performance concretes: Introduction- Development of high performance concretes- Materials of high performance concretes- Properties of high performance concretes- Self Consolidating concrete-properties- qualifications.

Text Books:

1. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, Standard Publications.
2. Concrete Technology by A.R. Santa Kumar, Oxford University press
3. Concrete technology by Neville and J J Brooks, Pearson publications, 2nd edition

References:

1. Concrete technology by M S Shetty, S. Chand publications (2006).
2. Defects and Deterioration in Buildings, EF & N Spon, London
3. Non-Destructive Evaluation of Concrete Structures by Bungey – Surrey University Press
4. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W.H.Ranso, (1981)
5. Building Failures: Diagnosis and Avoidance, EF & N Spon, London, B.A. Richardson, (1991).

Semester	V - VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20CEOE02
Name of the Course	Ground Improvement Techniques (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Employ the in-situ densification methods at ground surface and at depth. (K3)
- CO2:** Relate the importance of dewatering and different methods of stabilization. (K3)
- CO3:** Illustrate the reinforced earth technology and soil nailing to obviate the problems posed by conventional retaining walls. (K3)
- CO4:** Use the geosynthetics to improve the engineering performance of soils. (K3)
- CO5:** Select different techniques of grouting to solve the ground problems. (K3)

UNIT I: In situ densification methods: In situ densification of granular soils- vibration at ground surface and at depth, impact at ground and at depth – in situ densification of cohesive soils – pre loading – vertical drains – sand drains and geo drains – stone columns.

UNIT II: Dewatering: Sumps and interceptor ditches – single and multi stage well points – vacuum well points – horizontal wells– electro osmosis

Stabilization of soils: Methods of soil stabilization – mechanical – cement – lime – bitumen and polymer stabilization – use of industrial wastes like fly ash and granulated blast furnace slag.

UNIT III: Reinforced earth: Principles – components of reinforced earth –stability checks – soil nailing

UNIT IV: Geosynthetics: Geotextiles – types – functions, properties and applications – geogrids , geomembranes and gabions – properties and applications.

UNIT V: Grouting: Objectives of grouting – grouts and their applications – methods of grouting – stage of grouting.

Text Books:

1. Ground Improvement Techniques, Purushotham Raj, Laxmi Publications, New Delhi.
2. Ground Improvement Techniques, Nihar Ranjan Patro, Vikas Publishing House (p) limited , New Delhi.
3. An introduction to Soil Reinforcement and Geosynthetics, G. L. Siva Kumar Babu, Universities Press.

References:

1. Ground Improvement, M.P.Moseley, Blackie Academic and Professional, USA
2. Designing with Geosynthetics, R. M Koerner, Prentice Hall
3. Engineering Principles of Ground Modification by Manfred R. Hausmann, McGraw-Hill Inc.,

Semester	V - VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20CEOEO3
Name of the Course	Environmental Pollution and Control (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Describe the air pollution and its control methods. (K2)
CO2: Explain industrial waste water and ways to control it. (K3)
CO3: Generalize the solid, hazardous waste and control methods. (K2)
CO4: Illustrate the importance of Environmental sanitation methods. (K2)
CO5: Illustrate the importance of Sustainable development. (K3)

UNIT I: Air Pollution: Air pollution Control Methods–Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards. Noise Pollution: Noise standards, Measurement and control methods.

UNIT II: Industrial wastewater Management: Strategies for pollution control – Volume and Strength reduction–Recirculation of industrial waste water – Effluent standards.

UNIT III: Solid Waste Management: Solid waste characteristics –on-site handling and collection – separation and processing -Solid waste disposal method

Hazardous Waste: Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste–Disposal methods.

UNIT IV: Environmental Sanitation: Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low cost waste disposal methods.

UNIT V: Sustainable Development: Definition- elements of sustainable developments-Indicators of sustainable development- Sustainability Strategies- sustainable development.

Text Books:

1. Environmental Engineering, by Ruth F. Weiner and Robin Matthews – 4th Edition Elsevier, 2003.
2. Environmental Science and Engineering by J.G. Henry and G.W. Heinke – Pearson Education.
3. Environmental Engineering by Mackenzie L Davis & David A Cornwell. McGraw Hill Publishing.

References:

1. Solid Waste Engineering, Vesilind, P.A., Worrell, W., Reinhart, D., Cengage learning, New Delhi, 2004
2. Hazardous Waste Management, Charles A. Wentz, McGraw Hill Publication, 1995.

Semester	V - VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20CEOEO4
Name of the Course	Building Materials and Construction (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Describe different building materials and their importance in building construction. (K2)
CO2: Relate various components of cement and lime. (K3)
CO3: Generalize the brick and stone masonry in construction. (K2)
CO4: Interpret different aggregates and their specifications. (K2)
CO5: Describe the importance of different building components. (K2)

UNIT I: Stones, Bricks and Tiles: Building stones – classifications and quarrying – properties – structural requirements and dressing. Bricks – Composition of Brick earth – manufacture and structural requirements, Fly ash, Ceramics, Timber, Aluminum, Glass, Paints and Plastics: Wood - structure – types and properties– seasoning – defects; alternate materials for Timber–GI/ fibre – reinforced glass bricks, steel & aluminum, Plastics.

UNIT II: Cement & Admixtures: Ingredients of cement – manufacture – Chemical composition – Hydration - field & lab tests, Admixtures – mineral & chemical admixtures – uses, Various ingredients of lime – Constituents of lime stone – classification of lime – various methods of manufacture of lime

UNIT III: Mortars: Lime and Cement Mortars. **Masonry:** Brick masonry – types – bonds; Stone masonry – types; Composite masonry – Brick- stone composite; Concrete, Reinforced brick. Cavity and partition walls, Finishing's, Plastering, Pointing, Painting, Claddings – Types – Tiles – ACP.

UNIT IV: Aggregates: Classification of aggregate – Coarse and fine aggregates- particle shape and texture – Bond and Strength of aggregate – Specific gravity – Bulk Density, porosity and absorption – Moisture content of Aggregate- Bulking of sand – Sieve analysis.

Miscellaneous materials: Bitumen and asphaltic materials, structural steel and other metals, geo textiles, carbon composites including properties and uses.

UNIT V: Building Components: Lintels, Arches, walls, vaults – stair cases – types of floors, types of roofs – flat, curved, trussed. Foundations – types; Damp Proof Course; Joinery – doors – windows – materials – types. **Form work:** Types: Requirements – Standards – Scaffolding.

Text Books:

1. Building Materials and Construction – Arora & Bindra, Dhanpat Roy Publications. 2010,5th edition.
2. Building Materials, M. L. Gambhir, Tata McGraw Hill Publishing Co. Ltd. New Delhi. 2014,5th edition,.
3. Building Construction by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain – Laxmi Publications (P) Ltd., New Delhi. 2016,11th edition.
4. Building Materials, S. S. Bhavikatti, Vikas publications House private ltd. 2012, 1st edition.
5. Building Construction, S. S. Bhavikatti, Vikas publications House private ltd. 2012, 1st edition.
6. Building planning and drawing, Dr.N.Kumara swamy, A.kameswara Rao, 2012, 6th edition.

References:

1. Building Materials and Construction by G C Sahu, Joygopal Jena McGraw hill Pvt Ltd 2017,1st edition.
2. Building Materials by Duggal, New Age International. 2012 ,4th edition.
3. Building Materials by P. C. Varghese, PHI. 2015, 2nd edition.
4. Building Construction by PC Varghese PHI. 2007, 1st edition.
5. Construction Technology – Vol – I & II by R. Chubby, Longman UK.1987, 2nd edition.
6. Alternate Building Materials and Technology, Jagadish, Venkatarama Reddy and others; New Age Publications.2017,2ndedition.

Semester	V - VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20CEOEO5
Name of the Course	Remote Sensing and GIS (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Generalize the basic principles of Remote Sensing and GIS, including ground, air and satellite based sensor platforms. **(K2)**
- CO2:** Interpret the aerial photographs and satellite imageries. **(K2)**
- CO3:** Relate the process of data entry and preparation. **(K3)**
- CO4:** Examine the Spatial Data for a variety of applications. **(K3)**
- CO5:** Employ RS and GIS for diverse applications. **(K3)**

UNIT I: Introduction to Remote Sensing: Basic concepts of remote sensing, electromagnetic radiation, electromagnetic spectrum, interaction with atmosphere, energy interaction with the earth surfaces, Characteristics of remote sensing systems. **Sensors and platforms:** Introduction, types of sensors, airborne remote sensing, space borne remote sensing, image data characteristics, digital image data formats-band interleaved by pixel, band interleaved by line, band sequential, IRS, LANDSAT, SPOT, MODIS, ASTER, RISAT and CARTOSAT.

UNIT II: Image analysis: Introduction, elements of visual interpretations, digital image processing- image preprocessing, image enhancement, image classification, supervised classification, unsupervised classification.

UNIT III: Geographic Information System: Introduction, key components, application areas of GIS, map projections. **Data entry and preparation:** spatial data input, raster data models, vector data models.

UNIT IV: Spatial data analysis: Introduction, overlay function-vector overlay operations, raster overlay operations, arithmetic operators, comparison and logical operators, conditional expressions, overlay using a decision table, network analysis-optimal path finding, network allocation, network tracing and buffer analysis.

UNIT V: RS and GIS Applications: Land cover and land use, agriculture, forestry, geology, geomorphology, urban applications. **Applications of Hydrology, Water Resources and Disaster Management:** Food zoning and mapping, groundwater prospects and potential recharge zones, watershed management and disaster management with case studies.

Text Books:

1. "Remote sensing and GIS", Bhatta, B., Oxford University Press, 2008.
2. "Remote Sensing and Geographical Information Systems", Anji Reddy, M., B S Publications, 2008.
3. "Basics of Remote Sensing and GIS" Kumar. S., Laxmi Publications

References:

1. "Fundamentals of Remote Sensing", George Joseph, Universities Press, 2013.
2. "Concepts and Techniques of Geographical Information System", Chor Pang Lo and Yeung, A.K.W., Prentice Hall, India, 2006.
3. "Remote Sensing and its Applications", Narayan L.R.A, Universities Press, 2012.
4. "Introduction to Geographic Information Systems", Kand Tsung Chang, McGraw Hill Higher Education, 2009.
5. "Basics of Remote sensing & GIS", Kumar, S., Laxmi Publications, New Delhi, 2005.
6. "Principals of Geographical Information Systems", Burrough, P.A and McDonnell, R.A. Oxford University Press, 1998.
7. "Remote Sensing", Schowenger, R. A., Elsevier publishers, 2006.
8. "Remote Sensing and Image Interpretation", Lillesand, T.M, Kiefer, R.W. and Chipman, J.W., Wiley India Pvt. Ltd., New Delhi, 2013.
9. "Fundamentals of Geographic Information Systems", Demers, M.N, Wiley India Pvt.Ltd, 2013

Semester	V-VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20CEOE06
Name of the Course	Solid Waste Management (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Generalize Solid Waste and its management. **(K2)**
CO2: Assess different elements for managing Solid Waste. **(K3)**
CO3: Employ different methods for transportation and transformation of solid waste. **(K3)**
CO4: Organize different methods for processing and treatment of municipal solid waste. **(K3)**
CO5: Practice suitable disposal methods with respect to solid waste. **(K3)**

UNIT I: Introduction to Solid Waste Management: Goals and objectives of solid waste management, Classification of Solid Waste – Factors Influencing generation of solid waste – sampling and characterization –Future changes in waste composition, major legislation, monitoring responsibilities.

UNIT II: Basic Elements In Solid Waste Management: Elements and their inter relationship – principles of solid waste management- onsite handling, storage and processing of solid waste Collection of Solid Waste: Types and methods of waste collection systems, analysis of collection system – optimization of collection routes.

UNIT III: Transportation and Transformation of Solid Waste: Need for transfer operation, compaction of solid waste – transport means and methods, transfer station types and design requirements. Unit operations used for separation and transformation: shredding – materials separation and recovery, source reduction and waste minimization.

UNIT IV: Processing and Treatment: Processing of solid waste – Waste transformation through combustion and composting, anaerobic methods for materials recovery and treatment – Energy recovery – biogas generation and cleaning– Incinerators.

UNIT V: Disposal of Solid Waste: Methods of Disposal, Landfills: Site selection, design and operation, drainage and leachate collection systems –designated waste landfill remediation.

Text Books:

1. “Integrated Solid Waste Management”, George Tchobanoglous, McGraw Hill Publication, 1993
2. “Environmental Engineering”, Gerard Kiely, McGraw Hill Publication, 2007
3. “Environmental Science and Engineering”, J Glynn Henry,. Gary W.Heinke, Prentice-Hall of India Pvt Ltd, 1996

References:

1. “Solid Waste Engineering”, Vesilind, P.A., Worrell, W., Reinhart, D., Cenage learning, New Delhi, 2004
2. “Hazardous Waste Management”, Charles A. Wentz., McGraw Hill Publication, 1995.
3. “Introduction to Environmental Engineering” Mackenzie L Davis, David A.Cornwell, McGraw Hill Publication, 2017

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20CEOE07
Name of the Course	Disaster Management (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Describe different natural hazards and disaster management. (K2)
CO2: Generalize the risk and vulnerability of disaster. (K2)
CO3: Illustrate the role of technology in disaster management. (K3)
CO4: Relate the importance of education and community preparedness to disaster recovery. (K3)
CO5: Organize the multi-sectional issues created by disaster. (K2)

UNIT I: Natural Hazards and Disaster Management: Introduction of DM Disaster Management cycle – Five priorities for action- Case study methods of the following: floods, droughts – Earthquakes – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast – landslides. Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrorism - rail and air craft’s accidents-Management of these disasters

UNIT II: Risk and Vulnerability: – Building codes and land use planning – social vulnerability – environmental vulnerability -Financial management of disaster.

UNIT III: Role of Technology in Disaster Managements: Disaster management for infra structures, taxonomy of infra structure - mitigation programme for earth quakes –geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training- transformable indigenous knowledge in disaster reduction.

UNIT IV: Education and Community Preparedness: 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.

UNIT V: Multi-sectional Issues: Impact of disaster on poverty and deprivation- Climate change adaptation and human health -Exposure , health hazards and environmental risk-Forest management and disaster risk reduction - The Red cross and red crescent movement.

Text Books:

1. Disaster Management – Global Challenges and Local Solutions’ by Rajib shah & R R Krishnamurthy(2009), Universities press.
2. Disaster Science & Management’ by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
3. Disaster Management – Future Challenges and Opportunities’ by Jagbir Singh (2007), I K International Publishing House Pvt. Ltd.

Reference Books:

1. ‘Disaster Management’ edited by H K Gupta (2003), Universities press.
2. Natural Hazards and Disaster Management, Vulnerability and Mitigation by RB Singh
3. Disaster Management by Harish K.Gupta

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20CEOE08
Name of the Course	Water Quality and Conservation Systems (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Describe different parameters of Engineering Hydrology. **(K2)**
CO2: Relate different sources of surface and ground water. **(K3)**
CO3: Assess the importance of water supply systems and quality of water in reference to IS and WHO standards. **(K3)**
CO4: Develop different systems of plumbing. **(K3)**
CO5: Employ different conservation techniques. **(K3)**

UNIT I: Introduction to Hydrology: Engineering hydrology, applications, Hydrologic cycle, evaporation, evapotranspiration, precipitation, run off, infiltration, hydrological data-sources

UNIT II: Sources of Water: Surface water, Lakes, Rivers, Reservoirs, comparison of sources with reference to quality, quantity and other considerations.
Groundwater, types of water bearing formations, springs, Wells and Infiltration galleries, Yields from infiltration galleries.

UNIT III: Importance of Protected Water: Supply systems, Flow chart of public water supply system, Water borne diseases, Estimation of water usages in different purpose.

Quality and Analysis of Water: Characteristics of water–Physical, Chemical and Biological–Analysis of Water – Physical, Chemical and Biological characteristics, Comparison of sources with reference to quality- I.S. Drinking water quality standards and WHO guidelines for drinking water.

UNIT IV: Plumbing Systems: Systems of plumbing-types of pipes and sanitary fittings and other accessories–one pipe and two pipe systems – Design parameters and factors.

UNIT V: Water conservation: importance and necessity, objectives, systems-rainwater harvesting, recharge pits, watershed.

Text Books:

1. Environmental Engineering – Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus – Mc-Graw-Hill Book Company, New Delhi, 1985
2. Elements of Environmental Engineering, K. N. Duggal, S. Chand & Company Ltd.New Delhi, 2012.
3. Water Supply and Sanitary Engineering – G. S. Birdie and J. S. Birdie

References:

1. Water Supply Engineering – P. N. Modi.
2. Water Supply Engineering – B. C. Punmia
3. Water Supply and Sanitary Engineering – G. S. Birdie and J. S. Birdie.

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20EEOE1
Name of the Course	Non-Conventional Energy Sources (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Understand the concepts of solar radiation data, extra terrestrial radiation, and radiation on earth's surface. (K2)
- CO2:** Understand the operation of various solar thermal Systems. (K2)
- CO3:** Choose suitable maximum power point tracking technique in solar PV and wind application. (K3)
- CO4:** Explain basic principle and working of hydro and tidal power systems. (K2)
- CO5:** Explain the basic principle of biomass, fuel cell and geothermal systems. (K2)

UNIT-I: Fundamentals of Energy Systems: Energy conservation principle, Energy scenario (world and India), Solar radiation: Outside earth's atmosphere, Earth surface – Analysis of solar radiation data – Geometry – Radiation on tilted surface, Numerical problems.

UNIT-II: Solar Thermal Systems: Liquid flat plate collections: Performance analysis, Transmissivity, Absorptivity, Product collector efficiency factor, Collector heat removal factor, Numerical problems, Introduction to solar air heaters, Concentrating collectors and solar pond.

UNIT-III: Solar Photovoltaic Systems: Balance of systems, I-V & P-V characteristics, System design, Storage sizing, PV system sizing, Maximum power point techniques, Perturb and observe (P&O) technique, Incremental Conductance (INC), Hill climbing technique.

Wind Energy: Wind patterns, Types of turbines, Kinetic energy of wind, Betz coefficient, Tip-speed ratio, efficiency, Power output of wind turbine, Selection of generator (synchronous, induction), Maximum power point tracking.

UNIT-IV: Hydro and Tidal power systems: Basic working principle, Classification of hydro systems: large, small, micro, Measurement of head and flow, Energy equation, Types of turbines, Numerical problems. Tidal power-Basics, Kinetic energy equation, Numerical problems, Wave power-basics, Kinetic energy equation.

UNIT-V: Biomass, fuel cells and geothermal systems: Biomass Energy: Fuel classification – Pyrolysis – Direct combustion of heat– Different digesters and sizing, Fuel cell: classification – Efficiency – V-I characteristics–Geothermal: classification – Dry rock and aquifer –Energy analysis.

Text Books:

1. Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, TMH, New Delhi, 3rd Edition, 2013.
2. Renewable Energy Resources, John Twidell and Tony Weir, Taylor and Francis - second edition, 2013.

Reference Books:

1. Energy Science: Principles, Technologies and Impacts, John Andrews and Nick Jelly, Oxford University Press, 2nd edition, 2013.
2. Renewable Energy- Edited by Godfrey Boyle-oxford university.press,3rd edition, 2013.
3. Handbook of renewable technology Ahmed and Zobaa, Ramesh C Bansal, Worldscientific, Singapore, 2011.
4. Renewable Energy Technologies /Ramesh & Kumar /Narosa.
5. Renewable energy technologies – A practical guide for beginners – Chetong Singh Solanki, PHI, 2008.
6. Non-conventional energy source –B.H.khan- TMH-2nd edition, 2017.

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20EEOE2
Name of the Course	Basics of Control systems (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Construct the transfer function of various mechanical and electrical systems using block diagram algebra and signal flow graphs. (K2)

CO2: Find the time response specifications of second order systems and absolute, relative stability of LTI systems using Routh's stability criterion and the root locus method. (K3)

CO3: Assess the stability of LTI systems using frequency response methods. (K3)

CO4: Construct the lag, lead, lag-lead compensators from Bode diagrams to improve the system performance. (K2)

CO5: Understand the concepts in state space representation of LTI systems, controllability and observability. (K2)

UNIT – I: Mathematical modeling of control systems: Classification of control systems, open loop and closed loop control systems and their differences, Feedback characteristics, transfer function of linear system, differential equations of electrical networks, translational and rotational mechanical systems, transfer function of DC servo motor – AC servo motor – synchro, transmitter and receiver – block diagram algebra – representation by signal flow graph – reduction using Mason's gain formula.

UNIT-II: Time response analysis: Standard test signals – time response of first and second order systems – time domain specifications, steady state errors and error constants, effects of proportional (P), proportional-integral (PI), proportional-integral derivative (PID) systems.

Stability and root locus technique: The concept of stability – Routh's stability criterion – limitations of Routh's stability, root locus concept – construction of root loci (simple problems), Effect of addition of Poles and zeros to the transfer function.

UNIT-III: Frequency response analysis: Introduction to frequency domain specifications – Bode diagrams – transfer function from the Bode diagram – phase margin and gain margin – stability analysis from Bode plots, Polar plots, Nyquist stability criterion.

UNIT-IV: Classical control design techniques: Lag, lead, lag-lead compensators, design of compensators using Bode plots.

UNIT-V: State space analysis of LTI systems: Concepts of state, state variables and state model, state space representation of transfer function, diagonalization, solving the time invariant state equations, State Transition Matrix and its Properties, concepts of controllability and observability.

Text Books:

1. Control Systems principles and design, M. Gopal, Tata McGraw Hill education Pvt Ltd., 4th Edition, 2014.
2. Automatic control systems, Benjamin C. Kuo, Prentice Hall of India, 2nd Edition, 2014.

Reference Books:

1. Modern Control Engineering, Kotsuhiko Ogata, Prentice Hall of India, 2002.
2. Control Systems, ManikDhanesh N, Cengage Publications, 2012.
3. Control Systems Engineering, I.J.Nagarath and M.Gopal, Newage International Publications, 5th Edition, 2007.
4. Control Systems Engineering, S.Palani, Tata McGraw Hill Publications, 2009.5.
5. <https://nptel.ac.in/courses/107/106/107106081/>

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20EEOE3
Name of the Course	Principles of Electric Power Conversion (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Understand the basic operation of various power electronic devices and converters. (K2)
CO2: Apply the suitable power electronic converter for different electrical machines. (K3)
CO3: Understand the operation of various renewable energy sources. (K2)
CO4: Understand the operation of different energy storage systems and their applications. (K2)
CO5: Choose the suitable heating and welding method for different domestic and industrial applications. (K3)

UNIT-I: POWER ELECTRONIC DEVICES AND CONVERTERS

V-I Characteristics of SCR, MOSFET and IGBT. Phase controlled rectifiers, DC-DC converters and Inverters.

UNIT-II: APPLICATION OF CONVERTERS TO ELECTRICAL MACHINES

Speed control of DC motor, Induction motors, PMSM and BLDC drives

UNIT-III: RENEWABLE ENERGY SOURCES AND THEIR INTEGRATION TO GRID

Introduction to solar cell, solar panels, MPPT, wind and other renewable energy sources, Integration of renewable energy sources to the grid.

UNIT-IV: ENERGY STORAGE SYSTEMS

Study of automotive batteries, SMF, pumped storage systems, super-capacitors; fly wheels – applications, Li-ion batteries and applications to electric vehicles.

UNIT-V: DOMESTIC AND INDUSTRIAL APPLICATIONS

Induction heating, welding, melting, hardening, lighting applications and their control, UPS, battery chargers.

Text Books:

1. M.H.Rashid: Power Electronics-circuits, Devices and applications, Prentice Hall India, New Delhi, 2009
2. P.S.Bhimbra: Power Electronics, Khanna publishers, New Delhi, 2012
3. Ned Mohan, Undeland and Robbin: Power electronics converters, applications and design, John Wiley & Sons, Inc. New York, 2006.
4. Utilization of Electrical Energy and Traction, J.B.Gupta, Rajeev Manglik, Rohith Manglik, KATSON Books, 2012

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20EEOE4
Name of the Course	Programmable Logic Controller and Applications (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Understand the basic concepts of PLCs and their I/O modules. (K2)
CO2: Construct the control algorithms to PLC using ladder logic. (K2)
CO3: Illustrate the PLC registers for effective utilization in different applications. (K2)
CO4: Understand the function of various program control instructions. (K2)
CO5: Apply the suitable controller in real time applications. (K3)

Unit I: Introduction

PLC Basics: PLC system, I/O modules and interfacing, CPU processor, programming equipment, programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

Unit II: PLC Programming

PLC Programming: Input instructions, outputs, operational procedures, programming examples using contacts and coils. Digital logic gates, programming in the Boolean algebra system, conversion examples. Ladder diagrams and sequence listings, ladder diagram construction.

Unit III: Programmable Timers and Counters

Timer instructions – On delay time instruction – Off delay timer instruction – Retentive timer – Counter instructions – Up counter – Down counter – Cascading counters – Incremental encoder – Counter applications – Combining counter and timer functions.

Unit IV: Program Control Instructions

Master control reset instruction – Jump instructions and sub routines – Immediate input and output instructions. – Data manipulation – Data transfer operation – Data compare instruction – Data manipulation programs – Numerical data I/O interfaces – Math instructions – Addition, subtraction, multiplication & division instruction – Sequential instructions – Sequence programs – Shift registers – Word shift registers.

Unit V: Applications

Control of water level indicator – Alarm monitor - Conveyor motor control – Parking garage – Ladder diagram for process control – PID controller.

Text Books:

1. Programmable logic controllers by Frank D. Petruzella- McGraw Hill – 3rd Edition.
2. Programmable Logic Controllers – Principle and Applications by John W. Webb and Ronald A. Reiss, Fifth Edition, PHI

Reference Books:

1. Programmable Logic Controllers – Programming Method and Applications by JR.Hackworth and F.D Hackworth Jr. – Pearson, 2004.
2. Introduction to Programmable Logic Controllers- Gary Dunning- Cengage Learning. Programmable Logic Controllers –W. Bolton-Elsevier publisher, 2005.

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20EEOE5
Name of the Course	Energy Storage Systems (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Classify different energy storage systems. **(K2)**
CO2: Understand the operation of different energy storage systems. **(K2)**
CO3: Illustrate the role of electrical energy storage systems in various aspects. **(K2)**
CO4: Understand the operation of different Electrical Energy Storage (EES) systems. **(K2)**
CO5: Apply suitable EES system to various applications. **(K3)**

UNIT - I: Introduction: Necessity of energy storage, different types of energy storage, mechanical, chemical, electrical, electrochemical, biological, magnetic, electromagnetic, thermal, comparison of energy storage technologies.

UNIT - II: Energy Storage Systems: Thermal Energy storage-sensible and latent heat, phase change materials, Energy and exergy analysis of thermal energy storage, Electrical Energy storage-supercapacitors, Magnetic Energy storage-Superconducting systems, Mechanical-Pumped hydro, flywheels and pressurized air energy storage, Chemical-Hydrogen production and storage, Principle of direct energy conversion using fuel cells, thermodynamics of fuel cells, Types of fuel cells, Fuel cell performance, Electrochemical Energy Storage- Battery, primary, secondary and flow batteries.

UNIT – III: Needs for Electrical Energy Storage: Emerging needs for EES, More renewable energy-less fossil fuel, Smart Grid uses - the roles of electrical energy storage technologies-the roles from the viewpoint of a utility-the roles from the viewpoint of consumers-the roles from the viewpoint of generators of renewable energy.

UNIT - IV: Types of Electrical Energy Storage systems: Electrical storage systems, Double-layer capacitors (DLC), Superconducting magnetic energy storage (SMES),super charging stations, Thermal storage systems, Standards for EES, Technical comparison of EES technologies.

UNIT - V: Applications of Electrical Energy Storage: Renewable energy storage-Battery sizing and stand-alone applications, stationary (Power Grid application),Small scale application-Portable storage systems and medical devices, Mobile storage Applications- Electric vehicles (EVs), types of EVs, batteries and fuel cells, future technologies, hybrid systems for energy storage.

Text Books:

1. Energy Storage - Technologies and Applications by Ahmed Faheem Zobaa, InTech, 2013.
2. Fundamentals of Energy Storage by J. Jensen and B. Sorenson, Wiley-Interscience, NewYork, 984
3. Energy Storage: Fundamentals, Materials and Applications, by Huggins R. A., Springer,2019.

Reference Books:

1. Thermal energy storage: Systems and Applications by Dincer I. and Rosen M. A., Wileypub, 2011.
2. Electric & Hybrid Vehicles by G. Pistoia, Elsevier, 2010.
3. Fuel cell Fundamentals by R. O'Hayre, S. Cha, W. Colella and F. B. Prinz, Wiley Pub, 2016.

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20EEOE6
Name of the Course	Soft Computing Techniques (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Understand the basic concepts of different soft computing techniques like fuzzy, GA and neural network. **(K2)**
- CO2:** Understand the fundamental concepts of artificial neural networks. **(K2)**
- CO3:** Explain the basic concepts & convergence of GA. **(K2)**
- CO4:** Explain the basic concepts of fuzzy systems and its applications. **(K2)**
- CO5:** Apply different evolutionary algorithms to various applications. **(K3)**

Unit I: Introduction to AI

Artificial Intelligence – a Brief Review – Pitfalls of Traditional AI – Need for Computational Intelligence –Importance of Tolerance of Imprecision and Uncertainty - Constituent Techniques – Overview of Artificial Neural Networks - Fuzzy Logic - Evolutionary Computation.

Unit II: Artificial Neural Networks

Supervised Learning: Introduction and how brain works, Neuron as a simple computing element, The perceptron, Back propagation networks: architecture, multilayer perceptron, back propagation learning-input layer, accelerated learning in multilayer perceptron, The Hopfield network, Bidirectional associative memories(BAM), RBF Neural Network.

Unsupervised Learning: Hebbian Learning, Generalized Hebbian learning algorithm, Competitive learning, Self- Organizing Computational Maps: Kohonen Network.

Unit III: Genetic algorithms

Genetic algorithms basic concepts, encoding, fitness function, reproduction-Roulette wheel, Boltzmann, tournament, rank, and steady state selections, Convergence of GA, Applications of GA-case studies.

Unit IV: Fuzzy Logic

Fuzzy Sets – Properties – Membership Functions - Fuzzy Operations. Fuzzy Logic and Fuzzy Inference System

Unit V: Evolutionary Computation

Evolutionary Computation - Overview of other Bio-inspired Algorithms - Swarm Intelligence Algorithms

Text Books:

1. R. Rajasekaran and G. A and Vijayalakshmi Pai, Neural Networks, Fuzzy Logic, and Genetic, 2013.
2. Algorithms: Synthesis and Applications, Prentice Hall of India, 2008
3. D. E. Goldberg, Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley
4. T. Ross, Fuzzy Logic with Engineering Applications, Tata McGraw Hill, 2003

Reference Books:

1. L. Fausett, Fundamentals of Neural Networks, Prentice Hall, 2004

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20EEOE7
Name of the Course	Electric Vehicles (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Understand the fundamentals of an electric vehicle. **(K2)**
CO2: Explain the technical characteristics and properties of batteries. **(K2)**
CO3: Estimate the ratings and requirements of electrical machines. **(K2)**
CO4: Illustrate the regenerative braking system of an electric vehicle. **(K3)**
CO5: Estimate the sizing of components of hybrid electric vehicles. **(K2)**

UNIT I: ELECTRIC VEHICLES

Introduction, Components, vehicle mechanics – Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion - Propulsion System Design.

UNIT II: BATTERY

Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design, Properties of Batteries.

UNIT III: DC & AC ELECTRICAL MACHINES

Motor and Engine rating, Requirements, DC machines, Three phase A.C machines, Induction machines, permanent magnet machines, switched reluctance machines.

UNIT IV: ELECTRIC VEHICLE DRIVE TRAIN

Transmission configuration, Components – gears, differential, clutch, brakes regenerative braking, motor sizing.

UNIT V: HYBRID ELECTRIC VEHICLES

Types – series, parallel and series, parallel configuration – Design – Drive train, sizing of components.

Text Books:

1. Iqbal Hussain, “Electric & Hybrid Vehicles – Design Fundamentals”, Second Edition, CRC Press, 2011.
2. James Larminie, “Electric Vehicle Technology Explained”, John Wiley & Sons, 2003.

Reference Books:

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles : Fundamentals”, CRC Press, 2010.
2. Sandeep Dhameja, “Electric Vehicle Battery Systems”, Newnes, 2000
3. <http://nptel.ac.in/courses/108103009/>

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20EEOE8
Name of the Course	Indian Electricity Act, 2003. (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Understand the national policy, plan and the joint responsibilities of state and central governments. **(K2)**

CO2: Illustrate the process of licensing and the provisions related to transmission and distribution of electricity. **(K2)**

CO3: Understand the regulatory commissions and Central Electricity Authority (CEA). **(K2)**

CO4: Illustrate the Appellate Tribunal, Reorganization of boards, offences and penalty. **(K2)**

CO5: Understand the constitution procedures of special courts and dispute resolution. **(K2)**

UNIT - I: National electricity policy and plan, generation of electricity

Electricity Act: commencement, definitions, comments; national policy on standalone systems, non-conventional energy systems, electrification and local distribution for rural areas; joint responsibilities of state and central governments in rural electrification, requirement for setting up of generating station, hydro-electric generation, captive generation; duties of generating companies.

UNIT - II: Licensing, transmission and distribution of electricity

Licensing: powers, procedures, conditions, amendments, revocation, provisions, directions, suspension and sale; inter-state and intra-state transmission; other provisions relating to transmission; provisions with respect to distribution licenses, electricity traders, supply - consumer protection: standard performance.

UNIT - III: Tariff, works, CEA and Regulatory commissions

Works of licenses, provisions relating to overhead lines; Constitution and functions of Central Electricity Authority (CEA), directions and certain powers; Constitution, powers and functions of state and central commissions, other provisions, proceedings and powers of appropriate commission, Grants, Fund, Accounts Audit and Report.

UNIT - IV: Appellate Tribunal, Reorganization of boards, offences and penalty

Appellate Tribunal for electricity; investigation and assessment; reorganization of boards; Offences and penalties.

UNIT - V: Special courts, Dispute resolution, other provisions and Miscellaneous

Constitution of special courts, procedures, powers, appeal, revision; arbitration; protective clauses; miscellaneous and enactments.

Text Books:

1. The Electricity Act, 2003 {Act 36 of 2003, dt.2-6-2003, w.e.f. 10-6-2003 vide S.O. No. 669(E), dt. 10-6-2003} published by Commercial Law Publishers (I) Pvt. Ltd

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20EEOE9
Name of the Course	Power Systems for Data Centers (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Understand the basics of power in the data centre. **(K2)**

CO2: Illustrate the uninterrupted power supply. **(K2)**

CO3: Illustrate the operation of generators and various power devices. **(K2)**

CO4: Estimate the power required in the data centre. **(K2)**

CO5: Describe the different methods to improve data centre energy efficiency. **(K2)**

UNIT -I: Fundamentals of Power

Power basics and key terms, Power calculations, Grounding Power problems, Power protection system equipment.

UNIT -II: Uninterruptible Power Supply (UPS)

UPS basics, UPS topologies, UPS redundancy and efficiency, Modular UPS, UPS batteries Flywheel UPS.

UNIT –III: Generators and Other Power Devices

Generators, Automatic and static transfer switches, Power distribution units, Circuit Breakers, Circuit Breaker Coordination, Circuit Breaker Protection, Circuit Breaker Sizing.

UNIT –IV: Power Distribution in the Rack

Rack power redundancy, Server power calculations, Power cabling, calculating power requirements, Power consumption in the data centre, Reducing Wasted Power in the Data Centre: reducing server power

UNIT –V: Data Center Energy Efficiency and practices

Data centre power growth, Barriers to data centre energy efficiency, Power consumption in the data centre, Power Usage effectiveness (PUE), Measuring PUE, Other data centre efficiency metrics

Energy Efficiency Best Practices

Reducing the support infrastructure load, Systematic approach to improving energy efficiency.

Text Books:

1. Data Center Handbook, by Hwaiyu Geng, Publisher(s): Wiley ISBN: 9781118436639, 2014

Reference Books:

1. Designing Data Centers - Book 1: Power: Specifying the requirements, power generation, power distribution, power efficiency, and fault tolerance for data centers, by by B.A.Ayomaya, ISBN-13 : 979-8695727715
2. Guide to Data Centre Power Systems, Publication Year: 2021, Pages:278 ISBN-13: 978- 1-78561-828-4

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20EEOE10
Name of the Course	Concepts of Power System Engineering (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Understand the working of thermal and nuclear power generating stations. (K2)
CO2: Estimate the R,L and C parameters of transmission lines (Nominal T and π models). (K2)
CO3: Find the parameters of DC and AC distribution systems along with voltage drop. (K3)
CO4: Understand the operation of fuses and circuit breakers. (K2)
CO5: Illustrate the speed/time characteristics of different types of traction motors. (K2)

UNIT – I: Introduction to the Sources of Energy

Thermal Power Stations Selection of site, general layout of a thermal power plant showing paths of coal, steam, water, air, ash and flue gasses, ash handling system & operation of thermal plant

Nuclear Power Stations: Location of nuclear power plant, Working principle, Nuclear fission, Nuclear fuels, Nuclear chain reaction, nuclear reactor Components: Moderators, Control rods, Reflectors and Coolants.

UNIT – II: Parameters of Transmission line

Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, concept of GMR & GMD- Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance. Classification of Transmission Lines and their model representations -Nominal-T, Nominal- π , Ferranti effect - Numerical Problems.

UNIT – III: Distribution Systems

Classification of distribution systems, design features of distribution systems, radial distribution, ring main distribution, voltage drop calculations: DC distributors for following cases - radial DC distributor fed at one end and at both ends (equal / unequal voltages), ring main distributor.

UNIT-IV: Protective devices

Principle of operation of HRC fuses – SF₆, oil circuit breakers, circuit reclosures and Linesectionalizes.

UNIT–V: Electric Traction

System of electric traction and track electrification– Review of existing electric traction systems in India– Special features of traction motor–Mechanics of train movement–Speed–time curves for different services –Trapezoidal and quadrilateral speed time curves.

Text Books:

1. Generation, Distribution and Utilization of Electric Energy by C.L.Wadhawa New age International (P) Limited, Publishers, 2015.
2. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakrabarti, Dhanpat Rai & Co. Pvt. Ltd., 2008
3. Utilization of Electric Energy – by E. Openshaw Taylor, Orient Longman,1971.

Reference Books:

1. Electrical Power Systems by P.S.R. Murthy, B.S. Publications, 2017.
2. Art & Science of Utilization of electrical Energy – by Partab, DhanpatRai & Sons, 2017

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20EEOE11
Name of the Course	Fundamentals of Smart Grid Technologies (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Understand the basic structure of an electricity marketing conditions. (K2)
CO2: Illustrate the developing technologies in DC distribution and smart grid. (K2)
CO3: Understand the concepts of dynamic energy systems. (K2)
CO4: Illustrate the development of smart domestic system. (K2)
CO5: Illustrate the development of intelligent domestic system. (K2)

UNIT - I: Introduction to Smart Grid & evolving it to a Perfect Power System: Introduction: Introduction to smart grid- Electricity network-Local energy networks- Electric transportation-Low carbon central generation- Attributes of the smart grid- Alternate views of a smart grid. Smart Grid to Evolve a Perfect Power System: Introduction- Overview of the perfect power system configurations- Device level power system- Building integrated power systems- Distributed power systems-Fully integrated power system-Nodes of innovation.

UNIT - II: DC Distribution and Smart Grid: AC vs DC sources-Benefits of DC power delivery systems-Powering equipment and appliances with DC-Data centers and information technology loads-Future neighborhood-Potential future work and research. Intelligrid Architecture for the Smart grid: Introduction- Launching intelligrid- Intelligrid today- Smart grid vision based on the intelligrid architecture-Barriers and enabling technologies. SCADA, synchro phasors (WAMS).

UNIT – III: Dynamic Energy Systems Concept: Smart energy efficient end use devices-Smart distributed energy resources-Advanced whole building control systems- Integrated communications architecture-Energy Management-Role of technology in demand response-Current limitations to dynamic energy management- Distributed energy resources-Overview of a dynamic energy management-Key characteristics of smart devices- Key characteristics of advanced whole building control systems-Key characteristics of dynamic energy management system.

UNIT - IV: Energy Port as a Part of the Smart Grid & Market Implementation: Energy Port as Part of The Smart Grid: Concept of energy -Port, generic features of the energy port. Policies and Programs to Encourage End – Use Energy Efficiency: Policies and programs in action -multinational -national-state-city and corporate levels. Market Implementation: Framework-factors influencing customer acceptance and response- program planning-monitoring and evaluation.

UNIT - V: Efficient Electric End – Use Technology Alternatives: Existing technologies – lighting - Space conditioning - Indoor air quality - Domestic water heating – hyper efficient appliances - Ductless residential heat pumps and air conditioners - Variable refrigerant flow air conditioning-Heat pump water heating - Hyper efficient residential appliances - Data center energy efficiency-LED street and area lighting - Industrial motors and drives - Equipment retrofit and replacement – Process heating - Cogeneration, Thermal energy storage - Industrial energy management programs – Manufacturing process-Electro- technologies, Residential, Commercial and industrial sectors.

Text Books:

1. The Smart Grid, Enabling Energy Efficiency and Demand Side Response, Clark WGellings,CRC Press, 2009.
2. Smart Grids, Jean Claude Sabonnadiere, Nouredine Hadjsaid, Wiley-ISTE, IEEEPress,May 2012.
3. SMART GRID Fundamentals of Design and Analysis, James Momoh, IEEE press, A JohnWiley &Sons, Inc., Publication, 2012.

Reference Books:

1. Smart Grid: Technology and Applications, Janaka Ekanayake, Kithsiri Liyanage,Jianzhong.Wu, Akihiko Yokoyama, Nick Jenkins, Wiley, 2012.
2. Smart Grid: Fundamentals of Design and Analysis, James Momoh, Wiley, IEEE Press,2012.

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20EEOE12
Name of the Course	Distribution Automation (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Understand the basic principles of distribution and automation. (K2)

CO2: Describe the working functions of distribution automation. (K2)

CO3: Select appropriate Communication Technology for various parts of Distribution System for their automation. (K2)

CO4: Illustrate the technical benefits of Distribution Automation (DA). (K2)

CO5: Select an appropriate method for Economic Evaluation of DA plans. (K2)

UNIT-I: DISTRIBUTION AUTOMATION AND THE UTILITY SYSTEM: Introduction to Distribution Automation (DA), Control System Interfaces, Control and Data Requirements, Centralized (Vs) Decentralized Control, DA System (DAS), DA Hardware, DAS Software.

UNIT-II: DISTRIBUTION AUTOMATION FUNCTIONS: DA Capabilities, Automation System Computer Facilities, Management Processes, Information Management, System Reliability Management, System Efficiency Management, Voltage Management, Load Management, Management Process (Function) Interaction, Operating and Objective Priorities.

UNIT-III: COMMUNICATION SYSTEMS FOR DA: DA Communication Requirements - Communication Reliability, Cost Effectiveness, Data Rate Requirements, Two Way Capability, Ability to communicate during outages and faults, Ease of Operation and Maintenance, Conforming to the Architecture of Data Flow. Communication Systems used in DA - Distribution Line Carrier (Power line carrier), Ripple Control, Zero Crossing Technique, Telephone, Cable TV, Radio, AM Broadcast, FM SCA, VHF Radio, UHF Radio, Microwave, Satellite, Fibre Optics, Hybrid Communication Systems, Communication Systems used in Field Tests.

UNIT-IV: TECHNICAL BENEFITS: DA Benefit Categories, Capital Deferred Savings, Operation and Maintenance Savings, Interruption Related Savings, Customer-related Savings, Operational Savings, Improved Operation, Function Benefits, Potential Benefits for Functions, Function-shared Benefits, Guidelines for Formulation of Estimating Equations, Parameters Required, Economic Impact Areas, Resources for determining benefits, Integration of System Benefits into Economic Evaluation, Impact of DA on Distribution System.

UNIT-V: ECONOMIC EVALUATION METHODS: Development and Evaluation of Alternate Plans, Select Study Area, Select Study Period, Project Load Growth, Develop Alternatives, Calculate Operation and Maintenance Costs, Evaluate Alternatives. Economic Comparison of Alternate Plans: Classification of Expenses and Capital Expenditures, Comparison of Revenue Requirements of Alternative Plans, Book Life and Continuing Plant Analysis, Year-by- Year Revenue Requirement Analysis, Short Term Analysis, End of Study Adjustment, Break-Even Analysis, Sensitivity Analysis, Major Steps in Utility Economic Evaluation of DA (Flow-Chart) Computational Aids.

Text Books:

1. Dr.M.K. Khedkar and Dr.G.M.Dhole," A Textbook of Electric Power DistributionAutomation", University Science Press (Laxmi Publications Pvt. Ltd.), 2011
2. D. Bassett, K. Clinard, J. Grainger, S. Purucker, and D. Ward, "Tutorial Course:Distribution Automation", IEEE Tutorial Publication 88EH0280-8-PWR, 1988.

Reference Books:

1. James Northcote-Green, Robert Wilson "Control and Automation of Electrical Power Distribution Systems" CRC Press, Taylor and Francis Group, 2007.
2. James A. Momoh "Electric Power Distribution, Automation, Protection, and Control", CRC Press, Taylor and Francis Group, 2017.

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20MEOE1
Name of the Course	Basic Mechanical Engineering (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Discuss different types of materials, their properties and testing with applications. (K2)
CO2: Interpret concepts of thermodynamics, Refrigeration, air conditioning and working of IC engines and air conditioners. (K2)
CO3: Illustrate different manufacturing, joining, machining processes and machines with applications. (K2)
CO4: Explain concepts of force, power transmission and power plants. (K2)
CO5: Discuss the classification and working of pumps, turbines and gas turbines. (K2)

UNIT – I: ENGINEERING MATERIALS AND PROCESSES: ENGINEERING MATERIALS: Ferrous metals (Mild steel, Cast iron and its types, Stainless steel, High carbon steel), Non ferrous metals and alloys (Copper, Zinc, Aluminium, Tin, Nickel and their alloys). Properties- Strength, Hardness, Toughness, Brittleness, Creep, Fatigue, Stiffness, Ductility, Malleability, Elasticity, Plasticity, Specific gravity, Viscosity, Thermal conductivity, Specific heat, Corrosion resistance.

UNIT – II: THERMAL SCIENCE: THERMODYNAMICS: System, Surroundings, Thermodynamic equilibrium, Property, State, Path, Process, Cyclic process, Work, Heat, Energy, Enthalpy, Entropy, Internal energy, Laws of thermodynamics (Description only), Scales of temperature. **IC ENGINES:** Classification, Carnot, Otto, Diesel Cycles with P-V and T-S diagrams, 2 and 4 stroke C.I and S.I engines, working, Hybrid engines, Indicated power, Brake power, efficiencies. **REFRIGERATION AND AIRCONDITIONING:** Refrigerant and its types with applications, Unit of refrigeration, COP, working of vapour compression refrigeration.

UNIT – III: MANUFACTURING SCIENCE: Basic description of manufacturing processes-Casting, Forging, Rolling, Extrusion, Hot and cold working processes with applications. **METAL JOINING PROCESSES:** Basic description with sketches-Rivetting, Arc welding, Gas welding, Soldering and Brazing with applications.

UNIT – IV: FORCE AND POWER TRANSMISSION: FORCE SYSTEM AND ANALYSIS: Concepts of- Laws of motion, Free body diagrams, Resultant force, Equilibrium, Friction, laws of friction, Stress, types of stress, Strain, Poisson's ratio, Elastic constants, Moment, Moment of inertia, centroid, Torque. **POWER TRANSMISSION:** Description of working with sketches-Belt, Chain drives, Gear trains with applications, Single plate clutches. Basic concepts of hydraulic and pneumatic power transmission.

UNIT – V: PUMPS AND PRIME MOVERS:

PUMPS: Classification of pumps, Description and working of- Reciprocating and centrifugal pumps with applications, priming, Multistage pumps., Discharge and coefficient of discharge. **PRIME MOVERS:** Classification of hydraulic turbines, steam turbines, description and working of Pelton wheel and governing. Types of gas turbines and working of gas turbines with applications.

Text Books:

1. Thermal Engineering –Rajput RK, Laxmi publications.
2. Elements of Mechanical Engineering-Sadhu singh, S.chand publications.
3. Basic Mechanical Engineering –Pravin kumar, Pearson publications.
4. Elements of Mechanical Engineering-N.M. Bhatt and J.R.Mehta, Mahajan publishing house.

Reference Books:

1. Production Technology-P.C.Sharma
2. Thermal Engineering-PL Ballaney
3. Power Plant Engineering-Nagpal
4. Workshop Technology-Hajra choudhury

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20MEOE2
Name of the Course	Green Engineering Systems (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Illustrate the concept of Solar Radiation, Collection, Storage and Applications. (K2)
CO2: Discuss the construction and working of wind energy and bio-energy conversion systems. (K2)
CO3: Describe the construction and working of Geothermal and Ocean Energy conversion systems. (K2)
CO4: Illustrate the principles of environmental impact of current manufacturing practices. (K2)
CO5: Discuss the features and benefits of green building materials and its applications. (K2)

UNIT – I: INTRODUCTION: SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, instruments for measuring solar radiation and sun shine, Flat plate and concentrating collectors. **SOLAR ENERGY STORAGE AND APPLICATIONS:** Different Storage methods, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

UNIT – II: WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, types of winds. **BIO-MASS:** Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, bio fuels, I.C. engine operation.

UNIT – III: GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India. **OCEAN ENERGY:** OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT – IV: ENERGY EFFICIENT PROCESSES: Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmental friendly machining, vegetable based cutting fluids, zero waste manufacturing.

UNIT – V: GREEN BUILDINGS: Definition, features and benefits. Sustainable site selection and planning of buildings for maximum comfort. Environmental friendly building materials like bamboo, timber, rammed earth, hollow blocks, lime & lime pozzolana cement, agro materials and industrial waste, Ferro cement and Ferro-concrete, alternate roofing systems, paints to reduce heat gain of the buildings.

Text Books:

1. Sukhatme S.P. and J.K.Nayak, Solar Energy – Principles of Thermal Collection and Storage, TMH.
2. Khan B.H., Non-Conventional Energy Resources, Tata McGraw Hill, New Delhi, 2006.
3. Green Manufacturing Processes and Systems, Edited by J. Paulo Davim, Springer 2013.

Reference Books:

1. Alternative Building Materials and Technologies / K.S Jagadeesh, B.V Venkata Rama Reddy and K.S Nanjunda Ra.
2. Principles of Solar Energy / Frank Krieth & John F Kreider.
3. Non-Conventional Energy / Ashok V Desai / Wiley Eastern.
4. Renewable Energy Technologies / Ramesh & Kumar / Narosa
5. Renewable Energy Technologies / G.D Roy

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20MEOE3
Name of the Course	Computational Fluid Dynamics (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Apply techniques in the numerical solution of fluid equations. **(K3)**

CO2: Apply numerical modeling and its role in the field of heat transfer and fluid flow. **(K3)**

CO3: Develop methodologies used in CFD. **(K3)**

CO4: Compare various discretization methods and solving methodologies. **(K4)**

CO5: Apply skills in the actual implementation of CFD methods (e.g. boundary conditions, different numerical

schemes etc., Finite element methods in the application of CFD analysis to real life engineering designs.

(K3)

UNIT – I: ELEMENTARY DETAILS IN NUMERICAL TECHNIQUES: Number system and errors, representation of integers, fractions, floating point arithmetic, loss of significance and error propagation, condition and instability, computational methods for error estimation, convergence of sequences.

UNIT – II: APPLIED NUMERICAL METHODS: Solution of a system of simultaneous linear algebraic equations, iterative schemes of matrix inversion, direct methods for matrix inversion, direct methods for banded matrices.

EQUATIONS GOVERNING FLUID FLOW AND HEAT TRANSFER: Introduction, conservation of mass, Newton's second law of motion, expanded forms of Navier-stokes equations, conservation of energy principle, special forms of the Navier – stokes equations.

UNIT– III: Steady flow, dimensionless form of momentum and energy equations, stokes equation, conservative body force fields, stream function - vorticity formulation. Finite difference applications in heat conduction and convection – heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer, closure.

UNIT – IV: Finite differences, discretization, consistency, stability, and fundamentals of fluid flow modelling: introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

UNIT – V: Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modelling, conservative property, the up wind scheme.

FINITE VOLUME METHOD: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation.

Text Books:

1. Numerical heat transfer and fluid flow/Suhas V.Patankar- Butter –worth Publishers.
2. Computational fluid dynamics – Basics with applications -John. D.Anderson /McGraw Hill.

Reference Books:

1. Computational Fluid Flow and Heat Transfer/Niyogi, Pearson Publications.
2. Fundamentals of Computational Fluid Dynamics–Tapan K.Sengupta / Universities Press.
3. Computational fluid dynamics, 3rd edition/Wendt/Springer publishers

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20MEOE4
Name of the Course	Rapid Prototyping (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Understand virtual prototyping and testing of technology. **(K2)**
CO2: Construct CAD modelling for rapid prototyping. **(K3)**
CO3: Examine different types of process in rapid prototyping. **(K3)**
CO4: Explain Rapid Manufacturing errors. **(K2)**
CO5: Express the applications of rapid prototyping. **(K2)**

UNIT – I: Introduction: Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Classification of Rapid Manufacturing Processes: Additive, Subtractive, Formative, Generic RP process.

UNIT – II: CAD Modelling and Data Processing for RP: CAD model preparation, Data interfacing: formats (STL, SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP), conversation, validity checks, repair procedures; Part orientation and support generation, Support structure design, Model Slicing algorithms and contour data organization, direct and adaptive slicing, Tool path generation.

UNIT – III: RP Processes: Process Physics, Tooling, Process Analysis, Material and technological aspects, Applications, limitations and comparison of various rapid manufacturing processes. Photo polymerization (Stereo lithography (SL), Micro stereo lithography), Powder Bed Fusion (Selective laser Sintering (SLS), Electron Beam melting (EBM)), Extrusion-Based RP Systems (Fused Deposition Modelling (FDM)), 3D Printing, Sheet Lamination (Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC)), Beam Deposition (Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD)).

UNIT – IV: Errors in RP Processes: Pre-processing, processing, post-processing errors, Part building errors in SLA, SLS.

UNIT – V: Application of Rapid Prototyping and Technology: Functional models, pattern for investment and Vacuum casting, medical models, Art models, Engineering analysis models.

Reference Books:

1. Rapid Prototyping: Principles and Applications in Manufacturing. Chua C.K., Leong K.F., Chu S. L., World Scientific.
2. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing. Gibson, Ian, Rosen, David, Stucker, Brent, Pearson
3. Rapid Prototyping: Principles and Applications in Manufacturing. Noorani R, John Wiley & Sons.
4. Rapid Prototyping and Engineering applications: A tool box for prototype development. Liou W.L., Liou F. W., CRC Press
5. Rapid Prototyping: Theory and practice. Kamrani A. K., Nasr E. A., Springer

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20MEOE5
Name of the Course	Computer Aided Design (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Explain the basic fundamentals of CAD tools. **(K2)**
CO2: Find the characteristics of curves, Representation and continuity requirements. **(K3)**
CO3: Illustrate the Geometric Transformations and demonstrate various types of surfaces and Representation. **(K3)**
CO4: Differentiate between the methods of representing Solid Modelling. **(K4)**
CO5: Apply the local and global properties for product development. **(K3)**

UNIT – I: CAD Introduction: Need of machine design, use of computer, computer fundamentals, computer aided design process, CAD configuration, and CAD tools, positive and negative points of CAD, CAD and CAM integration.

UNIT – II: DESIGN OF CURVES: Fundamental of Curve Design, Parametric Space of a Curve, Representation, Parametric cubic curve, Blending functions, Truncation, extension, and subdivision, composite curve: continuity requirements .

UNIT – III: GEOMETRIC TRANSFORMATIONS: Translation, Rotation, Scaling Symmetry and Reflection, Homogeneous Transformations. Orthographic Projections, Axonometric Projections, Oblique Projections, Perspective Transformation.

DESIGN OF SURFACES: Fundamental of Surface Design, Parametric Space of a Surface, Representation of a Surface patch, sixteen point form, Four Curve Form, Plane.

UNIT – IV: SOLID MODELLING: Solid Modelling fundamentals, topology and geometry. Geometric Modelling Method, Constructive Solid Geometry (CSG), Boundary Representation (Brep), Introduction to Wireframe,surface and solid modelling techniques. Introduction CAD data exchange format IGES, STEP

UNIT – V: GEOMETRIC PROPERTIES: Local and global properties of a curve, Local and global properties of a surface, Global properties of complex solids, Relational properties, intersections. Applications in Product Development and other areas.

Reference Books:

1. Geometric Modeling: Michael E. Mortenson, Third Edition, Industrial Press Inc.2006.
2. Mathematical Elements of Computer Graphics, Rogers and Adams, McGraw Hill. 1994
3. CAD CAM Theory and Prectice: I. Zeid, Tata-McGraw Hill, 2006
4. Computer-Aided Engineering Design, B Sahay and ASaxena, Springer, 2005.
5. Differential Geometry of Curves and Surfaces, Thomas F. Banchoff and Stephen T. Lovett, ThomasBanchoff-Stephen Lovett, 2010.
6. Computational Geometry for Design and Manufacture, I.D. Faux and M.J. Pratt, John Wiley, 1980.
7. Lectures on Classical Differential Geometry, Dirk J. Struick, Addison Wesley, 1980.

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	3	0	0	3	V20MEOE6
Name of the Course	Mechatronics (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Understand the elements of Mechatronics & levels and explain various types of sensors, transducers and Mechatronics design process. **(K2)**
- CO2:** Sketch and explain various types of solid state devices like Diode, BJT, MOSFET, etc. **(K3)**
- CO3:** Illustrate and explain basic principles of Hydraulic, pneumatic, electrohydraulic, electro hydraulic servo actuating systems. **(K3)**
- CO4:** Illustrate and explain microprocessors, microcontrollers and PLC. **(K3)**
- CO5:** Sketch and explain System interfacing and data acquisition systems. **(K3)**

UNIT – I: MECHATRONICS SYSTEMS – elements & levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, advantages and disadvantages of mechatronics systems. Sensors and transducers, types, displacement, velocity, force, acceleration, liquid flow, liquid level, temperature and light sensors.

UNIT– II: SOLID STATE ELECTRONIC DEVICES - PN junction diode, BJT, FET, Analog signal conditioning, operational amplifiers, filters.

UNIT– III: HYDRAULIC AND PNEUMATIC ACTUATING SYSTEMS - Fluid systems, Hydraulic systems, and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems.

UNIT– IV: DIGITAL ELECTRONICS AND SYSTEMS - Digital logic control, micro processors and micro controllers, programming, programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT– V: SYSTEM AND INTERFACING AND DATA ACQUISITION – Data Acquisition Systems, Analog to Digital and Digital to Analog conversions; Digital Signal Processing.

Text Books:

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran, GK Vijaya Raghavan & MS Balasundaram/WILEY India Edition

Reference Books:

1. Mechatronics /Smaili A, Mrad F/ Oxford Higher Education, Oxford University Press
2. Mechatronics Source Book / Newton C Braga/Thomson Publications, Chennai.
3. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
4. Mechatronics System Design / Devdas shetty/Richard/Thomson.
5. Mechatronics/M.D.Singh/J.G.Joshi/PHI.
6. Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition / W.Bolton / Pearson, 2012
7. Mechatronics – Principles and Application / Godfrey C. Onwubolu/Elsevier, Indian print

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	2	0	2	3	V20ECTOE01
Name of the Course	Internet of Things (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Describe M2M and IOT Technologies. **(K2)**
CO2: Identify the layers and protocols in IOT. **(K2)**
CO3: Describe various communication technologies used in IOT. **(K2)**
CO4: Demonstrate various hardware components required for IOT applications. **(K2)**
CO5: Identify the cloud technologies & explain the applications of IoT. **(K2)**

UNIT I: INTRODUCTION

Introduction from M2M to IoT - An Architectural Overview, building architecture, Main design principles and needed capabilities, An IoT architecture outline, M2M and IoT Technology Fundamentals - Devices and gateways

UNIT II: IOT PROTOCOLS

Functionality of Layers in IoT –Study of protocols - Wireless HART, Z-Wave, 6LoWPAN, RPL, CoAP, MQTT.

UNIT III: COMMUNICATION TECHNOLOGIES IN IOT

IoT Connectivity – IEEE 802.15.4, Wi-Fi, Bluetooth, Zigbee, LPWAN, 5G Era.

UNIT IV: SYSTEM HARDWARE

Sensors, Actuators, Radio Frequency Identification, Introduction to Embedded Devices for IoT - RASPBERRY PI.

UNIT V: Cloud Computing & Case Studies

Data Collection, Storage and Computing Using a Cloud Platform for IoT Applications/Services. Real-time applications of IoT - Smart and Connected Cities, Agriculture.

Text Books:

1. “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence” Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle , 1st Edition, Academic Press, 2014.
2. IOT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, Cisco Press 800 East 96th Street Indianapolis, USA.
3. “Internet of Things (A Hands-on- Approach)”, Vijay Madiseti and ArshdeepBahga, 1st Edition, VPT, 2014.

Reference Books:

1. From Internet of Things to Smart Cities: Enabling Technologies - edited by Hongjian Sun, Chao Wang, Bashar I. Ahmad, CRC Press -2018.
2. “Architecting the Internet of Things”, Bernd Scholz-Reiter, Florian Michahelles, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer.
3. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning IOT, David Etter.

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	2	0	2	3	V20ECTOE02
Name of the Course	Communication Systems (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Demonstrate the fundamentals of communication systems. **(K2)**
CO2: Compare the various analog modulation and demodulation schemes. **(K2)**
CO3: Compare the various digital modulation and demodulation schemes. **(K2)**
CO4: Explain the wireless communication system concepts. **(K2)**
CO5: Outline the satellite & Optical communication system principles. **(K2)**

UNIT-I: Fundamentals of Communication systems: Block diagram of communication system; types of communications - analog and digital; Noise–types of noise, sources of noise, and noise figure.

UNIT-II: Fundamentals of Analog Communication: Need for modulation; Types of analog modulation techniques (AM, FM & PM). Sampling theorem, Nyquist criteria, introduction to PAM, PWM and PPM.

UNIT-III: Fundamentals of Digital Communication: Advantages; Working principle of PCM; introduction to digital modulation techniques-ASK, FSK, &PSK.

UNIT-IV: Fundamentals of Wireless Communication: Evolution of mobile communications, Mobile Radio System around the world, Comparison of Common wireless system, Concepts of 1G, 2G, 3G, 4G. , Introduction to 5G.

UNIT-V: Fundamentals of Satellite & Optical communication: Brief history of Satellite systems; Principles, architecture. Fundamentals of Optical Communication: Evolution of fiber optic system, Elements of an Optical Fiber Transmission link and Reception link.

Text Books:

1. Principles of Communications by H. Taub and D. Schilling, TMH, 2003.
2. Wireless Networks: Applications and Protocols by T. S. Rappaport, Pearson Education
3. Satellite Communications by Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.
4. Optical Fiber Communication by Gerd Kaiser (TMH)

References:

1. Electronic Communication Systems by Kennedy and Davis, TMH, 4th edition, 2004.
2. Wireless Communication and Networks: 3G and Beyond by I. SahaMisra, TMH Education.
3. Satellite Communications: Design Principles by M. Richharia, B S publications, 2nd Edition, 2003.

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	2	0	2	3	V20ECTOE03
Name of the Course	Principles of Image Processing (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Understand the different Transforms Techniques & their use in Image Processing Applications. **(K2)**
CO2: Describe Spatial and frequency domain filtering like smoothing and sharpening operations on Images. **(K2)**
CO3: Describe Restoration operations/techniques on Images. **(K2)**
CO4: Describe the Image compression Techniques and Image segmentation. **(K2)**
CO5: Explain the different color Image Processing Techniques. **(K2)**

UNIT-I: Introduction

Introduction: Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing.

Image Transforms: Discrete Fourier transform (DFT) and Discrete Cosine transform.

UNIT-II: Image Enhancement Techniques

Intensity Transformations and Spatial Filtering: Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters and sharpening spatial filters.

Filtering in the Frequency Domain: image smoothing using frequency domain filters, Image Sharpening using frequency domain filters.

UNIT-III: Image Restoration

Image Restoration : A model of the image degradation / Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering. Estimating the image degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering.

UNIT-IV: Image compression and Segmentation

Image compression: Fundamentals, Basic compression methods: Huffman coding, Arithmetic coding, LZW coding and subband coding.

Image segmentation: Fundamentals, point, line, edge detection, thresholding, based segmentation and simple morphological operations : Erosion and dilation, opening and closing.

UNIT-V: Color Image Processing

Color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening.

Text Books:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. Jayaraman, S. Esakkirajan, and T. Veerakumar, "Digital Image Processing", Tata McGraw Hill Education, 2011.

Reference Books:

1. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
2. B.Chanda, D.Dutta Majumder, "Digital Image Processing and Analysis", PHI, 2009.

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	2	0	2	3	V20ECTOE04
Name of the Course	Medical Electronics (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Explain the basics concepts of Bio-Medical Instrumentation. (K2)
CO2: Explain the concepts of electrode theory, classification of Electrodes and Transducers used in Bio-Medical Applications. (K2)
CO3: Explain the Anatomy and Physiology of Cardiovascular system and Illustrate the application of Bio-Medical Instruments to measure the Physiological parameters of Cardiovascular System. (K2)
CO4: Discuss the elements used for Patient's Health care & monitoring. (K2)
CO5: Classify different types of monitors, discuss the principals of recorders and Illustrate the methods of accident preventions. (K2)

UNIT-I:

INTRODUCTION TO BIOMEDICAL INSTRUMENTATION: Age of Biomedical Engineering, Development of Biomedical Instrumentation, Man Instrumentation System, Components of the Man-Instrument System, Physiological System of the Body, Problems Encountered in Measuring a Living System, Sources of Bioelectric Potentials, Muscle, Bioelectric Potentials, Sources of Bioelectric Potentials, Resting and Action Potentials, Bioelectric Potentials-ECG, EEG and EMG,

UNIT-II:

ELECTRODES AND TRANSDUCERS: Introduction, Electrode Theory, Bio potential Electrodes, Examples of Electrodes, Basic Transducer Principles, Active Transducers, Passive Transducers, Transducers for Biomedical Applications, Pulse Sensors, Respiration Sensor, Transducers with Digital Output.

UNIT-III:

CARDIOVASCULAR SYSTEM AND MEASUREMENTS: The Heart and Cardiovascular System, Electrocardiography, Blood Pressure Measurement, Measurement of Blood Flow and Cardiac Output, Measurement of Heart Sounds, Plethysmography.

UNIT-IV:

PATIENT CARE AND MONITORING: Elements of Intensive-Care Monitoring, Patient Monitoring Displays, Diagnosis, Calibration and Repair ability of Patient-Monitoring Equipment, Other Instrumentation for Monitoring Patients, Organization of the Hospital for Patient-Care Monitoring, Pacemakers, Defibrillators.

UNIT-V:

DIAGNOSTIC TECHNIQUES AND BIO-TELEMETRY: Principles of Ultrasonic Measurement, Ultrasonic Imaging, Ultrasonic Applications of Therapeutic Uses, Ultrasonic Diagnosis, X-Ray and Radio-Isotope Instrumentations, CAT Scan, Emission Computerized Tomography, MRI, Introduction to Biotelemetry, Physiological Parameters Adaptable to Biotelemetry, The Components of Biotelemetry System, Implantable Units, Telemetry for ECG Measurements during Exercise, Telemetry for Emergency Patient Monitoring

Text Books:

1. Bio-Medical Electronics and Instrumentation, Onkar N. Pandey, Rakesh Kumar, Katson Books.
2. Bio-Medical Instrumentation, Cromewell, Wiebell, Pfeiffer

References:

1. "Hand Book of Bio-Medical Instrumentation", Khandapur. McGraw Hill
2. "Introduction to Bio- Medical Equipment Technology", 4th Edition, Joseph J. Carr, John M. Brown, Pearson Publications.

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	2	0	2	3	V20ECTOE05
Name of the Course	Principles of Wireless Communications (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Discuss the cellular system evolution of mobile radio systems. **(K2)**
CO2: Illustrate the basic cellular concepts. **(K2)**
CO3: Explain the Various Propagation models. **(K2)**
CO4: Discuss the need of modulation, diversity and equalization in cellular & Mobile Communication. **(K2)**
CO5: Demonstrate the knowledge about GSM architecture, & upcoming technologies like 3G, 4G etc. **(K2)**

UNIT-I: Introduction of Wireless Communication History and evolution of mobile radio systems: Types of mobile wireless services/systems, WLL, Paging, Satellite systems.

UNIT-II: Cellular Concepts and System Design Fundamentals: Cellular concept and frequency reuse, channel assignment, handoff strategies, cell splitting, cell sectoring.

UNIT-III: Mobile radio Propagation Models: Radio wave propagation issues in personal wireless systems, Propagation models, Multipath fading.

UNIT-IV: Overview analog and digital modulation techniques Need For Modulation.

UNIT-V: Digital cellular networks: GSM architecture, GSM Services, multiple access schemes; FDMA, TDMA, CDMA, OFDMA;
Higher Generation Cellular Standards: 3G System architecture (UMTS), 4G System Architecture, Introduction to 5G.

Text Books:

1. Theodore S. Rappaport, —wireless communications Principles and Practices, PHI, 2005
2. Jochen Schiller, —Mobile Communications, Pearson Education, second edition, 2009.

Reference Books:

1. Lee W.C.Y, —Mobile communication Engineering
2. Theory and Applications, 2/e McGraw-Hill, New York, 2003
3. Andreas F. Molisch, —Wideband Wireless Digital Communication, Pearson Education 2001.

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	2	0	2	3	V20ECTOE06
Name of the Course	Basics of VLSI Design (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Identify the CMOS layout levels, and the design layers used in the process sequence. **(K2)**
CO2: Describe the general steps required for processing of CMOS integrated circuits. **(K2)**
CO3: Outline static CMOS combinational and sequential logic at the transistor level. **(K1)**
CO4: Demonstrate different logic styles such as complementary CMOS logic, pass-Transistor Logic, dynamic logic, etc. **(K3)**
CO5: Interpret the need for testability and testing methods in VLSI. **(K3)**

UNIT-I: Moore's law, speed power performance, n-MOS fabrication, CMOS fabrication: n-well, well processes, Bi-CMOS, Comparison of bipolar and CMOS. Basic Electrical Properties of MOS And Bi-CMOS Circuits: Drain to source current versus voltage characteristics, threshold voltage, trans conductance.

UNIT-II: Basic Electrical Properties of MOS And Bi-CMOS Circuits: n-MOS inverter, Determination of pull up to pull down ratio: n-MOS inverter driven through one or more pass transistors, alternative forms of pull up, CMOS inverter, Bi-CMOS inverters, latch up.
 Basic Circuit Concepts: Sheet resistance, area capacitance calculation, Delay unit, inverter delay, estimation of CMOS inverter delay, super buffers, Bi-CMOS drivers.

UNIT-III: MOS and Bi-CMOS Circuit Design Processes: MOS layers, stick diagrams, n-MOS design style, CMOS design style Design rules and layout & Scaling of MOS Circuits: λ - based design rules, scaling factors for device parameters

UNIT-IV: Subsystem Design and Layout-1: Switch logic pass transistor, Gate logic inverter, NAND gates, NOR gates, pseudo n-MOS, Dynamic CMOS Examples of structured design: Parity generator, Bus arbitration, multiplexers, logic function block, code converter.

UNIT-V: Subsystem Design and Layout-2: Clocked sequential circuits, dynamic shift registers, bus lines, General considerations, 4-bit arithmetic processes, 4-bit shifter, Regularity- Definition & Computation Practical aspects and testability: Some thoughts of performance, optimization and CAD tools for design and simulation.

Text Books:

1. "Basic VLSI Design", Douglas A Pucknell, Kamran Eshraghian, 3rd Edition, Prentice Hall of India publication, 2005.

References:

1. "CMOS Digital Integrated Circuits, Analysis And Design", Sung – Mo (Steve) Kang, Yusuf Leblebici, Tata McGraw Hill, 3rd Edition, 2003.
2. "VLSI Technology", S.M. Sze, 2nd edition, Tata McGraw Hill, 2003.

Semester	V- VII	L	T	P	C	COURSE CODE
Regulation	V20	2	0	2	3	V20ECTOE07
Name of the Course	Concepts of Embedded Systems (Open Elective)					
Branch	Common to All Branches					

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

- CO1:** Describe the Basic Concepts of embedded systems. **(K2)**
CO2: Describe the characteristics of Application & Domain-Specific Embedded Systems. **(K2)**
CO3: Explain the various elements of embedded hardware and their design principles. **(K2)**
CO4: Explain various software design approaches in embedded environment. **(K2)**
CO5: Discuss various tools used for Embedded system implementation and testing. **(K2)**

UNIT I: INTRODUCTION TO EMBEDDED SYSTEMS:

Introduction to Embedded Systems, Classification of Embedded systems, Major application areas of embedded systems, Purpose of embedded Systems, The Typical embedded system - core of the embedded system, Difference between RISC and CISC, Types of Memories.

UNIT II: CHARACTERISTICS OF EMBEDDED SYSTEM:

Characteristics of an embedded system, Quality attributes of embedded systems, Application-specific and Domain-Specific examples of an embedded system.

UNIT III: EMBEDDED HARDWARE DESIGN:

Analog Electronic Components, Digital electronic components, I/O types and examples, Serial communication devices (I2C, SPI, USB), GPRS, Watchdog timer, Real time Clock, Sensors and Actuators.

UNIT IV: EMBEDDED FIRMWARE DESIGN:

Embedded Firmware design approaches, Embedded Firmware development languages: Assembly level and High-level Programming Language, Advantages and Drawbacks of development languages, Concepts of C versus Embedded C and Compiler versus Cross-compiler.

UNIT V: EMBEDDED SYSTEM IMPLEMENTATION AND TESTING:

The main software utility tools - IDE and CAD, Translation tools - Pre-processors, Interpreters, Compilers and Linkers, Debugging tools, Quality assurance and testing of the design, Testing on host machine.

Text Books:

1. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013
2. Embedded Systems-By Shibu.K.V-Tata McGraw Hill Education Private Limited, 2013.

References:

1. Embedded Systems: Architecture, Programming and Design by Raj Kamal, Tata McGraw-Hill Education, 2011.
2. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
3. Embedded/Real Time Systems by KVKK Prasad by Dreamtech Publication.