20MA201 ENGINEERING MATHEMATICS I

L	T	P	C
3	1	0	4

Course Objective:

1. To teach the diagonalisation of the symmetric matrices and reduce quadratic forms to canonical forms using orthogonal transformation.
2. To impart knowledge on evolutes and envelopes.
3. To impart knowledge about functions of several variables, Taylors expansion in two variables and maxima and minima of functions of several variables.
4. To teach the various analytical methods of finding the solutions of linear differential equations with constant coefficients and variable coefficients.
5. To teach double and triple integrals and find areas and volumes using them.

Unit I MATRICES 12

Eigen values and Eigenvectors of a real matrix – Properties of Eigen values and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

Unit II DIFFERENTIAL CALCULUS 12

Radius of Curvature in Cartesian co-ordinates – Center and Circle of Curvature – Evolutes – Envelopes, Evolute as a envelope of its normal.

Unit III FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives – Euler‘s theorem - Jacobians – Taylor‘s expansion – Maxima and Minima – Constrained maxima and minima using Lagrangian Multipliers method.

Unit IV MULTIPLE INTEGRALS 12

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double integrals.

Unit V DIFFERENTIAL EQUATIONS 12

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Homogenous equation of Euler‘s and Legendre‘s type – Solution of simultaneous first order linear differential equations with constant coefficients.

Total : 60 Periods

Course Outcomes:

CO1 Find Eigen values and eigenvectors, diagonalization of a matrix, reduce quadratic form to canonical form.
CO2 Find evolutes and envelopes of standards curves.
CO3 Apply the concepts of functions of several variables to find maxima and minima of functions of several variables.
CO4 Apply various techniques in solving differential equations.
CO5 Find the area and volume using multiple integrals.

Text Books

1 GrewalB.S.,‖Higher Engineering Mathematics‖, Khanna Publishers, New Delhi , 43th Edition, 2014.

2 Veerarajan T, –Engineering Mathematics‖, Tata McGraw Hill Education Private Limited, 2017.

3 Kreyszig Erwin, –Advanced Engineering Mathematics –, John Wiley and Sons, 10th Edition, New Delhi, 2016.

References

1 Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition,2016.

2 Narayanan,S. and ManicavachagomPillai,T.K.,- "Calculus"Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.

3 Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.

4 Weir, M.D and Joel Hass, "Thomas Calculus", 12th Edition, Pearson India, 2016.

5 James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.

Web References

1 http://www.digimat.in/nptel/courses/video/111105035/L06.html

2 https://nptel.ac.in/courses/111/104/111104085/

3 https://www.youtube.com/watch?v=qN-klLYVeu4

		L	T	P	C
20PH201	**ENGINEERING PHYSICS**	**3**	**0**	**0**	**3**

Course Objective:

To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology

Unit I PROPERTIES OF MATTER **9**

Elasticity – types of moduli of elasticity (Qualitative) – Stress-strain diagram – Youngs‘ modulus-Rigidity modulus-Bulk modulus–Factors affecting elasticity-twisting couple of wire-Torsional pendulum-determination of rigidity modulus of a wire-Young‘s modulus by cantilever-uniform and non-uniform bending.

Unit II LASER AND FIBRE OPTICS **9**

Lasers: population of energy levels, Einstein_s A and B coefficients derivation – Semiconductor lasers homojunction and heterojunction – Industrial applications of laser. Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – fibre optic sensors: pressure and displacement.

Unit III ULTRASONICS **9**

Introduction–Properties of Ultrasonics- Production: Magnetostriction generator - Piezo electric

generator-Acoustic grating- Determination of wavelength and velocity of ultrasonic-applications- Cutting, welding and drilling-Non-destructive testing-Pulse echo system

Unit IV QUANTUM PHYSICS 9

Black body radiation – Planck_s theory (derivation) – Compton effect: experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger_s wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box.

Unit V CRYSTAL PHYSICS 9

Crystal systems - Bravais lattice - Lattice planes - Miller indices - Interplanar spacing in cubic lattice - Atomic radius, Coordination number and Packing factor for SC, BCC FCC and HCP crystal structures.

Total : 45 Periods

Course Outcomes:

CO1 Acquire knowledge on the basics of properties of matter and its applications

CO2 To have adequate knowledge on the concepts of fiber & Laser and their applications

CO3 To acquire knowledge on the concepts of Ultrasonics and their applications

CO4 To get knowledge on advanced Physics concepts of quantum theory and its applications

CO5 To understand knowledge on the concepts of the types and importance of crystal systems

Text Books

1 Bhattacharya, D.K. & Poonam, T., ‑Engineering Physics‖, Oxford University Press, First Edition, 2015

2 Gaur, R.K. & Gupta, S.L. , ‑Engineering Physics‖, Dhanpat Rai Publishers, 2nd Edition 2012

3 Pandey, B.K. & Chaturvedi, S., ‑Engineering Physics‖, Cengage Learning India, 1st Edition, 2012

References

1 Halliday, D., Resnick, R. & Walker, J. ―Principles of Physics‖. Wiley, 2015

2 Serway, R.A. & Jewett, J.W. ―Physics for Scientists and Engineers‖. Cengage Learning, 2010

3 Tipler, P.A. & Mosca, G. - Physics for Scientists and Engineers with Modern Physics_. W.H.Freeman, 2007

4 Arthur Beiser –Concepts of Modern Physics‖ Tata McGraw Hill, New Delhi – 2015

5 M.N Avadhanulu and PG Kshirsagar –A Text Book of Engineering physics‖ S. Chand and Company ltd., New Delhi 2016

6 Dr. G. Senthilkumar –Engineering Physics – I‖ VRB publishers Pvt Ltd., 2016

Web References

1 https://rmd.ac.in/dept/snh/notes/1/PHY/unit1.pdf

2 http://www.gpcet.ac.in/wp-content/uploads/2018/09/UNIT-1-EP-PDF.pdf

3 https://edurev.in/studytube/Ultrasonics-Engineering-Physics/69c2e4ad-43c2-4b74-8512-5603011fd403_t

4 http://en2k6.blogspot.com/2008/02/diffraction-of-light.html

20CY201 ENGINEERING CHEMISTRY

L	T	P	C
3	0	0	3

Course Objective:

1. To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
2. Develop knowledge on the basic principles of electrochemistry and understand the causes of corrosion.
3. To categorize different fuels and to understand its calorific value.
4. To develop an understanding of basic concepts of phase rule and the purpose of making alloys.
5. To develop fundamental knowledge in the area of polymer processing and all shaping operations used in the polymer industry.

Unit I WATER TECHNOLOGY 9

Hardness of water -types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water -Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

Unit II ELECTRO CHEMISTRY AND STORAGE DEVICES 9

Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation – reference electrodes –Calomel electrode - electrolysis of

water.
Batteries and fuel cells: Types of batteries- lead storage battery- nickel-cadmium battery- lithium battery, Lithium Sulphur Battery- fuel cell H_2 -O_2 fuel cell applications.

Unit III PHASE RULE AND ALLOYS 9

Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system.

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Ferrous and non-ferrous alloys – heat treatment of steel.

Unit IV FUELS AND COMBUSTION 9

Fuel Introduction- classification of fuels-analysis of coal - proximate and ultimate (determination of carbon and hydrogen)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) - petroleum- manufacture of synthetic petrol (Bergius process)- knocking-octane number - diesel oil- cetane number - natural gas- compressed natural gas (CNG)- liquefied petroleum gases(LPG). Power alcohol and bio diesel. Combustion of fuels: introduction- calorific value - flue gas analysis (ORSAT Method).

Unit V POLYMERS, PLASTICS AND COMPOSITES 9

Polymers – classification- Natural and synthetic. Thermoplastics - Thermosetting plastics – condensation and copolymerization Mechanism – Addition Polymerization: Engineering plastics PVC, PE, NYLON 6 and NYLON 66 Preparation, properties and applications. Techniques of Polymerization – Bulk and Suspension: Polymer composites – FRP and ceramic matrix composites.

Total : 45 Periods

Course Outcomes:

CO1 To understand the basic parameters of water, different water softening processes and effect of hard water in industries.
CO2 To develop an alternate energy source and to know the working of storage devices.
CO3 To understand industrial importance of phase rule and alloys
CO4 To summarize the various types of fuels and their real time applications in locomotives.
CO5 To synthesize polymers of commercial importance and additives for plastics.

Text Books

1 Ravikrishnan A., ―Engineering Chemistry‖, Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2019.
2 Pandey, B.K. & Chaturvedi, S., ―Engineering Physics‖. Cengage Learning India, 1st Edition, 2012.

References

1 S. Bahl, G.D.Tuli and ArunBahl ‐Essentials of Physical Chemistry:,S.Chand and Company Ltd,New Delhi, 2004.

2 Glasstone S., Electrochemistry, 5th edition, Maurice Press, USA, 2004.

3 P.C.Jain and Monica Jain, ‐Engineering Chemistry‖, 15th Edition, DhanpatRai Publishing Company (P),Ltd,New Delhi, 2007.

Web References

1 http://www.chemistry.wustl.edu/~edudev/LabTutorials/Water/FreshWater/hardness.html

2 https://en.wikipedia.org/wiki/Electrochemical_cell

3 http://www.brainkart.com/article/Phase-Rule-and-Alloys_6793/

4 https://nptel.ac.in/courses/103/105/103105110/

20EN101 TECHNICAL ENGLISH – I

L	T	P	C
3	0	0	3

Course Objective:

1. To enable students acquire listening and speaking skills in both formal and informal contexts.
2. To help learners develop their reading skills by familiarizing them with different types of reading strategies.
3. To equip the students with necessary skills for technical writing.

Unit I INTRODUCTION 9

Grammar and Vocabulary – Parts of Speech, Use of Tense – Present and One word Substitute. **Listening and Speaking** – Speaking about one‘s place, important festival, introducing oneself and speaking about one‘s family. **Reading** -- Reading Comprehension, skimming a reading passage scanning for specific information. **Writing** –Autobiographical Writing (Writing about one‘s leisure time activities, hometown, etc.)

Unit II READING AND STUDY SKILLS 9

Grammar and Vocabulary –, Subject verb Agreement, Words often confused. **Listening and Speaking** – Small talk, introducing one‘s friends and talking about daily activities. **Reading Comprehension** – Reading letters and interpreting the content. **Writing** – Personal Letters.

Unit III TECHNICAL WRITING AND GRAMMAR 9

Grammar and Vocabulary – Framing and expanding Compound Nouns, Past Tense, Synonyms and Antonyms. **Listening and Speaking** – Practice telephone skills and telephone etiquette (listening and responding, asking questions). **Reading -** making inference from the

reading passage - predicting the content of a reading passage - Summarizing. **Writing** – Writing Instructions and recommendations.

Unit IV REPORT WRITING 9

Grammar and Vocabulary — Cause and Effect, Active and Passive voice, Idioms and Phrases. **Listening and Speaking** – Asking and Responding to questions**. Reading** – Reading short stories for appreciation. **Writing** - Feasibility and Project Reports.

Unit V LISTENING AND SPEAKING SKILLS 9

Grammar and Vocabulary – Numerical Expression, Writing Definition and Future tense, Count/Uncountable Nouns. **Listening and Speaking** - Purchasing goods from shop and making enquiries. Holiday and Travel. **Reading**- Critical reading to analyze and interpret visual data, Note making. **Writing** – Analysis and Interpretation of data (Flow chart, Bar chart, Table & Pie chart).

Total : 45 Periods

Course Outcomes:

CO1 Improve their lexical, grammatical and communicative competence.
CO2 Enhance their communicative skills in real life situations.
CO3 Improve their oral and written communication skills.
CO4 Develop their employability and soft skills.
CO5 Speak appropriately and effectively in varied formal and informal contexts.

Text Books

1 Rajeevan Kaval,―English Grammar just for you‖, Oxford University Press 2015.
2 Sabina Pillai, ―Spoken English for my World‖, Oxford University Press 2016.

References

1 Meenakshi Raman and Sangeetha Sharma. ‗Technical Communication - Principles and Practice‖, Oxford University Press, 2009.
2 Rizvi, Ashraf. M., ‗Effective Technical Communication‖ Tata McGraw-Hill, New Delhi. 2005

Web References

1 www.englishclub.com
2 www.englishhilfen
3 www.owl.english.purdue.edu
4 www.indiabix.com

20CS301	PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objective:

1. Explain importance of python and describing its need as a programming language and to strengthen the knowledge of python to the student

Unit I INTRODUCTION **9**

Introduction to Python What is Python - Advantages and Disadvantages, Benefits and Limitation- Downloading and Python-installation-Python Versions-Running Python Scripts, Executing scripts with python launcher-Using interpreter interactively- Using variables-String types: normal, raw and Unicode-String operations and functions- Math operator and functions.

Unit II FUNCTIONS, TUPES, DICTIONARIES **9**

Raw input and input- Indentation-Boolean-Conditional Statements (if,elif)-Looping-Functions-Build-in Functions, User Defined Functions- Using List (index & slicing, list comprehensions)-Dictionaries -Tuples - Set- Operations and functions of Data types

Unit III PANDA LIBRARY FOR DATA AGGREGATION **9**

Using pandas-the data analysis libraries-Series and data frames-Pandas Series, Pandas Data frame, Series functionality, Data frame functionality-Grouping, Aggregating and applying-Merging and joining

Unit IV EXCEPTION HANDLING **9**

Dealing with Syntax error-Exceptions-Zero division error, Type division error, Name error-Handling Exception with try or Except, file handling.

Unit V REGULAR EXPRESSIONS **9**

Regular Expression: Regular expression objects- Pattern matching-Parsing data

Total : 45 Periods

Course Outcomes:

CO1: Identify and use various in-built functions, operators and statements supported by python.
CO2: To Have knowledge of basic searching and sorting algorithms
CO3: To have knowledge of python libraries for Data Aggregation
CO4: Identify Exceptions and use various technique to handle the errors and exceptions
CO5: To have knowledge about Regression and Regular Expression for Data Analysis

Text Books

1 IBM CE- Software Foundation with Python Programming by IBM CE 2018

References

1 Python Programming: An Introduction to Computer Science, 3rd Edition by John Zelle

2 Python Crash Course: A Hands-On, Project-Based Introduction to Programming Nov 2015 by Eric Matthes

3 Python: The Complete Reference Paperback – 20 Mar 2018 by Martin C. Brown

Web References

1 https://www.onlinegdb.com › online_python_compiler

2 https://www.python.org › shell

20PC201	**PHYSICS AND CHEMISTRY LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

Course Objectives:

1. To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
2. Develop knowledge on the basic principles of electrochemistry and understand the causes of corrosion.
3. To categorize different fuels and to understand its calorific value.
4. To develop an understanding of basic concepts of phase rule and the purpose of making alloys.
5. To develop fundamental knowledge in the area of polymer processing and all shaping operations used in the polymer industry.

List of Experiments

S. No	**Name of the Experiments**
	PHYSICS LABORATORY (Any five experiments)
1	Determination of rigidity modulus – Torsion pendulum

2 Determination of Young‘s modulus by non-uniform bending method

3 Determination of wavelength of Laser and determination of acceptance angle in an optical fiber

4 Determination of thermal conductivity of a bad conductor – Lee‘s Disc method.

5 Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer

6 Determination of wavelength of mercury spectrum – spectrometer grating

7 Determination of band gap of a semiconductor

8 Determination of thickness of a thin wire – Air wedge method

CHEMISTRY LABORATORY (Any five experiments)

1 Determination of chloride content of water sample by argentometric method.

2 Determination of strength of acids in a mixture using conductivity meter.

3 Conductometric titration of strong acid vs strong base.

4 Determination of alkalinity in water sample.

5 Determination of total, temporary & permanent hardness of water by EDTA method

6 Estimation of iron content of the given solution using potentiometer.

7 Conductometric precipitation titration using BaCl2 and Na2SO4

Total: 60 Periods

Course Outcomes:

CO1 Apply principles of elasticity, optics and thermal properties for engineering applications.
CO2 Analyze water sample for hardness and to estimate other impurities present in water.
CO3 Gain knowledge in problem solving, critical thinking and analytical reasoning as applied to scientific problems.
CO4 Take measurements in a physics laboratory and analyze the measurements to draw valid conclusions.
CO5 Write scientific communication and will prove that they can think critically and work independently.

20CS302	PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:

To gain knowledge on Python Programming includes array, collections, pandas, file handling and understanding the ability of regular expression

List of Experiments

S. No	Name of the Experiments
1	Program to print all prime number in an interval (programs on loops)
2	Program to display multiplication table (programs on operators)
3	Program to count the frequency of words in a file. (programs on files)
4	Program to create a calculator using function (programs on function)
5	Program to transpose a matrix (programs on arrays)
6	Program to remove punctuation from a string (programs on string)
7	Program to left rotate the elements of an array (programs on arrays)
8	Program to convert a given binary tree to a doubly linked list (programs on data structure)
9	Program to create and display a one-dimensional array-like object containing an array of data using Pandas module. (programs on pandas)
10	Program to add, subtract, multiple and divide two Pandas Series.
11	Sample Series: [2, 4, 6, 8, 10], [1, 3, 5, 7, 9] (programs on pandas)
12	Pandas program to find the index of a substring of DataFrame with beginning and end position. (programs on pandas)
13	Pandas program to extract the sentences where a specific word is present in a given column of a given DataFrame. (programs on pandas)

Total: 60 Periods

Course Outcomes:

CO1 Detect diversified solutions using python language.

CO2 Illustrate file access

CO3 Illustrate pandas

CO4 Illustrate regular expression

20TP701	SOFT SKILLS & APTITUDE – I	L	T	P	C
		0	0	2	1

Course Objective:

1. Introduce students to building blocks of Logical reasoning and Quantitative Aptitude
2. Train students on essential grammar for placements
3. Introduce students on scientific techniques to pick up skills
4. Provide an orientation for recruiter expectation in terms of non-verbal skills, and for how to build one‘s career with placements in mind

Unit I LESSONS ON EXCELLENCE 2

Skill introspection, Skill acquisition, consistent practice

Unit II LOGICAL REASONING 10

Thinking Skill

- Problem Solving
- Critical Thinking
- Lateral Thinking

Taught through thought-provoking word and rebus puzzles, and word-link builder Questions

Coding & decoding, Series, Analogy, Odd man out and Visual reasoning

- Coding and Decoding
- Series
- Analogy
- Odd Man Out
- Visual Reasoning

Sudoku puzzles

Solving introductory to moderate level sudoku puzzles to boost logical thinking and comfort with numbers

Attention to detail

Picture and word driven Qs to develop attention to detail as a skill

Unit III QUANTITATIVE APTITUDE 10

Speed Maths

- Addition and Subtraction of bigger numbers
- Square and square roots
- Cubes and cube roots
- Vedic maths techniques
- Multiplication Shortcuts
- Multiplication of 3 and higher digit numbers
- Simplifications
- Comparing fractions
- Shortcuts to find HCF and LCM
- Divisibility tests shortcuts

Algebra and functions

Unit IV RECRUITMENT ESSENTIALS 5

Looking at an engineering career through the prism of an effective resume

- Importance of a resume - the footprint of a person's career achievements
- How a resume looks like?
- An effective resume vs. a poor resume: what skills you must build starting today and how?

Impression Management

Getting it right for the interview:

- Grooming, dressing
- Body Language and other non-verbal signs
- Displaying the right behavior

Unit V VERBAL ABILITY **2**

Essential grammar for placements:

- Nouns and Pronouns
- Verbs
- Subject-Verb Agreement
- Pronoun-Antecedent Agreement
- Punctuations

Verbal Reasoning

Total : 30 Periods

Course Outcomes:

CO1 Enable students to solve questions on Verbal, Logical and Quantitative Aptitude of placement level

		L	T	P	C
20MA202	**ENGINEERING MATHEMATICS 1I**	**3**	**1**	**0**	**4**

Course Objective:

1. To use numerical methods to obtain approximate solutions to system of equations.
2. To acquaint the students with concepts of Line integral, Surface integral and volume integral and theorems based on that.
3. To describe basic properties of analytical functions and the concept of some standard transformations.
4. To teach the basic properties of complex integration and to evaluate on circular and semicircular contour.
5. To teach Laplace Transform and solve differential equations using Laplace transformations.

Unit I SOLUTION OF EQUATIONS 12

Solution of algebraic and transcendental equations – Fixed point iteration method – Newton Raphson method – Solution of linear system of equations – Gauss elimination method – Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel.

Unit II VECTOR CALCULUS 12

Gradient and Directional Derivative – Divergence and Curl – Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral – Volume integral – Green's, Gauss divergence and Stoke's theorems – Verification for flat surfaces.

Unit III COMPLEX VARIABLES 12

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates – Properties – Harmonic conjugates – Construction of analytic function – Conformal Mapping: $w = c + z,\ cz,\ 1/z,\ z^2 -$ Bilinear Transformations.

Unit IV COMPLEX INTEGRATION 12

Line integral – Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Evaluation of circular contour and semicircular contour.

Unit V LAPLACE TRANSFORMS 12

Existence conditions – Transforms of elementary functions – Shifting theorems – Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions –Solution of linear second order ordinary differential equations with constant coefficients.

Total : 60 Periods

Course Outcomes:

CO1 Find solutions to the algebraic and transcendental equations.
CO2 Evaluate the line integral, surface integral, volume integral and verify the theorems.
CO3 Construct analytic functions and understand the concept of mappings.
CO4 Understand the concept of Complex integrations and compute around circular and Semi circular contour.
CO5 Understand Laplace transform techniques and solve differential equations using Laplace Transforms.

Text Books

1 Grewal B.S., –Higher Engineering Mathematics‖, Khanna Publishers, New Delhi, 43^{rd} Edition, 2014

2 Kreyszig Erwin, –Advanced Engineering Mathematics –, John Wiley and Sons, 10th Edition, New Delhi, 2016.

References

1 Burden, R.L and Faires, J.D, –Numerical Analysis‖, 9th Edition, Cengage Learning, 2016.

2 Bali N., Goyal M. and Watkins C., –Advanced Engineering Mathematics‖, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3 Jain R.K. and Iyengar S.R.K., –Advanced Engineering Mathematics‖, Narosa Publications, New Delhi, 3rd Edition, 2007.
4 O'Neil, P.V. –Advanced Engineering Mathematics‖, Cengage Learning India Pvt., Ltd, New
Delhi, 2007
5 Wylie, R.C. and Barrett, L.C., –Advanced Engineering Mathematics –Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

Web References

1 https://www.youtube.com/watch?v=NED2Cl8u9Q0

2 https://www.youtube.com/watch?v=q01b-lV6y5Q

3 https://www.youtube.com/watch?v=nDD16hiutdc

20EN102 TECHNICAL ENGLISH – II

L	T	P	C
3	0	0	3

Course Objective:

1. To inculcate reading and writing habits in order to develop effective and efficient Communication skill.
2. To equip the students with necessary skills for technical writing.
3. To emphasize specially the development of speaking skills amongst students of engineering.

Unit I REASONING SKILLS **9**

Grammar and Vocabulary – Modal Verb, Words used as Noun and Verb. **Listening and Speaking** – Opening a conversation (greetings, comments on topics like weather etc.), closing a conversation (excuse, general wishes, positive comments and thanks) **Reading** – Developing analytical skills, deduction and inductive reasoning- Extensive reading. **Writing** - Letter to the editor via email, checklist.

Unit II CRITICAL READING & WRITING **9**

Grammar and Vocabulary – Conditional clauses, Prepositions, word formation using prefixes and suffixes. **Listening and Speaking** –Asking and giving directions, discussing various aspects of a book or a movie they have read or seen. **Reading** –Reading an article from newspaper-Critical reading. **Writing** – Writing Review of a given article/ passage, Writing summary.

Unit III INTERPRETATION OF DATA 9

Grammar and Vocabulary – Reported Speech, Homonyms and Homophones. **Listening and Speaking** – Seeking information and permission, expressing feelings (affection, anger and request), turn taking. **Reading** – Speed reading- reading passages with time limit. **Writing** – Interpreting Poster and advertisements and expanding a proverb.

Unit IV COMPREHENSION SKILLS 9

Grammar and Vocabulary – Purpose and Function Statement, Connectives and Phrasal Verbs **Listening and Speaking** –Talking about jobs and job interviews and negotiation skills. **Reading** – Reading short stories and passages – comprehension skills. **Writing** – Job Application Letter with Resume

Unit V FORMAL COMMUNICATION 9

Grammar and Vocabulary –Idioms and Phrases, Comparative Adjectives and error analysis. **Listening and Speaking** – Meetings and Group Discussion (initiating a discussion, exchanging suggestions and proposal, expressing dissent, agreement and assertiveness in expressing opinion. **Reading** – Note making skills – making notes from books or any written material-intensive reading. **Writing** – Proposal Writing and Jumbled sentences.

Total : 45 Periods

Course Outcomes:

CO1 Developing analytical skills, deduction and inductive reasoning
CO2 Develop the skill set to interpret data
CO3 Enhance formal and informal communication
CO4 Develop writing skills including project proposals
CO5 Express ideas and opinions in an effective manner

Text Books

1 Rajeevan Kaval. ―English Grammar just for you‖, Oxford University Press 2015.
2 Sabina Pillai. ―Spoken English for my World‖, Oxford University Press 2016

References

1 Meenakshi Raman and Sangeetha Sharma. ―Technical Communication - Principles and Practice‖, Oxford University Press, 2009.
2 Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005

Web References

1 www.englishclub.com

2 www.englishhilfen

3 www.owl.english.purdue.edu

4 www.indiabix.com

20PH202	PHYSICS OF MATERIALS	L	T	P	C
		3	0	0	3

Course Objective:

To understand the essential principles of Physics of electrical and magnetic materials and its properties. Become proficient in dielectric property, electromagnetic property and nano materials

Unit I ELECTRICAL PROPERTIES OF CONDUCTING MATERIALS 9

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Wiedemann-Franz law – Success and failures - Fermi- Dirac statistics – Density of energy states carrier concentration in metals - Energy bands in solids– tight binding approximation - Electron effective mass – concept of hole.

Unit II MAGNETIC PROPERTIES OF MATERIALS 9

Origin of Magnetism in materials – magnetic field and induction – magnetization - magnetic permeability and susceptibility–types of magnetic materials – Ferromagnetism: origin and exchange interaction- saturation magnetization and Curie temperature – Domain Theory, Hysteresis theory, soft and hard magnetic materials. Applications of Magnetic materials.

Unit III SEMICONDUCTOR PHYSICS 9

Introduction- types of semiconductors - Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Hall effect theory (n-type and p-type semiconductors) and its experiment- Applications.

Unit IV DIELECTRIC PROPERTIES OF MATERIALS 9

Dielectric materials: various types of Polarization mechanisms – Electronic, Ionic, Orientation and space charge polarization- Frequency and temperature dependence of polarization- dielectric loss – internal field – Clausius - Mosotti relation- various dielectric breakdown mechanisms- Applications of dielectric materials-Ferro electric Materials-Properties and applications.

Unit V NANO MATERIALS AND ITS APPLICATONS 9

Nanomaterials Introduction – synthesis-top down and bottom up approach- -physical vapour deposition-quantum dots - size dependence of Fermi energy– quantum confinement – applications- transistor-MOSFET- LED-Carbon nanotubes: preparation- chemical vapour deposition-properties and applications-Energy storage devices.

Total : 45 Periods

Course Outcomes:

CO1 To gain knowledge on electrical properties of materials
CO2 Acquire knowledge on basics of magnetic materials and its applications in variousdevices
CO3 To get knowledge on semiconductor and its applications
CO4 To have the necessary understanding on dielectric materials and its applications
CO5 To understand the basics of nano materials and their applications

Text Books

1 Kasap, S.O. ―Principles of Electronic Materials and Devices‖, McGraw-Hill Education, 3rd edition 2007.
2 Umesh K Mishra & Jasprit Singh, ―Semiconductor Device Physics and Design, springer, 2008.
3 Wahab, M.A. ―Solid State Physics: Structure and Properties of Materials, Narosa PublishingHouse, 2009.

References

1 Garcia, N. & Damask, A. ―Physics for Computer Science Students. Springer-Verlag, 2012.
2 Hanson, G.W. ―Fundamentals of Nanoelectronics. Pearson Education, 2009
3 Rogers, B., Adams, J. & Pennathur, S. ―Nanotechnology: Understanding Small Systems. CRC Press, 2014

Web References

1 https://www.nitsri.ac.in/Department/PHYSICS/Engg_physics.pdf
2 https://www.askiitians.com/iit-jee-magnetism/magnetic-properties-of-materials/
3 https://www.electronics-tutorials.ws/diode/diode_1.html
4 https://onlinelibrary.wiley.com/doi/pdf/10.1002/9783527805310.ch1
5 https://www.mitre.org/sites/default/files/pdf/nano_overview.pdf

20ME301 ENGINEERING GRAPHICS

L	T	P	C
3	0	0	3

Course Objective:

1. To understand general theory of projection, with a focus on the use of orthographic projection to represent three-dimensional objects in two-dimensional views.
2. To understand the application of industry practices and techniques in graphics engineering.
3. To apply auxiliary or sectional views to mostly represent engineered components.
4. To get exposure to dimension and annotate of two-dimensional design drawings.
5. To practice free hand 3D pictorial sketching to help with the visualisation process and to communicate ideas graphically and efficiently.

Unit I INTRODUCTION TO ENGINEERING DRAWING **9**

Principles of Engineering Drawing / Graphics – Various Drawing Instruments – Conventions in Drawing- Dimensioning – Lettering practice – BIS Conventions. Construction of Conic Sections using Eccentricity Method- Cycloid, Epicycloid and Hypocycloid –construction of Involutes of a circle and square- Drawing of tangents and normal to the above curves.

Unit II ORTHOGRAPHIC PROJECTION, PROJECTION OF POINTS AND LINES **9**

Orthographic Projection Rules – Conventions –First angle projection – Introduction to Third angle Projection, Projection of Points in all quadrants-Projection of Lines parallel and inclined to both planes(First angle Projection only).

Unit III PROJECTION OF PLANES AND SOLIDS **9**

Projection of regular planes - Plane inclined to both reference planes-Projections of regular solids - prisms and pyramids inclined to both planes.

Unit IV SECTION AND DEVELOPMENT OF SOLIDS **9**

Sectioning of solids- prisms, pyramids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section.- Development of lateral surfaces of simple and truncated solids –cylinders and cone

Unit V ISOMETRIC AND PERSPECTIVE PROJECTION **9**

Principles of Isometric Projection – Isometric Scale – Isometric Views– Conventions –Simple and combination of two solid objects in simple vertical positions-Perspective projection of prisms, pyramids and cylinders by visual ray method.

Total : 45 Periods

Course Outcomes:

CO1 Understanding of basic concepts of conic sections, cycloids and involutes of various shapes of engineering products.
CO2 Drawing the projection of points, lines and orthographic views of engineering components.
CO3 Projection of planes and projection of solids at different positions.
CO4 Visualization of sectional views of solids and development of surfaces
CO5 Drawing isometric projection and perspective views of an object/solid
CO6 Application of the concepts of drawing in practice.

Text Books

1 Natarajan C and Sundaramoorthy R, –Engineering Graphics‖, Tata McGraw-Hill Publishers, 2020.

2 Bhatt N.D. and Panchal V.M., –Engineering Drawing‖, Charotar Publishing House, 53rd Edition, 2014.

3 Venugopal K. and Prabhu Raja V., –Engineering Graphics‖, New Age International (P) Ltd, 2015.

References

1 Basant Agarwal and Agarwal C.M., –Engineering Drawing‖, Tata McGraw Hill Publishing Company Limited, New Delhi, 2009.

2 Gopalakrishna K.R., –Engineering Drawing‖ (Vol. I&II combined), Subhas Stores, Bangalore, 2007.

3 Luzzader, Warren.J. and Duff,John M., –Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production‖, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.

4 N S Parthasarathy and Vela Murali, –Engineering Graphics‖, Oxford University, Press, New Delhi,2015.

5 Shah M.B., and Rana B.C., –Engineering Drawing‖, Pearson, 2nd Edition, 2009

Web References

1 http://www.engineeringdrawing.org/

2 http://nptel.ac.in/courses/112103019/

3 http://freevideolectures.com/Course/3420/Engineering-Drawing

20CS424	JAVA FUNDAMENTALS	L	T	P	C
		3	0	0	3

Course Objective:

1. To understand Object Oriented Programming concepts and basic characteristics of Java
2. To gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
3. To understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and exception handling mechanisms.
4. To understand the principles of inheritance, packages and interfaces.
5. To Understand the basics of Exception Handling & Multi threading and how to handle events

Unit I INTRODUCTION TO OOP **9**

Introduction to OOP and its basic features, Classes, objects, data types,data members, abstraction, member functions, Polymorphism, Types of Inheritance and Interface – JVM Architecture - Basics of Java programming, Data types, Variables, Operators, Arrays.

Unit II JAVA FUNDAMENTALS **9**

Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java Basics of objects and classes in java, Constructors and Destructors, Static, super and final keywords – this pointer - Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, StringBuffer, File, this reference.

Unit III INHERITANCE AND JAVA PACKAGES **9**

Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, Util package.

Unit IV THREADS AND EXCEPTION HANDLING **9**

Thread - Thread life cycle and methods, Runnable interface, Multi-threading - Thread synchronization, Exception handling with try-catch-finally – Nested try-catch – User defined Exception **–** Files – IO streams

Unit V GENERIC PROGRAMMING AND COLLECTIONS **9**

Generics – Generic form of a generic class – Generic methods – Generic interface - Generic class hierarchies – Collections overview – Collection interfaces- Collection classes – Working with maps – Comparators.

Total : 45 Periods

Course Outcomes:

CO1 Demonstrate Java application programs using OOP principles and proper program structuring
CO2 Solve the inter-disciplinary applications using the concept of Inheritance
CO3 Demonstrate the concepts of Packages and inheritance
CO4 Analysis the error handling techniques using exception handling
CO5 Develop application using multi-threading and java swing

Text Books

1 The Complete Reference, Java 2 (Ninth Edition), Herbert Schild, TMH, 2017

2 Core Java Volume-I Fundamentals, Eleventh Edition, Horstmann & Cornell, Pearson Education

References

1 E. Balagurusamy, Java Programming with premier, second edition, Tata Mcgraw Hill, 2016.

2 KEN ARNOLD, Java Programming Language, Addison Wesely, 2000

3 John R Hubbard, Programming with Java, Tata Mcgraw Hill, 1998

Web References

1 https://www.edx.org/learn/java

2 https://trainings.internshala.com/java-traininghttps://dzone.com/articles/top-5-java-online-courses-for-beginners

3 https://onlinecourses-archive.nptel.ac.in/noc19_cs07

20CS425	JAVA PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:

1. To understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and exception handling mechanisms.
2. To understand the principles of inheritance, packages and interfaces.
3. To understand the basics of Exception Handling &Multi-threading
4. To develop applications using generic programming and event handling.

List of Experiments

S. No	Name of the Experiments
1	Programs using class and methods using Java

2	Implementation of Inheritance using Java
3	Inheritance via Interface and Abstract class
4	Programs on Package implementations
5	Implementation of Java Applications using Generic collections
6	Demonstration of IO Streams in Java
7	Demonstration of User Defined Exception handling in Java
8	Implementation of multi-threading in Java
9	Program using Applet with event handling
10	Program to demonstrate Layout Managers in Java
11	File Handling in Java

Total: 60 Periods

Course Outcomes:

CO1 Develop and implement Java programs for simple applications that make use of classes ,packages and interfaces

CO2 Analysis to handle I/O with exception handling

CO3 Develop and implement Java programs with exception handling and multithreading

CO4 Develop GUI with event handling

CO5 Design applications using file processing, generic programming and event handling.

20ME302	**ENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

Course Objectives:

1.To understand the basic manufacturing process like welding, molding, fitting, assembling, smithy and carpentry works

2. To practice using of basic manufacturing hand tools and equipment

3. To understand and practice in linear measuring devices

4. To understand the working of basic electrical and electronic equipment

5. To Analyze the electrical wiring concepts

List of Experiments

S. No	Name of the Experiments

I) CIVIL ENGINEERING

Buildings

1	Study of plumbing and carpentry components of residential and industrial buildings and Safety aspects.

Plumbing Works

1	Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers and elbows in household fittings.
2	Study of pipe connections requirements for pumps and turbines.
3	Preparation of plumbing line sketches for water supply and sewage works.
4	Hands-on-exercises: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
5	Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only

1	Study of the joints in roofs, doors, windows and furniture.
2	Hands-on-exercises: Wood work, joints by sawing, planning and cutting.

II) MECHANICAL ENGINEERING PRACTICE

Welding

1	Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
2	Gas welding practice

Basic Machining:

1	Simple Turning and Taper turning
2	Drilling Practice

Sheet Metal Work

1	Forming & Bending
2	Model making – Trays and funnels.

3 Different type of joints.

Machine assembly practice

1 Study of Pumps

2 Study of air conditioner

3 Study of Computer Assembly

Demonstration on

1 Smithy operations, upsetting, swaging, setting down and bending.

2 Foundry operations like mould preparation for gear and step cone pulley.

3 Fitting – Exercises – Preparation of square fitting and V – fitting models.

III) ELECTRICAL ENGINEERING PRACTICE

1 Residential house wiring using switches, fuse, indicator, lamp and energy meter.

2 Fluorescent lamp wiring.

3 Stair case wiring

4 Measurement of electrical quantities – voltage, current, power & power factor in R Circuit.

5 Measurement of energy using single phase energy meter.

6 Measurement of resistance to earth of electrical equipment.

IV) ELECTRONICS ENGINEERING PRACTICE

Study of all types of Active and Passive Electronic components and equipment‘s.

Measurement of resistance value and its tolerances using colour coding method.

Measurement of AC signal parameters using CRO.

Study of logic gates AND, OR, EXOR and NOT.

Generation of Clock Signal using IC 555 timer.

Soldering and De-soldering using discrete components.

Measurement of ripple factor of HWR and FWR.

Total: 60 Periods

Course Outcomes:

CO1 Exposure to various manufacturing process like smithy, carpentry, assembling, welding and different machines.
CO2 Understanding the various hand tools used in the basic mechanical engineering workshop sections-smithy, carpentry, assembling and welding.

CO3 Developing various shapes through different manufacturing methods
CO4 Exposure to the working of electrical equipments .
CO5 Analysis of the working concepts of various electronic components and their parameters.
CO6 Analysis of the parameters of timer circuit & rectifier circuit.

		L	T	P	C
20TP702	**SOFT SKILLS & APTITUDE – II**	**0**	**0**	**2**	**1**

Course Objective:

1. Solve Logical Reasoning questions of easy to intermediate level
2. Solve Quantitative Aptitude questions of easy to intermediate level
3. Solve Verbal Ability questions of easy to intermediate level

Unit I LOGICAL REASONING 11

Word group categorization questions

Puzzle type class involving students grouping words into right group orders of logical Sense

Cryptarithmetic

Data arrangements and Blood relations

- Linear Arrangement
- Circular Arrangement
- Multi-dimensional Arrangement
- Blood Relations

Unit II QUANTITATIVE APTITUDE 10

Ratio and Proportion

- Ratio
- Proportion
- Variation
- Simple equations
- Problems on Ages
- Mixtures and alligations

Percentages, Simple and Compound Interest

- Percentages as Fractions and Decimals
- Percentage Increase / Decrease

- Simple Interest
- Compound Interest
- Relation Between Simple and Compound Interest Number System
- Number system
- Power cycle
- Remainder cycle
- Factors, Multiples
- HCF and LCM

Unit III VERBAL ABILITY 9

Essential grammar for placements

- Prepositions
- Adjectives and Adverbs
- Tenses
- Forms and Speech and Voice
- Idioms and Phrasal Verbs
- Collocations, Gerund and Infinitives

Reading Comprehension for placements

- Types of questions
- Comprehension strategies
- Practice exercises

Articles, Prepositions and Interrogatives

- Definite and Indefinite Articles
- Omission of Articles
- Prepositions
- Compound Prepositions and Prepositional Phrases
- Interrogatives

Vocabulary for placements

- Exposure to solving questions of
- Synonyms
- Antonyms
- Analogy
- Confusing words
- Spelling correctness

Total : 30 Periods

Course Outcomes:

CO1 Enable students to approach learning Aptitude with ease, and understand recruiter expectation

20MA204 DISCRETE MATHEMATICS

L	T	P	C
3	1	0	4

Course Objective:

1. To teach logics and mathematical reasoning.
2. To acquaint the basic concepts of combinatorics.
3. To acquaint the knowledge of applying graph theory to solve real-world problems.
4. To familiarize the fundamental concepts of groups.
5. To introduce the concepts and significance of lattices and Boolean algebra which are widely used in computer science and engineering.

Unit I MATHEMATICAL LOGIC **12**

Propositional logic – Propositional equivalences - Predicates and quantifiers – Rules of inference.

Unit II COMBINATORICS **12**

Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions.

Unit III GRAPHS AND TREES **12**

Basic Definitions – Some Special Graphs – Matrix Representation of Graphs - Graph isomorphism - Eulerian and Hamiltonian Graphs – Trees –Minimal spanning Trees - Kruskal's algorithm.

Unit IV GROUPS **12**

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism‘s – Normal subgroup and cosets – Lagrange‘s theorem.

Unit V LATTICES AND BOOLEAN ALGEBRA **12**

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra**.**

Total : 60 Periods

Course Outcomes:

CO1 Understand the concepts needed to test the logic of a program.
CO2 Solve recurrence relations.
CO3 Understand various Graph models and Kruskal‘s algorithm.
CO4 Understand the concepts and properties of algebraic structures such as groups.
CO5 Understand the concepts of lattices and Boolean algebra.

Text Books

1 Rosen, K.H., "Discrete Mathematics and its Applications with combinatorics and

Graph Theory", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 2015
2 Tremblay, J.P. and Manohar.R, " Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint,2011

References;

1 Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007
2 Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum_s Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition,2010
3 Koshy, T. "Discrete Mathematics with Applications", Elsevier Publications,2006.

Web References;

1 https://nptel.ac.in/courses/111/107/111107058/

2 https://nptel.ac.in/courses/106/102/106102064/

3 http:www.infocobuild.com/education/audio-video-course /mathematics / DiscreteMathematics /CMI/lecture-38.html

4 http://www.infocobuild.com/education/audio-video-courses/mathematics/Discrete Mathematics-CMI/lecture-44.html

20EC304	DIGITAL PRINCIPLES AND SYSTEM DESIGN	L	T	P	C
		3	0	0	3

Course Objective:

1. To design digital circuits using simplified Boolean functions
2. To analyze and design combinational circuits
3. To analyze and design synchronous and asynchronous sequential circuits
4. To understand Programmable Logic Devices
5. To write HDL code for combinational and sequential circuits

Unit I BASIC CONCEPTS OF DIGITAL SYSTEMS 9

Number Systems - Arithmetic Operations - Boolean Algebra and Logic Gates - Theorems and Properties of Boolean Algebra - Boolean Functions - Canonical and Standard Forms - Simplification of Boolean Functions using Karnaugh Map and Tabulation method.

Unit II COMBINATIONAL CIRCUITS 9

Combinational Circuits – Analysis and Design Procedures - Binary Adder-Subtractor - Decimal Adder - Binary Multiplier - Magnitude Comparator - Decoders – Encoders – Multiplexers -

Introduction to HDL – HDL Models of Combinational circuits.

Unit III SYNCHRONOUS SEQUENTIAL CIRCUITS **9**

Sequential Circuits – Latches and Flip Flops – Analysis and Design Procedures – State Reduction and State Assignment – Shift Registers – Counters – HDL for Sequential Logic Circuits.

Unit IV ASYNCHRONOUS SEQUENTIAL CIRCUITS **9**

Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards.

Unit V MEMORY DEVICE AND PROGRAMMABLE LOGIC **9**

Introduction to Memory Devices-ROM, PROM, EPROM, EEPROM- Random Access Memory-Static RAM and Dynamic RAM, Memory Decoding – Error Detection and Correction, Programmable Logic Array – Programmable Array Logic – Sequential Programmable Devices

Total : 45 Periods

Course Outcomes:

CO1 Able to frame Boolean equations for solving a simple real-life engineering problem and realize them using gate-level building blocks.
CO2 Able to apply minimization techniques for efficient Boolean logic implementation.
CO3 Able to realize digital blocks using combinational and sequential subsystems
CO4 Able to design using state machine descriptions for practical real-life engineering problems.
CO5 Ability to examine the hazards in digital circuits and to know the architecture of various advanced devices.

Text Books

1 M. Morris Mano and Michael D. Ciletti, ―Digital Design‖, 5th Edition, Pearson, 2014.
2 S.Salivahanan and S.Arivazhagan―Digital Electronics‖, Ist Edition, Vikas Publishing House pvt Ltd, 2012.

References

1 Donald D.Givone, ‒Digital Principles and Design‖, Tata Mc-Graw Hill Publishing company limited, New Delhi, 2003.
2 Thomas L. Floyd, ‒Digital Fundamentals‖, 10th Edition, Pearson Education, NewDelhi, 2009.
3 Leach D, Malvino A P & Saha, ‒Digital Principles and Applications‖ 8th Edition, Tata McGrawHill Publishing Company, 2014

4 W H Gothman, –Digital Electronics: An introduction to theory and practice‖, 2nd Edition, Prentice Hall of India, 2000

5 John.M Yarbrough, –Digital Logic Applications and Design‖, Thomson – Vikas Publishing House, New Delhi, 2002

Web References

1 https://nptel.ac.in/courses/117/105/117105080/

2 https://nptel.ac.in/courses/117/106/117106086/

20CS401 **DATA STRUCTURES** **L T P C**
3 0 0 3

Course Objective:

1. To learn about the implementation and applications of basic data structure , Array
2. To impart a thorough understanding of linear data structures such as stack, queues and their applications.
3. To impart a thorough understanding of non-linear data structures such as trees, graphs and their applications.
4. To study about various sorting and searching techniques and their applications.
5. To learn various hashing techniques

Unit I INTRODUCTION AND ARRAYS **9**

Basic terminology – classification of data structures -Data structure - operations – Abstract Data Types (ADT) – Running time analysis - Linear Array – Arrays as ADT Representation - Searching: Sequential (linear) search and Binary Search - Record structures – representation.

Unit II LINEAR DATA STRUCTURE **9**

Linked List - Representation – Singly and Doubly Linked List - Operations - Header Linked List - Circular Linked List – Operations - Stack ADT – application of stack – recursion – tower of Hanoi - Queue ADT – circular queue – Dequeue – priority Queue-Application of Queues

Unit III NON LINEAR DATA STRUCTURE – TREES **9**

Trees – Terminologies -Binary Trees - representation – Tree Traversal techniques - Binary search tree – Operations - AVL Trees – B-Tree – B+ Trees - Heaps.

Unit IV NON LINEAR DATA STRUCTURE – GRAPHS **9**

Introduction – Terminology – Representation - Graphs Traversal - Breadth first search- Depth first search – Topological sort - Shortest-path algorithm- Dijkstra‘s Algorithm - Minimum

spanning trees – Prim's and Kruskal's algorithms

Unit V HASHING AND SORTING 9

Hashing- Separate Chaining - Open Addressing –Double Hashing - Rehashing – Extendible Hashing - Sorting – Bubble Sort – Insertion Sort - Selection Sort – Quick Sort – Merge Sort – Heap Sort – Radix Sort – Shell Sort

Total : 45 Periods

Course Outcomes:

CO1 To implement and perform various operations using arrays.
CO2 To explain and implement real time applications using linear data structures.
CO3 To experiment various applications using tree data structures
CO4 To apply graph algorithms for variety of real time problems.
CO5 To implement basic sorting and searching algorithms
CO6 To illustrate various hashing techniques.

Text Books

1 Mark Allen Weiss, –Data Structures and Algorithm Analysis in C‖, 2nd Edition, Pearson Education,1997

2 Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, –Data Structures and Algorithms‖, Pearson Education, 2009

References

1 Ellis Horowitz, SartajSahni, Susan Anderson-Freed, –Fundamentals of Data Structures in C‖, Second Edition, University Press, 2008

2 Robert Sedgewick, Kevin Wayne, –Algorithms‖, Fourth Edition, Pearson Education, 2011

3 Steven S.Skiena, ― The Algorithm Design manual‖, Second Edition, Springer, 2012

4 Noel Kalicharan, –Data Structures in C‖,2015

Web References

1 https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-introduction-to-algorithms-sma-5503-fall-2005/video-lectures/

2 http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html

3 https://www.cs.usfca.edu/~galles/visualization/Algorithms.html

20EC305	COMMUNICATION ENGINEERING	L	T	P	C
		3	0	0	3

Course Objective:

1. Apply analog communication techniques
2. Apply digital communication techniques
3. Analyze digital coding techniques
4. Analyze source and Error control coding
5. Gain Knowledge on Mobile computing

Unit I ANALOG COMMUNICATION **9**

Elements of communication System and its Fundamental limitations, Need of Modulation, Amplitude (Linear Modulation)-Generation and detection of DSB, SSB, VSB, Angle (Exponential Modulation)-Types of Angle Modulation, Concepts of Instantaneous frequency, Wideband and Narrowband FM, Generation and detection of FM, Generation and detection of PM

Unit II DIGITAL COMMUNICATION **9**

Model of a digital communication system ; logarithmic measure of information, entropy and information rate, conditional entropy and redundancy, source coding fixed and variable length code words, Source coding theorem, Shannon – fano and Huffman coding, Mutual information and channel capacity of a discrete memory less channel.

Unit III CODING AND TECHNIQUES **9**

Differential pulse code modulation, Delta modulation, Adaptive delta modulation, adaptive DPCM. Comparison of PCM and DM, Types of digital modulation, Method of generation and detection of coherent & non – coherent binary ASK, FSK & PSK, differential phase shift keying, Quadrature modulation techniques (QPSK and MSK)

Unit IV ERROR CONTROL CODING **9**

Error free communication over a noisy channel, Hamming sphere, hamming distance and hamming bound, relation between minimum distance and error detecting and correcting capability, linear block codes, encoding & syndrome decoding ; cyclic codes, encoders and decoders for systematic cycle codes ; convolutional codes, code tree & Trellis diagram, Viterbi and sequential decoding, burst error correction, comparison of performance.

Unit V MOBILE COMPUTING **9**

History of wireless communication, Evolution of Mobile Communication, Mobile and Wireless devices. A market for mobile communications. A simplified reference model for mobile

communications, Wireless-transmission: signals propagation, Multiplexing techniques, spread spectrum (DS-SS, FHSS), cellular system, Frequency reuse, channel assignment strategies, handoff strategies, Introduction to GSM, Introduction to wireless networks, 2G, 3G, 4G and 5G, Mobile IP.

Total : 45 Periods

Course Outcomes:

CO1 Apply analog communication techniques
CO2 Apply digital communication techniques
CO3 Analyze digital coding techniques
CO4 Analyze source and Error control coding
CO5 Gain Knowledge on Mobile computing

Text Books

1 S. Haykin, –Communication Systems‖, John Willy & Sons, 5th Edition

2 Simon Haykin, –Digital Communication‖, John Wiley.

3 Jochen Schiller, –Mobile Communication‖, Pearson Education, 2nd Edition,2009

References;

1 Taub, Herbert & Schilling, Donald L. , –Communication Systems‖, Tata McGraw-Hill

2 Carlson, A. Bruce, Crilly, Paul B. & Rutledge, Janet C. , –Communication Systems an Introduction to Signals & Noise in Electrical Communication‖, Tata McGraw-Hill.

3 Kennedy, George & Davis, Bernard ,–Electronic Communication Systems‖ , Tata McGraw-Hill , 4th Ed.

4 Singh, R.P. & Sapre, S.D, –Communication Systems: Analog & Digital‖, Tata McGraw- Hill.

5 Taub & Schilling, –Principles of Communication Systems‖, Tata McGraw-Hill

6 Willium C. Y. Lee, –Mobile communication Design and fundamentals.

		L	T	P	C
20CS402	**CLEAN CODING AND DEVOPS**	**2**	**0**	**2**	**3**

Course Objective:

1. Understand about the clean code.

2. Explain the importance of naming conventions.
3. Understand the importance of comments in the applications
4. Understand & install different tools used in DevOps stack
5. Explain the benefits of DevOps and how various industries are benefitting
6. Explain how to automatically rollback a release if it is failed

Unit I INTRODUCTION TO CLEAN CODING **10**

Coding principles introduction-Bad and Good code-marshalling and unmarshalling-Names and Functions-distinct names-Defining meaningful context-Usage of domain and function names-Usage of exceptions and its error code names/descriptions. Right comments and types of formatting- Clean and bad comments-Vertical and horizontal formatting-Objects and data structures-Data abstraction-Data and object antisymmetric-Data transfer objects

Unit II INTRODUCTION TO DEV-OPS **10**

An overview about DevOps,-Why it is needed? how it is different from traditional IT & Agile - DevOps Principles,- DevOps Lifecycle - An overview about CI/CD pipeline and various tools-setup a complete CI/CD pipeline from scratch using DevOps tools - How DevOps is used in various technologies/industries.

Unit III ADVANCED DEV-OPS **10**

An overview of advanced DevOps concepts - Automatic Rollback & Provisioning, Scalability, Clustering & Infrastructure as Code An overview of Cloud computing - -Why DevOps on cloud - Cloud services - Setup a CI/CD pipeline in Cloud

Total : 30 Periods

Lab Experiments:

1. Implementation of Velocity & The Jobs of Delivery
2. Testing Stack
3. Execution of Feature Flags and the Blue/Green Pattern
4. The Medium/Integration Test
5. Creating a Culture of Experimentation **Total: 30 Periods**

Course Outcomes:

CO1: Understand the importance of comments in the applications.
CO2: Understand the data and object antisymmetric
CO3: Understand Cloud computing concepts
CO4: Explain why DevOps on cloud and various DevOps services available on IBM Cloud

Text Books

1 DevOps: A Software Architect's Perspective by Ingo M. Weber, Len Bass, and Liming Zhu

2 A hand book of agile software craftsmanship, Robert C Martin

References

1 IBM Course Ware

20MC804	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	L	T	P	C
		2	0	0	0

Course Objective:

1. Understand the concept of Traditional knowledge and its importance
2. Know the need and importance of protecting traditional knowledge.
3. Know the various enactments related to the protection of traditional knowledge.
4. Understand the concepts of Intellectual property to protect the traditional knowledge

Unit I INTRODUCTION TO TRADITIONAL KNOWLEDGE 9

Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

Unit II PROTECTION OF TRADITIONAL KNOWLEDGE 9

Protection of traditional knowledge: The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK

Unit III LEGAL FRAME WORK AND TK 9

A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act);
B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indicators act 2003.

Unit IV TRADITIONAL KNOWLEDGE AND INTELLECTUAL PROPERTY 9

Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

Unit V TRADITIONAL KNOWLEDGE IN DIFFERENT SECTORS 9

Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK. 139.

Total : 45 Periods

Course Outcomes:

CO1 Able to understand the concept of Traditional knowledge and its importance
CO2 Enable to know significance of protecting traditional knowledge
CO3 Enable to identify the various enactments related to the protection of traditional knowledge
CO4 Understand the concepts of Intellectual property to protect the traditional knowledge

Text Books

1 Traditional Knowledge System in India, by Amit Jha, 2009.
2 Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.

References

1 Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
2 "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2

Web References

1 http://nbaindia.org/uploaded/docs/traditionalknowledge_190707.pdf
2 https://www.springer.com/gp/book/9788132239215

20EC307	DIGITAL SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:

1. To understand the various Basic Logic Gates.
2. To design and Implement Combinational Circuits
3. To design and Implement Sequential Circuits
4. To Understand the various Components used in the Design of Digital Computer.
5. To Simulate HDL for Digital Circuits

List of Experiments

S. No Name of the Experiments

Hardware Experiments

1 Verification of Basic Logic Gates AND, OR, NOT, NAND, NOR, X-OR and X-NOR.
2 Construct a Half Adder, Full Adder, Half Subtractor, and Full Subtractor using logic gates.

3 Construct a Code Converter circuit.(Binary to gray and BCD to XS-3)

4 Implementation of Magnitude Comparator circuit using logic gates.

5 Construct an Encoder and Decoder circuit using logic gates.

6 Construct a Multiplexer and De-Multiplexer circuit using logic gates.

7 Construct a Parity Generator and Checker circuit using logic gates.

8 Verification of SR, JK, D and T Flip Flops.

9 Design of Synchronous Counter using flip-flops.

10 Design of Shift Registers using flip-flops.

Software Experiments (Using VHDL OR VERILOG)

11 Simulation of Combinational circuits using HDL

12 Simulation of Sequential circuits using HDL.

Total: 60 Periods

Course Outcomes:

CO1 Implement Simplified Combinational Circuit using Basic logic gates.
CO2 Implement Combinational Circuit and Sequential Circuit using MSI Devices
CO3 Analyze a given digital Circuit.
CO4 Design the different functional Units in a digital Computer
CO5 Modeling of Combinational and Sequential circuits using HDL

20CS403 DATA STRUCTURES LABORATORY

L	T	P	C
0	0	4	2

Course Objectives:

1. To learn about the implementation and applications of basic data structure , Array
2. To understand dynamic memory allocation and processing of various types of linked list
3. To understand the operations of Stack and Queue ADT.
4. To learn about various tree operations.
5. To understand about important graph algorithms

List of Experiments

S. No	Name of the Experiments
1	Implementation of Searching Algorithms
2	Implementation of LIST ADT using Array and Linked Representation
3	Array and Linked list Implementation of Stack ADT

4	Array and Linked list Implementation of Queue ADT
5	Implementation of Binary Trees and Traversal techniques
6	Implementation of Binary Search Trees
7	Implementation of Graph Representation and Traversal algorithm – BFS and DFS
8	Implementation of Topological Sorting
9	Implementation of Minimum Spanning Tree algorithms
10	Implementation of Shortest path algorithms
11	Implementation of sorting algorithms

Total: 60 Periods

Course Outcomes:

CO1 To implement various searching algorithms

CO2 To implement List ADT and perform operations using both static and dynamic memory allocation

CO3 To write functions to implement stack ADT and Queue ADT

CO4 To Create trees, store and retrieve data effectively

CO5 To solve real world problems using graph algorithms

CO6 To implement various sorting technique and compare their performance

20TP703	**SOFT SKILLS & APTITUDE – III**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

Course Objective:

1. Solve Logical Reasoning questions of easy to intermediate level
2. Solve Quantitative Aptitude questions of easy to intermediate level
3. Solve Verbal Ability questions of easy to intermediate level
4. Display good writing skills while dealing with essays

Unit I LOGICAL REASONING **9**

Clocks, calendars, Direction sense and Cubes

- Clocks
- Calendars
- Direction Sense
- Cubes

Data interpretation and Data sufficiency

- Data Interpretation – Tables
- Data Interpretation - Pie Chart
- Data Interpretation - Bar Graph
- Data Sufficiency

Unit II QUANTITATIVE APTITUDE 9

Time and work

- Work with different efficiencies
- Pipes and cisterns
- Work equivalence
- Division of wages

Time, Speed and Distance

- Basics of time, speed and distance
- Relative speed
- Problems based on trains
- Problems based on boats and streams
- Problems based on racesProfit and loss, Partnerships and averages
- Basic terminologies in profit and loss
- Partnership
- Averages
- Weighted average

Unit III VERBAL ABILITY 9

Sentence Correction

- Subject-Verb Agreement
- Modifiers
- Parallelism
- Pronoun-Antecedent Agreement
- Verb Time Sequences
- Comparisons
- Prepositions
- Determiners

Sentence Completion and Para-jumbles

- Pro-active thinking
- Reactive thinking (signpost words, root words, prefix suffix, sentence structure clues)
- Fixed jumbles
- Anchored jumbles

Unit IV WRITING SKILLS FOR PLACEMENTS 3

Essay writing

- Idea generation for topics
- Best practices
- Practice and feedback

Total : 30 Periods

Course Outcomes:

CO1 Enable students to solve Aptitude questions of placement level with ease, as well as write effective essays

20MA207 PROBABILITY AND QUEUEING THEORY

L	T	P	C
3	1	0	4

Course Objective:

1. To impart knowledge on random variable, moment generating function and their properties.
2. To teach the nature of standard distributions in discrete and continuous cases.
3. To teach the concept of two dimensional random variables and its characteristics.
4. To acquaint the concepts of random processes and classifications.
5. To teach queueing models and its performance measures.

Unit I PROBABILITY AND RANDOM VARIABLES **12**

Axioms of Probability – Conditional Probability – Total Probability – Baye_s Theorem – Random Variables – Probability mass functions – Probability Density functions – Properties – Moments- Moment generating functions and their properties.

Unit II STANDARD DISTRIBUTIONS **12**

Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Normal distributions and their properties – Functions of Random Variables

Unit III TWO-DIMENSIONAL RANDOM VARIABLES **12**

Joint distribution – Marginal and conditional distribution - Co-variance – Correlation and Regression – Transformation of Random Variables – Central Limit Theorem.

Unit IV RANDOM PROCESSES **12**

Classification – Stationary process – Markov process - Markov Chain – Pure Birth and Death Process- Poisson process – Random telegraph process.

Unit V QUEUEING MODELS **12**

Markovian queues- birth and death processes- single and multiple server queueing models-Little‘s formula-Queues with finite waiting rooms- queues with impatient customers-balking and reneging**.**

Total : 60 Periods

Course Outcomes:

CO1 Understand the nature of random variables and its properties.
CO2 Understand the nature of standard distributions in discrete and continuous cases.
CO3 Understand the Phenomenon of two dimensional random variables and its characteristics.
CO4 Know about random processes, Markov chains and transition probabilities.
CO5 Acquire skills in categorize the characteristics of queueing models..

Text Books

1 S.C. Gupta and V.K. Kapoor, -Fundamentals of Mathematical Statistics‖, 11th revised Edition, Sultan Chand & Sons, 2007

2 T. Veerarajan —‖Probability and Random Processes‖, Tata McGraw Hill, Third reprint 2009.

References

1 Roy D. Yates and David J Goodman, — Probability and Stochastic Processes-A friendly Introduction for Electrical and Computer Engineers‖, Joh Wiley & Sons, Inc.,2011

2 Miller. S.L. and Childers. D.G., —‖Probability and Random Processes with Applications to Signal Processing and Communications ", Academic Press, 2004.

3 Trivedi K.S — Probability and Statistics with reliability‖ Queueing and Computer Science Applications, 2ndEdition, John Wiley and Sons,2002.

4 Gross D and Shortle J.F, Thompson, J.M, and Harris C.M -Fundamentals of Queuing Theory‖Wiley Student 4th Edition, 2014

5 Siva Ramakrishna Dass, —‖Probability and Statistics‖, Viji Academy, 2014.

6 Douglas C. Montgomery, -Applied Statistics and Probability for engineers‖, 3rd Edition,2003

Web References

1 https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-042j-mathematics-for-computer-science-spring-2015/probability/tp12-1/vertical-1f097d8a0a33/bayes-theorem/

2 https://nptel.ac.in/courses/111/105/111105042/

3 https://www.youtube.com/watch?v=xGkpXk-AnWU

20CS405	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

Course Objective:

1. Course introduces the fundamental concepts and techniques necessary for the understanding and practice of the design and implementation of database applications.
2. Students are expected to acquire practical skills for the design and implementation of database applications. In particular, they should master entity-relationship design and SQL data definition and manipulation.

3. Students should understand the theory of query languages, integrity constraints and normalization.
4. Students should learn about the internal storage structures using different file and indexing techniques.
5. Students should understand the practical differences between relational and non-relational database management systems.
6. Students should be able to understand state-of-art database technology, to easily follow technological developments.

Unit I INTRODUCTION 9

Database-System Applications - Purpose of Database Systems - View of Data: Data abstraction, Instances & Schemas, Data models – Database Languages: Data Manipulation Language, Data Definition Language – Database Engine – Database and Application Architecture – Database Users and Administrators, Database vault, Database firewalls.

Unit II RELATIONAL MODEL AND SQL 9

Structure of Relational Databases -Database Schema- Keys- Schema Diagrams- Relational Query Languages-The Relational Algebra- SQL Data Definition - Basic Structure of SQL Queries - Basic Operations - Set Operations - Null Values -Aggregate Functions - Nested Sub queries-Join Expressions-Views-Functions and Procedures, Triggers.

Unit III RELATIONAL DATABASE DESIGN 9

The Entity-Relationship Model- Complex Attributes- Mapping Cardinalities-Integrity Constraints- Primary Key- Removing Redundant Attributes in Entity Sets- Reducing E-R Diagrams to Relational Schemas- Features of Good Relational Designs- Decomposition Using Functional Dependencies - Normal Forms

Unit IV INDEXING AND TRANSACTION MANAGEMENT 9

RAID- Database Storage Architecture-File Organization-Organization of Records in Files-Indexing- Ordered Indices-B + Tree Index Files - B+ Tree Extensions - Hash Indices-Transactions-ACID Properties-Concurrency Control-Lock based protocols-Timestamp based protocols

Unit V DISTRIBUTED AND NON RELATIONAL DATABASES 9

Data Partitioning- Replication- Distributed File Systems- Parallel Key-Value Stores-Non relational databases-Need for NOSQL Databases, Types, MongoDB – Datatypes, Creating, Updating and Deleting Documents, Querying the database.

Total : 45 Periods

Course Outcomes:

CO1 Classify the database languages and understand the architecture of a database.
CO2 Map ER model to Relational model to perform database design effectively.
CO3 Write queries using normalization criteria and optimize queries.
CO4 Compare and contrast various indexing strategies in different database systems.
CO5 Students will be able to identify what type of NoSQL database to implement based on business requirements.
CO6 Classify the specific database technology for current industry standards.

Text Books

1 Abraham Silberschatz, Henry F. Korth, S. Sudharshan, ―Database System Concepts‖, Seventh Edition, Tata McGraw Hill, 2014.

2 G. K. Gupta, ―Database Management Systems‖, Tata McGraw Hill, 2018.

References

1 Ramez Elmasri, Shamkant B. Navathe, ―Fundamentals of Database Systems‖, Seventh Edition, Pearson Education, 2017

2 C. J. Date, A. Kannan, S. Swamynathan, ―An Introduction to Database Systems‖, Eighth Edition, Pearson Education, 2006

3 Carlos Coronel, Steven Morris, Peter Rob, ―Database Systems: Design, Implementation and Management‖, Ninth Edition, Cengage Learning, 2011.

Web References

1 https://www.digimat.in/nptel/courses/video/106105175/L01.html

20CS406	**OPERATING SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objective:

1. To understand the basic concepts of operating system.

2. To learn the mechanisms of OS to handle processes, thread, scheduling mechanism and Inter Process communication.

3. To expose several aspects of OS design including: Process synchronization, Deadlocks and File systems.

4. To learn memory management strategies in contemporary OS.

5. To appreciate the emerging trends in operating systems.

Unit I INTRODUCTION 9

Operating System Evolution, Operating System types, Operating System Structures: System components, Operating System Services, System Calls, System Programs, System Structure, Virtual Machines, System Design and Implementation. Multicore Programming–Multithreading Models–Thread Libraries–Threading Issues.

Unit II PROCESS MANAGEMENT AND SCHEDULING 9

Process Concept, Process Scheduling, Context Switch, Operations on Processes, Inter Process Communication, IPC in Shared,Memory Systems, IPC in Message,Passing Systems, Examples of IPC Systems. CPU Scheduling, Scheduling Criteria, CPU Scheduling Algorithms, Multilevel Queue, Multilevel Feedback Queue–Thread Scheduling–Real-Time CPU Scheduling.

Unit III PROCESS SYNCHRONIZATION AND DEADLOCK 9

The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Critical Regions, Monitors,Dining Philosophers Problem, Readers Writers Problem,Deadlock: System model – Deadlock characteristics – Methods for handling deadlocks – Deadlock prevention Deadlock avoidance - Deadlock detection - Deadlock recovery

Unit IV MEMORYMANAGEMENT 9

Logical Versus Physical Address Space, Basics of linking and loading, Swapping, Contiguous Memory Allocation, Virtual Memory - Paging–Structure of the Page Table, Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing–Memory Mapped Files, Allocating Kernel Memory.

Unit V FILE AND DISK MANAGEMENT 9

Files-Naming, Structure, Types, Access, Attributes, Operations, Implementation. Directories: Operations, Path Names, Hierarchical Directory System, Implementation, Allocation Methods, Free Space Management, Mass Storage: Disk Structure - RAID Levels, Disk Scheduling Algorithms, Swap Space Management-Streams.

Total : 45 Periods

Course Outcomes:

CO1 Analyze the structure and basic architectural components of OS.

CO2 Apply various scheduling algorithms
CO3 Implement the Process Synchronization techniques
CO4 Simulate disk scheduling and Memory management techniques
CO5 Understand various file management system
CO6 Articulate the main concepts, key ideas, strengths and limitations of operating system.

Text Books

1 Silberschatz A, Galvin P, Gagne G, "Operating Systems Concepts", John Wiley and Sons, Singapore, 2016

2 William Stallings, "Operating Systems: Internals and Design Principles", Pearson Education, NewDelhi, 2018.

References

1 Andrew S.Tanenbaum,"Modern Operating System",4th Edition, PHI Learning, New Delhi, 2018.

2 D.M.Dhamdhere, ―Operating Systems : A Concept –based Approach‖, Second Edition. Tata Mc Graw–Hill, 2006

3 Harvey M Deitel, Paul J Deitel, David R Choffnes, "Operating Systems", 3rd Edition, Pearson Education, New Delhi,2013

Web References:

1 https://pdos.csail.mit.edu/6.828/2014/xv6/book–rev8.pdf

2 The xv6 source code: gitclonegit://pdos.csail.mit.edu/xv6/xv6.git

3 https://learn.saylor.org/coursehttps://www.classcentral.com/tag/operating-systems /CS401

4 https://in.udacity.com/course/introduction-to-operating-systems--ud923/

20CS307 COMPUTER ARCHITECTURE

L	T	P	C
3	0	0	3

Course Objective:

1. To study the concepts of the basic structure and operation of a digital computer.

2. To impart knowledge about the operation of the arithmetic unit including the algorithms & implementation addition, subtraction, multiplication & division

3. To know in detail the different types of control and the concept of pipelining.

4. To know the hierarchical memory system including cache memory and virtual memory.

5. To acquire knowledge about the diverse ways of communicating with I/O devices and

standard I/O Interfaces

Unit I BASIC STRUCTURE OF COMPUTERS 9

Functional units-Basic operational concepts-Bus structures-Software-performance-Memory locations and addresses- Memory operations- Instruction and instruction sequencing-Addressing modes- Basic I/O operations

Unit II ARITHMETIC OPERATIONS 9

Arithmetic Operations - Addition and subtraction of signed numbers - Design of fast adders - Multiplication of positive numbers - Signed operand multiplication and fast multiplication - Integer division- Floating point and fixed point operations

Unit III BASIC PROCESSING UNIT AND PIPELINING 9

Fundamental concepts - Execution of a complete instruction - Multiple bus organization - Hardwired control - Micro programmed control - Pipelining: Basic concepts - Data hazards - Instruction hazards -Data path and control considerations - Superscalar Operation. Intel Pentium Processor Architecture & Working, Sun Ultra Sparc, Sandiego Super Computer Center.

Unit IV MEMORY SYSTEM & I/O ORGANIZATION 9

Basic concepts - Semiconductor RAM - ROM - Speed - Size and cost - Cache memories – Performance Considerations-Virtual memory - Memory management requirements - Secondary storage devices. Accessing I/O devices - Programmed Input/output Interrupts - Direct Memory Access- Buses - Interface circuits - Standard I/O Interfaces (PCI, SCSI, and USB), IOP - CPU Communication.

Unit V MULTICORE ARCHITECTURE 9

Multi-Core Architectures: Software and hardware multithreading – SMT and CMP architectures – Design issues – Case studies – Intel Multi-core architecture – SUN CMP architecture - heterogeneous multi-core processors – case study: IBM Cell Processor.

Total : 45 Periods

Course Outcomes:

CO1 Identify the basic structure of a digital computer and instruction sets with addressing modes

CO2 Comprehend the arithmetic operations of binary number system

CO3 Recognize the organization of the basic processing unit and examine the basic concepts of pipe-lining

CO4 Infer the processor concepts by introducing multi-core, cluster , shared and distributed architecture concepts

CO5 Explicate the standard I/O interfaces and peripheral devices

CO6 Determine the performance of different types of memory

Text Books

1 William Stallings, Computer Organization and Architecture – Designing for Performance‖, 8th Edition, Pearson Education, 2009.

2 John P. Hayes, Computer Architecture and Organization, 3rd Edition, Tata McGraw Hill, 2002.

References

1 Carl Hamacher, Zvonko Vranesic and Safwat Zaky, ―Computer Organization and Embedded Systems, 6th Edition, Tata McGraw Hill, 2002

2 David A. Patterson and John L. Hennessy, ―Computer Organization and Design: The Hardware/Software interface‖, 3rd Edition, Elsevier, 2005.

3 V.P. Heuring, H.F. Jordan, ―Computer Systems Design and Architecture, 2nd Edition, Pearson Education, 2004.

4 Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill reprint 2011

Web References

1 https://www.edx.org/course/computation-structures-2-computer-architecture

2 https://learn.saylor.org/course/CS301

3 https://www.classcentral.com/subject/algorithms-and-data-structures

4 https://www.classcentral.com/tag/computer-architecture

20CS407	ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	0	3

Course Objective:

1. To understand and apply the algorithm analysis techniques.
2. To critically analyze the efficiency of alternative algorithmic solutions for the same problem
3. To understand different algorithm design techniques
4. To apply appropriate method to solve a given problem.
5. To understand the limitations of Algorithmic power.

Unit I INTRODUCTION TO ALGORITHM ANALYSIS 9

Introduction to Algorithm Analysis – Notion of Time and Space Complexity - Algorithm efficiency – Asymptotic Notations – Recurrence Relations – Solving Recurrence equations - Iteration Method, Recurrence Tree Method and Master‘s Theorem - Mathematical analysis for Recursive and Non-recursive algorithms - Empirical analysis of algorithm.

Brute Force Approach:

General Approach – Algorithm Analysis –Applications

Unit II DIVIDE-AND-CONQUER & DECREASE-AND-CONQUER 9

Divide And Conquer:

General Strategy –Analysis of algorithm - Merge sort - Quick sort - Strassen‘s Matrix Multiplication – Multiplication of Large Integers – Convex Hull and Closest pair problem.

Decrease and Conquer:

Introduction - General Method – Analysis - Insertion sort - Topological sort – Binary Search – Fake-Coin Problem – Interpolation Search.

Unit III DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE 9

Dynamic Programming:

Introduction - Principle of Optimality – General Approach for problem solving - Analysis – Coin Changing Problem - Optimal Binary Search Trees - Warshall‘s and Floyd‘s Algorithm - Knapsack Problem and Memory functions.

Greedy Technique:

Greedy Approach Introduction - Analysis of algorithm - Examples: Container Loading Problem – Prim‘s and Kruskal‘s Algorithm - Dijkstra‘s Algorithm - Huffman Trees.

Unit IV ITERATIVE IMPROVEMENT 9

The Simplex Method – The maximum Flow problem – Min Cut Max Flow Theorem and Proof – Maximum Matching in a Bipartite graph – Stable marriage Problem

Unit V BACKTRACKING & BRANCH AND BOUND 9

P, NP and NP-Complete Problems - Backtracking – n-Queens problem – Hamiltonian Circuit Problem – Subset Sum Problem-Branch and Bound – Assignment problem – Knapsack Problem – Traveling Salesman Problem- Graph Coloring problem- Approximation Algorithms for NP – Hard Problems – Traveling Salesman problem – Knapsack problem.

Total : 45 Periods

Course Outcomes:

CO1 Analyze the time and space complexity of algorithms and Solve recurrence equations.
CO2 Design algorithms using Divide and Conquer Strategy and Decrease and conquer strategy
CO3 Compare Dynamic Programming and Divide and Conquer Strategies.
CO4 Solve Optimization problems using Greedy strategy and iterative improvement techniques
CO5 Design efficient algorithms using Back Tracking and Branch Bound Techniques for solving problems.
CO6 Classify computational problems into P, NP, NP-Hard and NP-Complete.

Text Books

1 Anany Levitin –Introduction to the Design and Analysis of Algorithms‖, Third Edition, Pearson Education Limited, 2014

2 Parag H.Dave, Himanshu B.Dave, ― Design and Analysis of Algorithms‖, Pearson Education, 2008.

3 Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, –The Design and Analysis of Computer Algorithms‖, Pearson Education, 2009

4 Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2007.

References

1 Sandeep Sen and Amit Kumar, –Design and Analysis of Algorithms – A Contemporary Perspective‖ , Cambridge University Press, 2019

2 S.K.Basu, –Design Methods and Analysis of Algorithms‖, Second Edition, PHI Learning Private India Limited, 2013

3 Harsh Bhasin, ―Algorithms Design and Analysis‖, Oxford university press, 2016

4 John Kleinberg, Eva Tardos, –Algorithm Design‖, Pearson Education, 2009

Web References

1 http://nptel.ac.in/

2 https://online.stanford.edu/courses/cs161-design-and-analysis-algorithms

3 https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2015/lecture-videos/

4 https://www.classcentral.com/course/edx-algorithm-design-and-analysis-8520

20CS404	DATA VISUALIZATION	L	T	P	C
		2	0	2	3

Course Objective:

1. To give overview of descriptive and inferential statistics.
2. To provide basics of R and Python.
3. To manipulate and visualize data using R, python and Watson Studio.
4. To focus on plots using Matplotlib and seaborn.
5. To analyze data using various visualization tools.
6. To create maps in python using folium.

Unit I **INTRODUCTION TO STATISTICS** **10**

Data collection methods – Descriptive Statistics: Mean, Median, Mode – Inferential Statistics :Random Variables, Probability Distributions, Normal Distribution, Sampling and Sampling Distribution.

Unit II **VISUALIZATION USING R** **10**

Overview of R - Descriptive data analysis using R – Data manipulation with R – Data visualization with R - R studio installation - Data manipulation with R - Data Visualization with R – Python scripiting basics-Pandas (text data, date time columns, indexing and selecting data, groupby ,Merge/join datasets)

Unit III **VISUALIZATION USING PYTHON** **10**

Data Visualization tools in python – Basic plots using Matplotlib - Specialized Visualization tools using Matplotlib - Advanced Visualization tools using Matplotlib-Seaborn functionalities – Spatial visualization and analysis in python in folium – Usage of Seaborn functionalities – Case studies.

Total : 30 Periods

List of Experiments (Indicative)

1. Program to do the descriptive analysis using R
2. Program to do data manipulation.
3. Program for data visualization operations for builtin data set using R
4. Program to implement the Exploratory Data Analysis(EDA) for a data set
5. Consider your own data set and do the following visualization using tableu tool
   a) Line graph /with style
   b) Bar Graph
   c) Histogram
   d) Scatter plot
   e) Pie chart
6. Program to create maps with markers and Chropleth maps with Folium

Total : 30 Periods

Course Outcomes:

CO1: Differentiate descriptive and inferential statistics.
CO2: Use R to do statistics and to visualize data.

CO3: Visualize analyzed data using IBM Watson Studio.
CO4: Familiar with python scripts used for visualization.
CO5: Use advance visualization tool and sea born functionalities..

Text Books

1 Wes McKinney, ―Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython‖ , Oreilly, 2011.

2 Andreas C. Muller, Sarah Guido, ―Introduction to Machine Learning with Python: A Guide for Data Scientists‖, Oreilly, 2016

References

1 IBM Course ware

20CS408	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:

1. To understand data definitions and data manipulation commands.
2. To learn the use of nested and join queries.
3. To understand functions, procedures and procedural extensions of data bases.
4. To be familiar with the use of a front end tool.
5. To understand design and implementation of typical database applications.

List of Experiments

S. No	Name of the Experiments
1	Execution of basic SQL commands DDL, DML, DCL in SQL.
2	Implementation of Aggregation operations in SQL.
3	Implementation of Date, Time, String operations in SQL.
4	Implementation of Set Operations in SQL.
5	Implementation of Join operations in SQL.
6	Implementation of Sub Queries in SQL.
7	Implementation of Views in SQL.
8	Implementation of Sequences in SQL.

9	Implementation of Triggers in SQL.
10	Implementation of Procedures in SQL.
11	Implementation of Functions in SQL.
12	Programs on PL/SQL.
13	Study of MongoDB
14	Mini Project

Total: 60 Periods

Course Outcomes:

CO1 To understand data definitions and data manipulation commands.
CO2 To learn the use of nested and join queries.
CO3 To understand functions, procedures and procedural extensions of data bases.
CO4 To learn the use of views and triggers.
CO5 To be familiar with the use of a front end tool.
CO6 To understand design and implementation of typical database applications.

20CS409	OPERATING SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:

1. To learn about the basic commands of operating systems and write shell script program
2. To understand the Scheduling, Page replacement algorithms
3. To understand the various memory management Schemes
4. To understand file management
5. To understand the basic configuration of Linux

List of Experiments

S. No	Name of the Experiments
1	Basic Unix system commands
2	Execution of Basic shell scripts
3	Implementation of Process Management and Inter Process Communication System Calls
4	Implementation of CPU Scheduling Algorithms

5	Implementation of threads.
6	Implementation of semaphores to avoid deadlock.
7	Implementation of banker‘s algorithm to avoid deadlock.
8	Implementation of Memory Management Schemes
9	Implementation of Page Replacement Algorithms
10	Implementation of MiniFile Manager
11	Implementation of Disk Scheduling Algorithms

Total: 60 Periods

Course Outcomes:

CO1 Understand the basic Unix Commands and write shell scripts

CO2 Understand and implement basic services and functions of the operating system Using system calls.

CO3 Use modern OS system calls and synchronization libraries in software / hardware Interface

CO4 Understand the benefits of thread over process and implement synchronized programs

CO5 Analyze various IPC techniques in the operating system

CO6 Implement memory management schemes and page replacement schemes..

20TP704 SOFT SKILLS & APTITUDE – IV

L	T	P	C
0	0	2	1

Course Objective:

1. Solve Logical Reasoning questions of easy to intermediate level
2. Solve Quantitative Aptitude questions of easy to intermediate level
3. Solve Verbal Ability questions of easy to intermediate level
4. Crack mock interviews with ease
5. Be introduced to problem-solving techniques and algorithms

Unit I LOGICAL REASONING **5**

Logical connectives, Syllogism and Venn diagrams

- Logical Connectives
- Syllogisms
- Venn Diagrams – Interpretation
- Venn Diagrams – Solving

Unit II QUANTITATIVE APTITUDE 5

Logarithms, Progressions, Geometry and Quadratic equations

- Logarithm
- Arithmetic Progression
- Geometric Progression
- Geometry
- Mensuration
- Coded inequalities
- Quadratic Equations

Permutation, Combination and Probability

- Fundamental Counting Principle
- Permutation and Combination
- Computation of Permutation
- Circular Permutations
- Computation of Combination
- Probability

Unit III VERBAL ABILITY 5

Critical Reasoning

- Argument – Identifying the Different Parts (Premise, assumption, conclusion)
- Strengthening statement
- Weakening statement
- Mimic the pattern

Unit IV RECRUITMENT ESSENTIALS 10

Cracking interviews - demonstration through a few mocks
Sample mock interviews to demonstrate how to crack the:

- HR interview
- MR interview
- Technical interview

Cracking other kinds of interviews

- Skype/ Telephonic interviews
- Panel interviews
- Stress interviews

Resume building – workshop
A workshop to make students write an accurate resume

Unit V PROBLEM SOLVING AND ALGORITHMIC SKILLS 5

Logical methods to solve problem statements in Programming

- Basic algorithms introduced

Total : 30 Periods

Course Outcomes:

CO1 Enable students to solve Aptitude questions of placement level with ease, as well as write effective essays.

		L	T	P	C
20CS410	**AUTOMATA AND COMPILER DESIGN**	**3**	**1**	**0**	**4**

Course Objective:

1. To have an understanding of Computational languages.
2. To have a knowledge of regular languages and context free languages and its properties.
3. To know the relation between regular language, context free language and corresponding recognizers.
4. To understand, design and implement a lexical analyzer and parser.
5. To design DFA & NFA with different conversion techniques.
6. To implement code generation schemes.
7. To perform optimization of codes and gain knowledge about runtime environments.
8. To Understand Lex and YACC tools**.**

Unit I FINITE MACHINE AND REGULAR EXPRESSION **12**

Finite State Machine, Deterministic finite automation, equivalence between NFA and DFA, Conversion of NFA into DFA, minimization of FSM- Regular sets, regular expressions, Equivalence between RE and FA, inter conversion, Pumping lemma, Closure properties of regular sets.

Unit II Context Free Grammar **12**

Context Free Grammars, Normal Forms, Chomsky Normal Form (CNF), Greibach Normal Form (GNF) , Pushdown automata (PDA) – Languages of a PDA - Equivalence of PDA_s and CFG_s

Unit III Lexical and Syntax Analysis **12**

Phases of compiler – Lexical Analyzer – LEX - Role of parser- Elimination of ambiguity- Top down parsing: Recursive-Descent parsing, Non- recursive predictive parsing; LL(1) grammars, Bottom-Up parsing:- Shift-Reduce parsers, Operating precedence parsing: design of operator precedence table, parsing –LR parsers:- Construction of SLR parser tables and parsing , CLR parsing-LALR parsing- Syntax errors-YACC

Unit IV Intermediate Code generator 12

Syntax Directed Translations: Syntax-directed definitions, Translation Schemes, construction of syntax trees, DAG'S- bottom-up evaluation of s-attributed definitions, l-attributed definitions; Run-time environments: Source language issues, storage organization, storage-allocation strategies, symbol tables: local and global symbol table structures and management. Type checking Systems: Data type as set of values with set of operations; data types; type checking models; Type-checking algorithms.

Unit V Code generator 12

Intermediate languages, Three Address code: declarations, assignment statements, addressing array elements, Boolean expressions, case statements, back patching. Code optimization: The principle source of optimization, optimization of basic blocks, Loop optimizations Issues in the design of a code generator, the target machine, Reducing the memory access times by exploiting addressing modes- peephole optimizations, basic blocks, DAG's

Total : 60 Periods

Course Outcomes:

C01 To design the Context free grammar and Push down automata for a context free Language
CO2 Apply the pumping lemma properties to Regular and Context Free Languages
CO3 Design a lexical analyzer to identify the tokens in a program
CO4 Construct a parser through the application of grammar.
CO5 Design a compiler for a small language with code generation.
CO6 Analyze various code optimization techniques

Text Books

1 A. V. Aho et al, Compilers: Principles, techniques, & tools, Second Edition,Pearson Education, 2007

2 K. D. Cooper and L. Torczon, Engineering a compiler, Morgan Kaufmann, 2004

References

1 D.M. Dhamdhere -Systems programming and operating systems‖ Tata McGraw- Hill Pub.

2 A. V. Aho et al, Compilers: Principles, techniques, & tools, Second Edition,Pearson Education, 2007

3 K. D. Cooper and L. Torczon, Engineering a compiler, Morgan Kaufmann, 2004

Web References

1 https://swayam.gov.in/nd1_noc19_cs79

2 https://online.stanford.edu/courses/soe-ycsautomata-automata-theory

3 https://nptel.ac.in/courses/106104028/

4 structureshttps://freevideolectures.com/course/3045/theory-of-computation-i

20CS411	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

Course Objective:

1. To study the concepts of data communications and functions of different layers of ISO/OSI
2. reference architecture
3. To understand the error detection and correction methods and types of LAN
4. To study the concepts of sub netting and routing mechanisms.
5. To understand the different types of protocols and network components.
6. To study the application protocols and network security

Unit I DATA COMMUNICATIONS AND PHYSICAL LAYER 9

Introduction, history and development of computer networks, networks topologies, ISO/OSI model and protocols. Different types of transmission media, errors in transmission: attenuation, noise. Repeaters. Encoding (NRZ, NRZI, Manchester, 4B/5B). MAC Layer: Aloha, TDMA, CDMA, CSMA/CD, CSMA/CA.

Unit II DATA LINK LAYER 9

Error detection (Parity, CRC, Hamming code), Sliding Window, Stop and Wait protocols, LAN: Design, specifications of popular technologies, switching, Ethernet, Gigabit Ethernet, Token Ring, Token Bus, Bluetooth, Wi-Fi, Wi-Max, FDDI, PPP, bridging and SDN.

Unit III NETWORK LAYER 9

Internet Protocol, IPv6, ARP, DHCP, ICMP, Distance vector routing, Link state routing, Classless Inter-domain routing, RIP, OSPF, BGP, Subnetting, , Network Address Translation

Unit IV TRANSPORT LAYER 9

UDP, TCP, Connection establishment and termination, sliding window revisited, flow and congestion control, timers, retransmission, TCP extensions, Design issues in protocols at different layers, Socket Programming

Unit V APPLICATION LAYER 9

DNS, E-Mail -SMTP, MIME, POP3, IMAP, FTP, HTTP, WWW, symmetric and asymmetric key cryptography, Sharing of symmetric keys – Diffie-Hellman key Exchange, Public Key Infrastructure, Public Key Authentication Protocols, Firewalls.

Total : 45 Periods

Course Outcomes:

CO1 Understand the fundamentals of data communications and functions of layered architecture.

CO2 Practice the error detection and correction methods and understand the different network technologies

CO3 Analyse the requirements for a given organizational structure and select the most appropriate networking architecture and routing technologies

CO4 Understand the transport layer principles and reliable data transfer

CO5 Understand the application layer protocols and also the use of cryptography and network security

Text Books

1 AS Tanenbaum, DJ Wetherall, ―Computer Networks‖, 5th Edition, Prentice-Hall, 2011.

2 Behrouz A. Forouzan, ―Data communication and Networking‖, 4th Edition, Tata McGrawHill, 2007

References

1 Peterson & Davie, "Computer Networks, A Systems Approach", 3rd Edition, Harcourt, 2013

2 William Stallings, -Data and Computer Communications‖, 8th Edition, PHI, 2006

Web References

1 https://www.udacity.com/course/computer-networking--ud436

2 https://www.classcentral.com/subject/computer-networking

3 https://online.stanford.edu/courses/cs144-introduction-computer-networking

20CS412 **WEB PROGRAMMING**

L	T	P	C
2	0	4	4

Course Objective:

1. To understand the basics of WWW and Web design
2. Develop website using HTML, CSS and java scripts
3. To develop web application using PHP & MySQL
4. To send and receive data using XML &AJAX

Unit I Introduction to webdesign, HTML and CSS **9**

Concept of HTTP Protocol : Request and Response, Web browser and Web servers. Concepts of effective web design, Page Layout and linking, Planning and publishing website, Designing effective navigation. Basics of HTML – Tags- Features of HTML. Introduction to CSS –CSS Layout Techniques

Unit II JAVASCRIPT 9

Introduction to Javascript – Javascript grammar and Types – JS with DOM and Events- JS with UI/Events – Advance working with functions – object properties – Understanding forms – Form Validation - Error Handling

Unit III Ajax: Communicating with the Web Server **9**

Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Using XML with application, Transforming XML using XSL and XSLT, AJAX Architecture- Dynamic web page Creation using AJAX.

Unit IV PHP **9**

PHP : Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files

Unit V Advance Features **9**

Node.js, React JS, Java FX, Cookies and Sessions, Object Oriented Programming with PHP, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables,

Total : 45 Periods

List of experiments:

1. Write HTML/Java scripts to display your CV in navigator, your Institute website, Department Website and Tutorial website for specific subject

2. Design HTML form for keeping student record and validate it using Java script.
3. Write an HTML program to design an entry form of student details and send it to store at database server like SQL, Oracle or MS Access.
4. Write programs using Java script for Web Page to display browsers information.
5. Write a Java applet to display the Application Program screen i.e. calculator and other.
6. Writing program in XML for creation of DTD, which specifies set of rules. Create a style sheet in CSS/ XSL & display the document in internet explorer.
7. Program to illustrate JDBC connectivity. Program for maintaining database by sending queries. Design and implement a simple servlet book query with the help of JDBC & SQL. Create MS Access Database,.
8. Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and pwd4 respectively. Write a servlet for doing the following. Create a Cookie and add these four user id‘s and passwords to this Cookie. 2. Read the user id and passwords entered in the Login form and authenticate with the values available in the cookies.
9. Install a database (Mysql or Oracle). Create a table which should contain at least the following fields: name, password, email-id, phone number Write a PHP to connect to that database and extract data from the tables and display them. Insert the details of the users who register with the web site, whenever a new user clicks the submit button in the registration page.
10. Write a PHP which insert the details of the 3 or 4 users who register with the web site by using registration form. Authenticate the user when he submits the login form using the user name and password from the database
11. Design and implement a simple shopping cart example with session tracking API.
12. Mini Project

Total : 45 Periods

Course Outcomes:

CO1 Describe the concepts of WWW including browser and HTTP protocol.

CO2 Develop the modern web pages using the HTML and CSS features with different layouts as per need of applications.

CO3 Use the JavaScript to develop the dynamic web pages.

CO4 Use server side scripting with PHP to generate the web pages dynamically using the database connectivity.

CO5 Develop the modern Web applications using the XML and AJAX

Text Books

1 HTML 5, Black Book, dreamtech Press, 2017

2 Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel, Pearson, 2017

3 Developing Web Applications in PHP and AJAX, Harwani, McGraw Hill 2015

References

1 Web Technology: Theory and Practice by M. Srinivasan Publisher: Pearson India, 2016

2 Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India, 2017

Web References

1 https://www.w3schools.com/php/

2 https://www.coursera.org/lecture/website-coding/introduction-to-javascript-SofLM

		L	T	P	C
20CS416	**SOFTWARE ENGINEERING**	**3**	**0**	**0**	**3**

Course Objective:

1. To know the fundamentals of project management activities.
2. To design software using models.
3. To gather knowledge on various software testing, maintenance methods
4. To develop an efficient software system through good group cohesiveness.
5. To verify the quality of software products

Unit I FUNDAMENTALS OF SE AND REQUIREMENT ENGINEERING 9

Software Engineering Fundamentals; Software processes: Software life-cycle and process models; Process assessment models; Overview of Project Management activities; Software requirements and specifications: Requirements elicitation; Requirements analysis modeling techniques; Functional and nonfunctional requirements; User requirements, System requirements, requirement validation and software requirement specification document. Prototyping - Basic concepts of formal specification techniques

Unit II SOFTWARE DESIGN 9

Fundamental design concepts and principles; Design characteristics; System Models - Context, Behavioral, Data and, Object models, Architectural design- System structuring, Control models; Structured design; Object-oriented analysis and design; User interface design; Design for reuse; Design patterns;

Unit III SOFTWARE VALIDATION AND MAINTENANCE 9

Software validation: Validation planning; Testing fundamentals, including test plan creation and test case generation; Black-box and white-box testing techniques; Unit, integration, validation, and system testing; Object-oriented testing; Inspections. Software evolution: Software maintenance; Characteristics of maintainable software; Reengineering; Legacy systems; Software reuse.

Unit IV SOFTWARE PROJECT MANAGEMENT 9

Team management – Team processes, Team organization and decision -making, Roles and responsibilities in a software team, Role identification and assignment, Project tracking, Team problem resolution; Project planning and scheduling; Software measurement and estimation techniques; Risk analysis and management; Software quality assurance; Software configuration management

Unit V SOFTWARE QUALITY PROCESS IMPROVEMENT 9

Overview of Quality management and Process Improvement; Overview of SEI -CMM, ISO 9000, CMMI, PCMM, TQM and Six Sigma; overview of CASE tools. Software tools and environments: Programming environments; Project management tools; Requirements analysis and design modeling tools; testing tools; Configuration management tools;

Total : 45 Periods

Course Outcomes:

CO1 Analyze a problem, identify and define the computing requirements appropriate to its solution.

CO2 Design, implement and evaluate a system / computer based system process, component or program to meet desired needs

CO3 Apply design and development principles in the construction of software systems.

CO4 Apply testing methods for the software products
CO5 Improve the product by checking the quality of the software products

Text Books

1 R. S. Pressman, Software Engineering, a practitioner‘s approach,McGraw Hill,7th Edition, 2010.

2 Ian Sommerville, "Software Engineering", 9th Edition, Addison- Wesley, 2011

References

1 Pankaj Jalote, ‑Software Engineering, A Precise Approach‖, Wiley India, 2010.

2 Kelkar S.A., ―Software Engineering‖, Prentice Hall of India Pvt Ltd, 2007.

3 Stephen R.Schach, ―Software Engineering‖, Tata McGraw-Hill Publishing Company Limited,2007.

Web References

1 https://www.coursera.org/courses?query=object%20oriented%20design

2 https://www.coursera.org/learn/object-oriented-design

3 https://onlinecourses-archive.nptel.ac.in/noc17_cs25

4 https://pl.cs.jhu.edu/oose/

20 MC 802 ENVIRONMENTAL SCIENCE AND ENGINEERING

L	T	P	C
2	0	0	0

Course Objective:

1. To analyse possible patterns and relationships between a biotic or abiotic factor and a biological system.

2. To identify the pollutants, their sources, transport mechanisms and respective controls.

3. To identify the methods for recycling, recovery and reuse of the materials considered to be waste.

4. To give in-depth information about the laws, the national policy, Acts related to environmental issue.

5. To define the size, distribution of population and Social awareness.

Unit I ECOSYSTEM DYNAMICS AND BIODIVERSITY 6

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – food chains, food webs and ecological pyramids .Introduction to biodiversity— value of biodiversity: consumptive use, productive use - endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Unit II ENVIRONMENTAL POLLUTION 6

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution - environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act– role of an individual in prevention of pollution.

Unit III NATURAL RESOURCES 6

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – role of an individual in conservation of natural resources.

Unit IV SOCIAL ISSUES AND THE ENVIRONMENT 6

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization - environmental ethics.

Unit V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – HIV / AIDS – role of information technology in environment and human health – Case studies.

Total : 30 Periods

Course Outcomes:

CO1 To understand the value of these ecosystems to humans and to animals and plants.

CO2 To identify the major pollutants and abatement devices for environmental management and sustainable development.

CO3 To explain how we can use natural resources in sustainable manner.

CO4 To explain knowledge of various acts and laws and will be able to identify the industries that are violating these rules.

CO5 To estimate the population - economic growth, energy requirement and demand.

Text Books

1 Benny Joseph, _Environmental Science and Engineering‘, Tata McGraw-Hill, New Delhi, 2006.
2 Gilbert M.Masters, _Introduction to Environmental Engineering and Science‘, 2nd edition, Pearson Education, 2004.

References

1 Dharmendra S. Sengar, _Environmental law‘, Prentice hall of India Pvt Ltd,New Delhi, 2007.
2 2. Erach Bharucha, ‒Textbook of Environmental Studies‖, Universities Press(I) Pvt, Ltd, Hyderabad, 2015.
3 Rajagopalan, R, _Environmental Studies-From Crisis to Cure‘, Oxford University Press, 2005.
4 G. Tyler Miller and Scott E. Spoolman, ‒Environmental Science‖, Cengage Learning India Pvt,2010.

Web References

1 https://www.conserve-energy-future.com

2 https://.livescience.com/topics/pollution/4

20CS413	NETWORK PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:

1. To understand the working principle of various communication protocols.
2. To analyze the various routing algorithms.
3. To know the concept of data transfer between nodes

List of Experiments

Name of the Experiments

1. Study of different types of Network cables and Practically implement the cross-wired cable and

   straight through cable using clamping tool.

2. Install and Configure Wired and Wireless NIC and transfer files between

systems in LAN and Wireless LAN.

3. Install and configure Network Devices: HUB, Switch and Routers.
4. Connect the computers in Local Area Network.
5. Configure Host IP, Subnet Mask and Default
6. Gateway in a System in LAN (TCP/IP Configuration).
7. Establish Peer to Peer network connection using two systems using Switch and Router in a LAN.
8. Configure Internet connection and use IPCONFIG,
9. PING / Tracer and Net stat utilities to debug the network issues.
10. Transfer files between systems in LAN using FTP
11. Configuration, install Print server in a LAN and share the printer in a network.
12. Study of basic network command and Network configuration commands
13. Configure a Network topology using packet tracer software

Total : 60 Periods

Course Outcomes:

CO1 Understand fundamental underlying principles of computer networking

CO2 Understand details and functionality of layered network architecture.

CO3 Apply mathematical foundations to solve computational problems in computer networking

CO4 Analyze performance of various communication protocols.

CO5 Compare routing algorithms

CO6 Practice packet /file transmission between nodes.

Web References

1 www.brianlinkletter.com › open-source-network-simulators

2 https://netsim.erinn.io

20CS417	DESIGN THINKING LABORATORY	L	T	P	C
		1	0	2	2

Course Objectives:

1. Expose students to the design process as a tool for innovation.
2. Develop students' professional skills in client management and communication.
3. Students develop a portfolio of work to set them apart in the job market.
4. Provide an authentic opportunity for students to develop teamwork and leadership skills.
5. Demonstrate the value of developing a local network and assist students in making, lasting connections with the business community

List of Experiments

Name of the Experiments

1. Listening
2. HMW
3. User Research
4. Practice mapping insights from user research
5. Practice ideation and prioritization
6. Collaboratively consolidate storyboards
7. Develop a summary Hill statement
8. Build your story board and hill into a prototype
9. Practice teaching selected section

Total: 45 Hours

Course Outcomes:

CO1: Students develop a strong understanding of the Design Process and how it can be applied in a variety of business settings

CO2: Students learn to build empathy for target audiences from different ‑cultures‖

CO3: Students learn to research and understand the unique needs of a company around specific challenges

CO4: Students learn to develop and test innovative ideas through a rapid iteration cycle

		L	T	P	C
20TP705	**PROGRAMMING ASPECTS & TECHNICAL APTITUDE – I**	**0**	**0**	**2**	**1**

Unit I Object and Class **6**

Types of programming, Disadvantages of functional programming, Classes & Objects, Attributes, Methods, Objects, Solving MCQs based on Objects and Classes, Solving tricky questions based on encapsulation, Solving frequently asked object based questions

Unit II Data types, Basic I / O **6**

Data types, Data, Why data type, Variables, Available data types, Numeric – int, float, double, Character – char, string, Solving MCQs based on type casting, data types, Solving debugging based MCQs, Printing Getting input from user during run time, Command line arguments, Solving programming questions based on CLA, Solving MCQs questions based on CLA

Unit III Decision Making, Loop Control **6**

Need for control statement, if..else, if..else if..else, Nested if..else, Switch case, Common mistakes with control statements (like using = instead of ==), Solving frequently asked questions on decision making, Types of looping statements, Entry Controlled, For, While, Exit Controlled, do while, break and continue, Demo on looping, Common mistakes with looping statements (like using ; at the end of the loop), Solving pattern programming problems, series problems, Solving predict the output questions

Unit IV String, Date, Array **6**

String handling, date handing, Solving problems based on arrays like searching, sorting, rearranging, iteration), Multi-dimensional arrays, Solving pattern problems using 2D arrays, Real time application based on 2D arrays

Unit V PROBLEM SOLVING AND ALGORITHMIC SKILLS **6**

Types of access specifiers, Demo on access specifiers, Assignment on access modifiers - Instance Members, Solving MCQs based on modifiers

Total : 30 Periods

		L	T	P	C
20CS414	**ARTIFICIAL INTELLIGENCE**	**3**	**0**	**0**	**3**

Course Objective:

1. To understand fundamental concepts in Artificial Intelligence.
2. To learn about various searching methods
3. To understand the problem solving techniques and knowledge representation.
4. To learn from observations and know about the reinforcement learning.

5. To implement, and evaluate a computer-based intelligent systems.

Unit I INTRODUCTION **9**

Intelligent Agents – Agents and environments – Good behavior – The nature of environments – structure of agents – Problem Solving - problem solving agents – example problems – searching for solutions – uniformed search strategies - avoiding repeated states – searching with partial information.

Unit II SEARCHING TECHNIQUES **9**

Informed search and exploration – Informed search strategies – heuristic function – local search algorithms and optimistic problems – local search in continuous spaces – online search agents and unknown environments – Constraint satisfaction problems (CSP) – Backtracking search and Local search for CSP – Structure of problems – Adversarial Search – Games – Optimal decisions in games – Alpha – Beta Pruning – imperfect real-time decision – games that include an element of chance.

Unit III KNOWLEDGE REPRESENTATION **9**

Introduction to Logical Agents- First order logic – Syntax and semantics for first order logic – Using first order logic – Knowledge engineering in first order logic - Inference in First order logic – prepositional versus first order logic – unification and lifting – forward chaining – backward chaining – Resolution – Knowledge representation – Ontological Engineering - Categories and objects

Unit IV LEARNING **9**

Learning from observations – forms of learning – Inductive learning – Learning decision trees – Ensemble learning – Knowledge in learning – Logical formulation of learning – Explanation based learning – Learning using relevant information – Inductive logic programming – Statistical learning methods – Learning with complete data - Learning with hidden variable – EM algorithm – Instance based learning – Neural networks – Reinforcement learning – Passive reinforcement learning – Active reinforcement learning – Generalization in reinforcement learning

Unit V APPLICATIONS **9**

Communication – Communication as action – Formal grammar for a fragment of English – Syntactic analysis – Augmented grammars – Semantic interpretation – Ambiguity and disambiguation –Discourse understanding – Grammar induction – Probabilistic language processing – Probabilistic language models – Information retrieval – Information Extraction – Machine translation.

Total : 45 Periods

Course Outcomes:

CO1: Recognize the various types and working units of artificial intelligence
CO2: Able to apply searching strategies on the problem space
CO3: Interpret the logic behind the building of knowledge base and knowledge representation.
CO4: Apply suitable learning methodology while designing systems based on their applications.
CO5: Design applications using AI techniques

Text Books

1 Stuart Russell, Peter Norvig, ―Artificial Intelligence – A Modern Approach, 3rd Edition, Pearson Education / Prentice Hall of India, 2013

2 Nils J. Nilsson, ―Artificial Intelligence: A new Synthesis, Harcourt Asia Pvt. Ltd., 2000

3 Rajiv Chopra, Artificial Intelligence - A Practical Approach, S Chand Pub, 2014

References

1 Elaine Rich and Kevin Knight, ―Artificial Intelligence, 2nd Edition, Tata McGraw-Hill , 2003.

2 George F. Luger, ―Artificial Intelligence-Structures and Strategies for Complex Problem Solving, Pearson Education / PHI, 2002

Web References

1 https://www.edx.org/learn/artificial-intelligence

2 https://www.classcentral.com/subject/ai

3 https://www.udacity.com/course/intro-to-artificial-intelligence--cs271

		L	T	P	C
20CS415	**DEVELOPMENT OF MACHINE LEARNING MODELS**	**2**	**0**	**2**	**3**

Course Objective:

1. To understand various tools used in machine learning.
2. To learn about various policies and classification models.
3. To understand the problem solving techniques and knowledge representation in various catalogs.

UNIT I INTRODUCTION TO MACHINE LEARNING 6+6

Machine learning Introduction-Types of Machine learning -Supervised, Unsupervised and reinforcement-Over fitting and Regression-Classification-Clustering-Parametric vs non-Parametric models-Linear model

UNIT II INTRODUCTION TO IBM CLOUD 6+6

Introduction to IBM cloud- Resources-IBM Cloud Infrastructure- Security-IBM Cloud Foundry-Cloud Park for data- IBM cloud vs Amazon cloud - Cloud Native Storage and Data Service

Unit III INTRODUCTION TO WATSON STUDIO 6+6

Introduction to Watson studio- Project creation- Storage- Access control- Prebuilt Watson application- Watson Solutions- Catalog and govern data

Unit IV MACHINE LEARNING IN WATSON 6+6

Watson knowledge studio and Watson knowledge catalog-Watson Discovery Services-Watson Auto AI-Watson Open Scale- visual recognition- Watson API

Unit V NATURAL LANGUAGE PROCESSING 6+6

NLP Introduction-Natural language Understanding (NLU)-Conversational AI-Building blocks of chatbot-Watson Assistant-Speech to Text -Text to speech.

List of Experiments:

1.Linear regression

2. Group the similar data items using the ML algorithm.

3. Implement a K-Means Clustering

4. Cloud enrolment

5.Working with prebuilt Watson application

6.Create a chart bot for student help centre college.

7. Create a model to Convert Audio note to Text by using Watson API.

8. Create a model to Convert Text to Audio note by using Watson API.

Total: 60 Periods

Course Outcomes:

At the end of the course, the students would,

CO1: Understand the environment and tools to solve your business problems by collaboratively working with data.

CO2: Apply various machine learning algorithms for various problems.

CO3: Demonstrate various cloud services and their security features

CO4: Analyze and visualize data, to cleanse and shape data, to ingest streaming data, or to create and train machine learning models using modern tools.

CO5: Apply the tool for interactions between computers and human language, and build applications.

References 1

IBM Courseware

20EC311	MICROPROCESSOR AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3

Course Objective

1. To Demonstrate the Architecture of 8086 Microprocessor.
2. To interpret the system bus structure and Multi-processor Configuration of 8086 Microprocessor.
3. To apply the design aspects of I/O and Memory Interfacing Circuits
4. To Examine the Architecture of 8051 Microcontroller
5. To Practice the design aspect of interfacing circuits with 8051 Microcontroller

Unit I 8086 MICROPROCESSOR 9

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines.

Unit II 8086 SYSTEM BUS STRUCTURE AN MULTI PROCESSOR CONFIGURATION 9

Basic 8086 configurations – System bus timing –System Design – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to ARM processors.

Unit III PERIPHERAL DEVICES AND THEIR INTERFACING 9

Address space portioning-Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface -D/A and A/D Interface - Timer - Keyboard /display controller – Interrupt controller – DMA controller.

Unit IV 8051 MICROCONTROLLER 9

Over view of 8051 family-Architecture of 8051 –I/O Pins Ports Circuits and I/O Port Programming - Instruction set - Addressing modes - Assembly language programming.

Unit V 8051 MICROCONTROLLER INTERFACING WITH PERIPHERAL DEVICE. 9

8051 Timers Programming - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor Interfacing.

Total: 45 Periods

TEXT BOOKS:

1. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family – Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2007

2. Krishna Kant, "Microprocessors and Microcontrollers Architecture, programming and system design using 8085, 8086, 8051 and 8096". PHI 2007.

REFERENCE BOOKS:

R1 - 1. Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing The PC",Del Publishers, 2007.
R2 - 2. Doughlas V.Hall, "Microprocessors and Interfacing, Programming and Hardware:,TMH 2012.
R3 - 3. B. Ram ," Micro processors and Micro controllers", 8th Edition, Dhanpat Rai Publicatio Pvt. Ltd., 2015.
R4 - 4. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontrc and Embedded Systems: Using Assembly and C", Second Edition, Pearson Education, 2011

WEB REFERENCES:

1. https://nptel.ac.in/courses/117/106/117106086/
2. https://nptel.ac.in/courses/108/103/108103157/
3. https://nptel.ac.in/courses/108/105/108105102/

20MC803 INDIAN CONSTITUTION

L	T	P	C
3	0	0	0

Course Objective:

- To know about Indian constitution.
- To know about central government and state government functionalities in India.
- To know about Indian society

Unit I INTRODUCTION **9**

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

Unit II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT **9**

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

Unit III STRUCTURE AND FUNCTION OF STATE GOVERNMENT **9**

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

Unit IV CONSTITUTION FUCTIONS **9**

Indian Federal System – Center – State Relations – President‟s Rule – Constitutional Amendments – Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

Unit V INDIAN SOCIETY **9**

Society : Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

Total : 45 Periods

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

CO1 Understand the functions of the Indian government.

CO2 Describe and abide the rules of the Indian constitution.

CO3 Appraise and appreciate different culture among the people.

CO4 Illustrate the functions of constitution.

CO5 Express the nature of Indian society and citizens

Text Books

1 Durga Das Basu, “Introduction to the Constitution of India “, Prentice Hall of India, New

Delhi.2016.

2 Maciver and Page, " Society: An Introduction Analysis ", Mac Milan India Ltd., New Delhi.2015

References

1 Sharma, Brij Kishore, " Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.2017.

2 U.R.Gahai, "Indian Political System ", New Academic Publishing House, Jalaendhar.2013.

3 R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.2015.

		L	T	P	C
20EC421	**MICROPORCESSOR AND MICROCONTROLLERS LABORATORY**	**0**	**0**	**4**	**2**

Course Objective

- Introduce ALP concepts, features and Coding methods
- Write ALP for arithmetic and logical operations in 8086 and 8051
- Differentiate Serial and Parallel Interface
- Interface different I/Os with Microprocessors
- Be familiar with 8086 Emulator

LIST OF EXPERIMENTS

8086 Programs using kit and 8086 Emulator

16 – BIT MICROPROCESSOR (8086)

1. Arithmetic Operations & Logical operations using 8086
2. Move a Data Block without Overlap
3. Code Conversion
4. Decimal Arithmetic
5. Matrix Operation
6. String Operation
7. Find and Replace a data in String
8. Maximum and Minimum Number
9. Sorting

PERIPHERALS AND INTERFACING EXPERIMENTS

10. Parallel Interface
11. Serial interface
12. Timer Interface

13. Stepper motor Interface
14. Key board and Display Interface
15. A/D Interface
16. D/A Interface

8051 Experiments using kit

17. Arithmetic and Logical Operations
18. Square and Cube of a Number
19. 2's complement of a Number
20. Unpacked BCD to ASCII Code

Total : 60 Periods

Course Outcome:

CO1 Write ALP Programs for fixed and Floating Point and Arithmetic
CO2 Interface different I/Os with processor
CO3 Generate waveforms using Microprocessors
CO4 Execute Programs in 8051
CO5 Explain the difference between simulator and Emulator

		L	T	P	C
20TP706	**PROGRAMMING ASPECTS & TECHNICAL APTITUDE – II**	**0**	**0**	**2**	**1**

Unit I Inheritance, Aggregation & Associations 10

Need, Is A – Inheritance, Types of inheritance supported, Diagrammatic representation, Demo on inheritance, Has A – Aggregation, Diagrammatic representation, Demo on aggregation, Uses A – Association, Diagrammatic representation, Demo on association, Assignment on relationships, Solving MCQs based on relationships between classes

Unit II Interface & Abstract classes (Java specific) 5

Abstract Classes, Need, Abstract Classes, Abstract Methods, Interfaces, Assignment on abstract classes and interface

Unit III Packages (Java specific) 3

Need for packages, Access specifiers & packages, Import classes from other packages

Unit IV Collections (Java specific) List, Tuple & Dict in Python 12

Array List, Linked List, List Interface, Hash Set, Map Interface, Hash Map, Set List, Tuple & Dict, Programming questions based on collections, Real world problems based on data structure

Unit V Solving algorithmic problems **15**

Case study: Using correct data structures, Modifying well known existing algorithms, Discussion on computing the complexity of the algorithm, Solving dynamic programming questions

Total : 45 Periods

SEMESTER VII

		L	T	P	C
20CS419	**CLOUD COMPUTING**	**3**	**0**	**0**	**3**

Course Objective:

1. To understand the concept of cloud computing.
2. To know about the cloud services.
3. To have knowledge on the various issues in cloud computing.
4. To be familiar with the lead players in cloud.
5. To appreciate the emergence of cloud as the next generation computing paradigm and web based communication.

UNIT I UNDERSTANDING CLOUD COMPUTING **9**

Cloud Computing – History of Cloud Computing – Cloud Architecture – Cloud Storage – Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services.

UNIT II DEVELOPING CLOUD SERVICES **9**

Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools – Amazon Ec2 – Google App Engine – IBM Clouds.

UNIT III CLOUD COMPUTING FOR EVERYONE **9**

Centralizing Email Communications – Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud Computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for the Corporation.

UNIT IV USING CLOUD SERVICES **9**

Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications – Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Databases – Storing and Sharing Files.

UNIT V ADVANCED WAY TO COLLABORATE ONLINE **9**

Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis.

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able to

CO1. Articulate the main concepts, key technologies, strengths and limitations of cloud computing.

CO2. Learn the key and enabling technologies that help in the development of cloud.

CO3. Develop the ability to understand and use the architecture of compute and storage cloud.

CO4. Install and use current cloud technologies.

C05. Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

CO6 Choose among various cloud technologies for implementing applications.

Text Books

1 Michael Miller, Cloud Computing, 9th Edition Pearson Education, 2014.

2 Anthony T.Velte, Cloud Computing, 12th Edition, Tata Mcgraw Hill, 2013.

References

1. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, 2016.
2. Applications and Data Centers in the Cloud with SLAs, Emereo Pvt Limited, July 2018.

Web References

1 https://alison.com › IT › Software Engineering › Operating Systems Courses.

		L	T	P	C
20CS420	**CRYPTOGRAPHY AND NETWORK SECRUITY**	**3**	**0**	**0**	**3**

Course Objective:

1. To know the methods of conventional encryption.
2. To understand the concepts of public key encryption and number theory.
3. To understand authentication and Hash functions.
4. To know the network security tools and applications.
5. To understand the system level security used.

9

UNIT I INTRODUCTION TO CRYPTOGRAPHY

Basic concepts: confidentiality, integrity, availability, security policies, security mechanisms, assurance - Basic cryptography Historical background Transposition/Substitution, Caesar Cipher Introduction to Symmetric crypto primitives, Asymmetric crypto primitives - perfect security – information theory – product cryptosystem – cryptanalysis.

UNIT II SYMMETRIC CIPHERS **9**

Traditional Symmetric ciphers - Substitution ciphers - Transposition ciphers - stream and block ciphers. Modern Symmetric key ciphers - Modern block and Stream ciphers - Data Encryption Standard - DES analysis - Structure - Multiple DES - Advanced data Encryption Standard - Transformation - Key Expansion – Analysis - Modern Block Ciphers - Stream Ciphers - other issues.

UNIT III ASYMMETRIC CIPHERS **9**

Mathematics of cryptography - Primality testing - factorization - Chinese remainder theorem - Quadratic congruence - exponentiation and logarithm - RSA Cryptosystem - Rabin Cryptosystem - Elgamal Cryptosystem - Elliptic cryptosystem.

UNIT IV MESSAGE INTEGRITY AND MESSAGE AUTHENTICATION **9**

Message integrity and Message authentication - Cryptographic hash functions - Digital signature - Key management - private and public - distribution - Kerberos - PGP - Security at application layer -Transport layer - Network layer - IKE-ISAKMP.

UNIT V ADVANCED NETWORK SECURITY **9**

Security in GSM - Security in 3G - Security in Java and .Net - Operating Systems - Network Security -firewalls and VPN - Case studies - Single Sign On (SSO) - Denial of service (DoS) - Cross Site Scripting Vulnerability (CSSV).

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able

CO1. To design and conduct experiments to analyze and interpret data.

CO2. To use Cryptography in different fields of Engineering and Mathematics.

CO3. To analyze and select a suitable Cipher for an application.

CO4. To use the best solution for a threat.

CO5. To use efficient algorithms for obtaining optimal solutions for a problem.

CO6. To protect any network from the threats in the world.

Text Books

1. William Stallings, ― Cryptography and Network security, Pearson Education, Eighth

Edition, 2020.

2. Cryptography and Network security, Atul Kahate, Tata McGraw-Hill Pub company Ltd., fourth Edition, 2012.

References

1. BehrouzA.Forouzan ― Cryptography and Network Secuity, The McGraw-Hill Companies, 2015.
2. Roberta Bragg, Mark Rhodes- Ousley, Keith Strassberg ―Network Security: The Complete Reference‖, Tata McGraw-Hill, 2014.
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, ―Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall. 2011.

Web References

1 https://www.coursera.org/lecture/managing-network-cybersecurity/cryptography-and-network-security-w9SuJ.

2 https://onlinecourses.nptel.ac.in/noc20_cs21/preview.

20MB101 ORGANIZATIONAL BEHAVIOR AND ACCOUNTING

L	T	P	C
3	0	0	3

Course Objective:

1. To help the students to develop cognizance of the importance of human behaviour.
2. To enable students to describe how people behave under different conditions and understand why people behave as they do.
3. To provide the students to analyse specific strategic human resources demands for future action.
4. To enable students to synthesize related information and evaluate options for the most logical and optimal solution such that they would be able.
5. To predict and control human behavior and improve results.

UNIT I FOCUS AND PURPOSE **9**

Definition, need and importance of organizational behaviour – Nature and scope – Frame work – Organizational behaviour models.

UNIT II INDIVIDUAL BEHAVIOUR **9**

Personality – types – Factors influencing personality – Theories – Learning – Types of learners – The learning process – Learning theories – Organizational behaviour modification. Misbehaviour – Types – Management Intervention. Emotions - Emotional Labour – Emotional Intelligence –

Theories. Attitudes – Characteristics – Components – Formation – Measurement- Values. Perceptions – Importance – Factors influencing perception – Interpersonal perception- Impression Management Motivation – importance – Types – Effects on work behavior.

UNIT III GROUP BEHAVIOUR **9**

Organization structure – Formation – Groups in organizations – Influence – Group dynamics – Emergence of informal leaders and working norms – Group decision making techniques – Team building - Interpersonal relations – Communication – Control.

UNIT IV LEADERSHIP AND POWER **9**

Meaning – Importance – Leadership styles – Theories – Leaders Vs Managers – Sources of power – Power centers – Power and Politics.

UNIT V DYNAMICS OF ORGANIZATIONAL BEHAVIOUR **9**

Organizational culture and climate – Factors affecting organizational climate – Importance. Job satisfaction – Determinants – Measurements – Influence on behavior. Organizational change – Importance – Stability Vs Change – Proactive Vs Reaction change – the change process – Resistance to change – Managing change Stress – Work Stressors – Prevention and Management of stress – Balancing work and Life. organizational development – Characteristics – objectives –. Organizational effectiveness.

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able to

CO1. Demonstrate the applicability of the concept of organizational behavior to understand the behavior of people in the organization.

CO2 Demonstrate the applicability of analyzing the complexities associated with management of individual behavior in the organization.

CO3 Analyze the complexities associated with management of the group behavior in the organization.

CO4: Demonstrate how the organizational behavior can integrate in understanding the motivation (why) behind behavior of people in the organization.

CO5. To bring about the thorough understanding of source of finance to entrepreneurs.

CO6. The students will gain more knowledge on Group Behavior.

Text Books

1. Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 5th edition, 2014.
2. Fred Luthans, Organisational Behavior, McGraw Hill, 11th Edition, 2011.

References

1. Schermerhorn, Hunt and Osborn, Organisational behavior, John Wiley, 9th Edition, 2012.
2. UdaiPareek, Understanding Organisational Behaviour, 4th Edition, Oxford Higher Education, 2014.

20CS421	MOBILE APPLICATION DEVELOPMENT LABORATORY	L	T	P	C
		0	0	4	2

Course Objective:

1. To understand the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
2. To understand how to work with various mobile application development frameworks.
3. To learn the basic and important design concepts and issues of development of mobile applications.
4. To understand the capabilities and limitations of mobile devices.

Course Outcomes:

At the end of the course, students will be able to

CO1. Develop mobile applications using GUI and Layouts.
CO2. Develop mobile applications using Event Listener.
CO3. Develop mobile applications using Databases.
CO4. Develop mobile applications using RSS Feed, Internal/External Storage, SMS, Multithreading and GPS.
CO5. Analyze and discover own mobile app for simple needs.

List of Experiments

1. Develop an application that uses GUI components, Font and Colours.
2. Develop an application that uses Layout Managers and event listeners.
3. Write an application that draws basic graphical primitives on the screen.
4. Develop an application that makes use of databases.
5. Develop an application that makes use of Notification Manager.
6. Implement an application that uses Multi-threading.
7. Develop a native application that uses GPS location information.

8. Implement an application that writes data to the SD card.
9. Implement an application that creates an alert upon receiving a message.
10. Write a mobile application that makes use of RSS feed.
11. Develop a mobile application to send an email.
12. Develop an application that uses Google Kotlin.
13. Develop a Mobile application for simple needs (Mini Project).

Total : 60 Periods

Text Book

1. Mark Lassoff, Mobile App Development with HTML5, Learn To Program, Incorporated; 1st Edition 2015.

References

1. Jonathan McCallister, Mobile Apps Made Simple: The Ultimate Guide to Quickly Creating, Designing and Utilizing Mobile Apps for Your Business – 2nd Edition 2017.
2. Michael Burton, Android App Development For Dummies 3rd Edition, Kindle Edition, John wiley and Sons, 2015.

20CS422 CLOUD COMPUTING LABORATORY

L	T	P	C
0	0	4	2

Course Objective:

1. To develop web applications in cloud.
2. To learn the design and development process involved in creating a cloud based application.
3. To learn to implement and use parallel programming using Hadoop.

Course Outcomes:

At the end of the course, students will be able to

CO1. Configure various virtualization tools such as Virtual Box, VMware workstation.
CO2. Design and deploy a web application in a PaaS environment.
CO3. Learn how to simulate a cloud environment to implement new schedulers.
CO4. Install and use a generic cloud environment that can be used as a private cloud.
CO5. Manipulate large data sets in a parallel environment.

List of Experiments

1. Install Virtual box/VMware Workstation with different flavours of Linux or windows OS on

top of windows7 or 8 and execute simple Programs.

2. Install Google App Engine. Create hello world app and other simple web applications using python/java.

3. Use GAE launcher to launch the web applications.

4. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm that is not present in Cloud Sim.

5. Find a procedure to transfer the files from one virtual machine to another virtual machine.

6. Find a procedure to launch virtual machine using try stack (Online Open stack Demo Version).

7. Install Hadoop single node cluster and run simple applications like word count.

Total : 60 Periods

ONLINE RESOURCES:

1. https://www.edureka.co › blog › hadoop-tutorial
2. https://intellipaat.com › Home › Tutorials
3. https://www.bmc.com › blogs › hadoop-introduction

20CS423	ARTIFICIAL INTELLIGENCE ANALYST	L	T	P	C
		1	0	2	2

Course Objective:

1. Introduce the basic principles, techniques of AI.
2. Strong foundation of fundamental concepts in Artificial Intelligence.
3. Apply AI techniques to real-world problems to develop intelligent systems.
4. Implement the generic algorithms of Deep learning.
5. To connect existing statistical techniques to machine translation technologies.
6. IBM CE Minor Projects.

List of Experiments

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm.

Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

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

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

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

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

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

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

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

UNIT I AI LANDSCAPE & AI INDUSTRY ADOPTION APPROACHES 9

Impact in the world today - History and Evolution of AI - AI Explained - AI Systems Features - AI Industry Impact - AI Insights and Knowledge - AI Automation - Autonomous Vehicles - Smart Robotics - Future Workforce and AI. Introduction to Virtual Agents and Chatbot.

UNIT II NLP AND COMPUTER VISION 9

NLP Overview - NLP components - UIMA Pipeline - Sentiment Analysis - Virtual Agents Overview - Virtual Agents for the Enterprise - Computer Vision Overview - Image Classification and Tagging - AI Vision through Deep Learning - Neural Network for Facial Recognition - 1 - hot Encoding - Computer Vision for the Enterprise.

UNIT III MACHINE LEARNING AND DEEP LEARNING 9

Machine Learning - Decision Tree Classifier - Neural Nets with Back Propagation - Deep Learning - Gradient Descent - Multilayer perceptron - Deep learning ecosystem FUTURE TRENDS FOR AI - Narrow – Broad - General - AI at International Space - CIMON - Limits of machine and human - AI predictions in the next 5 years.

Total : 45 Periods

Text Books

1. Artificial Intelligence | Third Edition | By Pearson: A Modern Approach by Russell 2015.
2. Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems by Sowmya Vajjala , Bodhisattwa Majumder , et al., 2020.

References

1. Demystifying Artificial intelligence: Simplified AI and Machine Learning concepts for Everyone (English Edition) by Prashant Kikani, 2021.
2. Computer Vision: A Modern Approach by Forsyth / Ponce 2015.
3. IBM Courseware.

PROFESSIONAL ELECTIVES (PEC)

LIST OF STREAM BASED ELECTIVE COURSES

		L	T	P	C
20CS501	**MACHINE LEARNING**	**3**	**0**	**0**	**3**

Course Objective:

1. To understand the basic concepts of machine learning and probability theory.
2. To appreciate supervised learning and their applications.
3. To understand unsupervised learning like clustering and EM algorithms.
4. To understand the theoretical and practical aspects of probabilistic graphical models.
5. To learn other learning aspects such as reinforcement learning, representation learning, deep learning, neural networks and other technologies.

UNIT I INTRODUCTION 9

Introduction: Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation- Machine Learning – Types of Machine Learning – Supervised Learning – Unsupervised Learning – Basic Concepts in Machine Learning – Machine Learning Process – Weight Space – Testing Machine Learning Algorithms.

UNIT II SUPERVISED LEARNING **9**

Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component, Regression, Partial Least squares Week - Linear Classification, Logistic Regression, Linear Discriminant Analysis Week 4: Perceptron, Discriminant Functions – Probabilistic Generative Models – Probabilistic Discriminative Models – Laplace Approximation – Bayesian Logistic Regression – Common Classification Algorithms – k-Nearest Neighbors – Decision Trees – Random Forest model – Support Vector Machines.

UNIT III UNSUPERVISED LEARNING **9**

Mixture Models and EM – K-Means Clustering –Spectral Clustering – Hierarchical Clustering – The Curse of Dimensionality – Dimensionality Reduction – Principal Component Analysis – Latent Variable Models (LVM) – Latent Dirichlet Allocation (LDA).

UNIT IV GRAPHICAL MODELS **9**

Gradient Boosting, Random Forests, Multi-class Classification, Naive Bayes, Bayesian Networks, Undirected Graphical Models, HMM, Variable Elimination, Belief Propagation- Conditional Independence – Markov Random Fields – Learning – Naive Bayes Classifiers – Markov Model – Hidden Markov Model.

UNIT V ADVANCED LEARNING **9**

Reinforcement Learning – Representation Learning – Neural Networks – Active Learning – Ensemble Learning – Optional videos (RL framework, TD learning, Solution, Methods, Applications).

Total : 45 Periods

Course Outcomes:

CO1. Choose and implement classification or regression algorithms for an application using an open source tool.

CO2. Implement probabilistic discriminative and generative algorithms for an application and analyze the results.

CO3. Use a tool to implement typical clustering algorithms for different types of applications.

CO4. Design and implement an HMM for a sequence model type of application.

CO5. Implement appropriate learning algorithms for any real time application using an open source tool.

CO6. Identify applications suitable for different types of machine learning with suitable justification.

Text Book

1. Ethem Alpaydin, ‑Introduction to Machine Learning‖, 4th Edition, Prentice Hall of India, 2020.

References

1. Christopher Bishop, –Pattern Recognition and Machine Learning‖, Springer, 2011.
2. Kevin P. Murphy, –Machine Learning: A Probabilistic Perspective‖, MIT Press, 2012.
3. Stephen Marsland, –Machine Learning – An Algorithmic Perspective‖, Second Edition, CRC Press, 2014.
4. Tom Mitchell, –Machine Learning‖, McGraw-Hill, 2017.
5. Trevor Hastie, Robert Tibshirani, Jerome Friedman, –The Elements of Statistical Learning‖, Second Edition, Springer, 2008.
6. Fabio Nelli, ―Python Data Analytics with Pandas, Numpy, and Matplotlib‖, Second Edition, Apress, 2018.

20CS502 SOFT COMPUTING

L	T	P	C
3	0	0	3

Course Objective:

1. To understand the concepts of Artificial Intelligence, ANN.
2. To understand the concepts of Genetic Algorithms and Fuzzy systems and its applications.
3. To introduce the concept of meta-cognitive of soft computing.
4. To understand Fuzzy Logic, Various fuzzy systems and their functions.
5. To compute character recognition, pattern classification, regression.

UNIT I INTRODUCTION **9**

Introduction to soft computing- Neural Computing- Brain as Neural network-Basic Properties of Neurons – Neuron Models – Rosenblatt‘s Perceptron – The widrow -Hoff LMS Learning Algorithm-Order of a Predicate and a Perceptron – Complexity of Learning using Feed forward Networks.

UNIT II FUZZY SYSTEMS **9**

Fuzzy Sets and Fuzzy Matrices Fuzzy Functions – Decompositions Fuzzy Automata and Languages Fuzzy Control Method – Fuzzy Decision Making.

UNIT III NEURO-FUZZY SYSTEMS **9**

Introduction to Neuro – Fuzzy Systems – Fuzzy System Design Procedures – Fuzzy Sets and Logic Background - Fuzzy / ANN Design and Implementation.

UNIT IV GENETIC ALGORITHMS **9**

Introduction – Robustness of Traditional Optimization and Search Techniques – The goals of optimization-Computer Implementation-Data Structures, Reproduction, Crossover and Mutation – Mapping Objective Functions to fitness form – Some Applications of Genetic Algorithms.

UNIT V ARTIFICIAL INTELLIGENCE 9

AI technique-Level of the Model – Problems, Problem Spaces and Search – Issues in the Design of Search Programs – Heuristic Search Techniques – Knowledge Representations and Mappings.

Total : 45 Periods

Course Outcomes:

CO1. To understand the facts and outline the different process carried out in fuzzy logic, ANN and Genetic Algorithms. Source tool.

CO2. To apply the concepts and meta-cognitive of soft computing and Soft computing techniques to solve character recognition, pattern classification, regression.

CO3. To analyze process/procedures to handle real world problems using soft computing.

CO4. To Evaluate various techniques of soft computing to defend the best working solutions.

CO5. To Design hybrid system to revise the principles of soft computing in various applications.

CO6. To effectively use modern software tools to solve real problems using a soft computing approach and evaluate various soft computing approaches for a given problem.

Text Books

1. Bose, N.K. and Liang, P. Neural Network Fundamentals with Graphs, Algorithms and Applications. McGraw-Hill Series.
2. Timothy J. Ross, –Fuzzy Logic with Engineering Applications‖, McGraw- Hill International Editions, 2011.

References

1. Elaine Rich and Kelvin knight, ―Artificial Intelligence‖, McGraw- Hill 2000.
2. David E. Goldberg, –Genetic Algorithms-In Search, optimization and Machine Learning‖, Pearson Education.
3. Robert J. Schalkoff, –Artificial Neural Networks‖, McGraw-Hill International Editions, 1997.
4. Freeman J.A. & D.M. Skapura , –Neural Networks: Algorithms, Applications and Programming Techniques‖, Addison Wesley, 1992.

20CS503 NATURAL LANGUAGE PROCESSING

L	T	P	C
3	0	0	3

Course Objective:

1. To learn the fundamentals of natural language processing.
2. To understand the use of CFG and PCFG in NLP.
3. To understand the role of semantics of sentences and pragmatics.
4. To apply the NLP techniques to ML applications.
5. To understand the basis of semantic analysis and discourse analysis and drives it machine translation.

UNIT I OVERVIEW AND LANGUAGE MODELING **9**

Origins and Challenges of NLP – Language and Grammar - Processing Indian Languages – NLP Applications – Information Retrieval – Language Modeling – Various Grammar based Language Models – Statistical Language Model.

UNIT II WORD LEVEL ANALYSIS **9**

Regular Expressions – Finite State Automata – Morphological Parsing – Spelling Error Detection and correction – Words and Word classes – Part of Speech Tagging.

UNIT III SYNTACTIC ANALYSIS **9**

Grammars (e.g. Formal/Chomsky hierarchy, DCGs, systemic, case, unification, stochastic) - Parsing (top-down, bottom-up, chart (Earley algorithm), CYK algorithm) - Automated estimation of probabilistic model parameters (inside-outside algorithm) - Data Oriented Parsing - Grammar formalisms and tree banks - Efficient parsing for context-free grammars (CFGs) - Statistical parsing and probabilistic CFGs (PCFGs) - Lexicalized PCFGs.

UNIT IV SEMANTIC ANALYSIS AND DISCOURSE PROCESSING **9**

Meaning Representation – Lexical Semantics – Ambiguity – Word Sense Disambiguation – Cohesion – Reference Resolution – Discourse Coherence and Structure - Pragmatic Analysis.

UNIT V NATURAL LANGUAGE GENERATION AND MACHINE TRANSLATION **9**

Architecture of NLG Systems– Generation Tasks and Representations – Application of NLG – Problems in Machine Translation – Characteristics of Indian Languages – Machine Translation Approaches – Translation involving Indian Languages.

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able

CO1. To demonstrate the basics of language modeling.

CO2. To explain about the various phases of language processing.

CO3. To discuss the approaches for analyzing the syntax and semantics in NLP.

CO4. To summarize the approaches to discourse, generation, dialogue and summarization within NLP.

CO5. To associate current methods for statistical approaches to machine translation.

CO6. To differentiate semantic and discourse in terms of NLP.

Text Books

1. Tanveer Siddiqui, U.S. Tiwary, –Natural Language Processing and Information Retrieval‖, Oxford University Press, 2011.
2. Daniel Jurafsky and James H. Martin, –Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition‖, Prentice Hall, 2020.

References

1. Nitin Indurkhya, Fred J.Damerau, –Handbook of Natural language Processing‖, Second Edition, CRC Press, 2010.
2. James Allen, –Natural Language Understanding‖, Addison Wesley, 2008.
3. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python, First Edition, OReilly Media, 2012.

Web References

1 https://nptel.ac.in/courses/106/105/106105158/.

2 https://www.coursera.org/specializations/natural-language-processing.

		L	T	P	C
20CS504	**DEEP LEARNING**	**3**	**0**	**0**	**3**

Course Objective:

1. To present the mathematical, statistical and computational challenges of building neural networks.
2. Gain knowledge in Machine Learning Basics.
3. Understand and apply Optimization on Deep Models and Networks.
4. Understand and analyze Recurrent and Recursive Networks.
5. Understand the representation of neural networks in machine learning.

UNIT I INTRODUCTION **9**

Introduction : Historical Trends in Deep Learning - Linear Algebra: Scalars - Vectors - Matrices - Tensors - Matrices - Norms – Eigen decomposition - Probability and Information Theory: Random variable and distributed Probability - Bayes Rule - Information Theory and structured probabilistic models.

UNIT II MACHINE LEARNING BASICS **9**

Numerical Computation: Overflow and Underflow - Gradient based Optimization – Constrained Optimization - Learning Algorithms: Capacity - Overfitting - Under fitting - Bayesian Classification - Supervised - unsupervised algorithms - Building machine learning algorithm.

UNIT III ADVANCED NEURAL NETWORKS **9**

Deep Feed forward Networks : Gradient based learning - Hidden Units – Transformation - Architectural design – Back Propagation algorithms - Regularization for deep learning: Dataset Augmentation - Noise Robustes –Semi supervised learning -Multitask learning - Adserial training.

UNIT IV OPTIMIZATION ON DEEP MODELS **9**

Optimization for training Deep Models: Challenges in Neural Networks optimization - Basic Algorithms - Algorithms Adaptive learning Rates - Approximate Second Order Methods - Optimization Strategies and Meta Algorithms -Convolutional Networks: Motivation - Structured Output - Unsupervised features – Neuro scientific basics for Convolutional Networks.

UNIT V RECURRENT AND RECURSIVE NETWORKS **9**

Computational graphs - Recurrent Neural networks - Bidirectional RNN - Deep Recurrent Networks - Echo State Networks - Practical Methodology - Applications: Large Scale Deep Learning – Computer Vision - Speech Recognition - Natural language Processing, Case studies in classification, Regression and deep networks.

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able

CO1. To understand the Basic fundamentals Deep learning and Machine Learning Algorithms.
CO2. To apply the concepts and meta-cognitive of soft computing and Soft computing techniques to solve character recognition, pattern classification, regression.
CO3. To analyze Deep learning Mathematical Models.
CO4. To Evaluate Recurrent and Recursive Networks and Natural language Processing.
CO5. To Design the Deep Feed forward Networks.
CO6. To explore the deep learning applications.

Text Book

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, Cambridge University Press, 2017.

References

1. Duda, R.O., Hart, P.E., and Stork, D.G. Pattern Classication. Wiley-Interscience. 2nd Edition.2001.
2. Theodoridis, S. and Koutroumbas, K. Pattern Recognition. Edition 4. Academic Press, 2008.
3. Russell, S. and Norvig, N. Articial Intelligence: A Modern Approach. Prentice Hall Series in Articial Intelligence. 2003.
4. Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press. 1995.

5. Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning. Springer. 2001.
6. Duda, R.O., Hart, P.E., and Stork, D.G. Pattern Classication. Wiley-Interscience. 2nd Edition.2001

20CS505 **QUANTUM COMPUTING**

L	T	P	C
3	0	0	3

Course Objective:

1. To understand the concepts of quantum information processing.
2. To understand the concepts of quantum computation and its applications.
3. To introduce the concept of quantum cryptography of quantum computing.
4. To compute quantum information theory.

UNIT I INTRODUCTION **9**

Quantum computing — motivation, foundations, and prominent applications. Review of linear algebra in the context of quantum information, Dirac‘s bracket notation, limitation of classical algorithms-four postulates-mechanics, qubits, quantum gates and circuits.

UNIT II BASIC QUANTUM ALGORITHMS I **9**

Deutsch‘s algorithm, analyzing quantum algorithms, and implementing quantum circuits via QISKIT

UNIT III BASIC QUANTUM ALGORITHMS II **9**

Simon‘s problem and the Bernstein -V-azirani algorithm. Grover‘s quantum search algorithm, the BBBV Theorem, and applications of Grover‘s algorithm.

UNIT IV INTRODUCTION TO QUANTUM CRYPTOGRAPHY

RSA Algorithm–Quantum Cryptography and Shor‘s integer factorization algorithm-Post-Quantum Security, Quantum Key Distribution.

UNIT V INTRODUCTION TO QUANTUM INFORMATION **9**

Superdense Coding, Nocloning Theorem, Quantum Teleportation - Applications -Quantum Money, The Elitzur-Vaidman Bomb.

Total : 45 Periods

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

CO1. Understand quantum computation, quantum cryptography, and quantum information theory.
CO2. Analyze the behavior of basic quantum algorithms.
CO3. Implement simple quantum algorithms and information channels in the quantum circuit model.

CO4. Simulate a simple quantum error-correcting code.
CO5. Prove basic facts about quantum information channels.
CO6. Analyse fundamental quantum algorithms.

Text Book

1. Michael A. Nielsen, Issac L. Chuang, ‑Quantum Computation and Quantum Information‖, Tenth Edition, Cambridge University Press, 2010.

References

1. Scott Aaronson, ‑Quantum Computing Since Democritus‖, Cambridge University Press, 2013.
2. S. A. Fenner. Course Notes (https://cse.sc.edu/~fenner/csce790/notes/index.html). 2017, revised 2021.
3. M. A. Nielsen and I. L. Chuang. Quantum Computation and Quantum Information (the 10th Anniversary Edition is optional but recommended). Cambridge University Press, 2000 (10th Anniversary Edition: 2010).

20CS508 **REINFORCEMENT LEARNING** **L T P C**
3 0 0 3

Course Objective:

1. To know basis of reinforcement learning.
2. To learn about the dynamic programming in reinforcement learning.
3. To implement prediction and control methods.
4. To acquire knowledge about the policy optimization.
5. To create recent application by applying reinforcement learning.

UNIT I INTRODUCTION **9**

Introduction and Basics of RL, Defining RL Framework and Markov Decision Process, Polices, Value Functions and Bellman Equations, Exploration vs. Exploitation, Code Standards and Libraries used in RL.

UNIT II DYNAMIC PROGRAMING **9**

Overview of dynamic programing for MDP, definition and formulation of planning in MDPs, principle of optimality, iterative policy evaluation, policy iteration, value iteration, Banach fixed point theorem, proof of contraction mapping property of Bellman expectation and optimality operators, proof of convergence of policy evaluation and value iteration algorithms, DP extensions.

UNIT III MONTE CARLO METHODS AND TEMPORAL DIFFERENCE METHODS **9**

Overview of Monte Carlo methods for model free RL, First visit and every visit Monte Carlo, Monte Carlo control, On policy and off policy learning, Importance sampling. Incremental Monte Carlo Methods for Model Free Prediction, Overview TD(0), TD(1) and TD(λ), k-step estimators, unified view of DP, MC and TD evaluation methods, TD Control methods - SARSA, Q-Learning and their variants.

UNIT IV POLICY OPTIMIZATION **9**

Introduction to policy-based methods, Vanilla Policy Gradient, REINFORCE algorithm and stochastic policy search, Actor-critic methods (A2C, A3C), Advanced policy gradient (PPO, TRPO, DDPG).

UNIT V RECENT ADVANCES AND APPLICATIONS **9**

Meta-learning, Multi-Agent Reinforcement Learning, Partially Observable Markov Decision Process, Ethics in RL, Applying RL for real-world problems, Tools for Animation Creation Learning – Computer Vision - Speech Recognition - Natural language Processing, Case studies in classification, Regression and deep networks.

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able to

CO1. Knowledge of basic and advanced reinforcement learning techniques.

CO2. Identification of suitable learning tasks to which these learning techniques can be applied.

CO3. Appreciation of some of the current limitations of reinforcement learning techniques.

CO4. Formulation of decision problems set up and run computational experiments, evaluation of results from experiments.

CO5. Identification of suitable learning tasks to which these learning techniques can be applied.

CO6. Apply the recent advances and create the application using reinforcement learning.

Text Book

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", Second Edition, MIT Press, 2019.

References

1. Li, Yuxi. "Deep reinforcement learning." arXiv preprint arXiv: 1810.06339 (2018).

2. Wiering, Marco, and Martijn Van Otterlo. "Reinforcement learning." Adaptation, learning, and optimization 12, 2012.

3. Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach. –Pearson Education Limited, 2016.

4. Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. "Deep learning." MIT press, 2016.

20CS509 PREDICTIVE MODELING

L	T	P	C
3	0	0	3

Course Objective:

1. To introduce various techniques for data preparation for prediction.
2. To study various tools and techniques used for predicting continuous and discrete variable.
3. To learn how to represent the predicted data and result.
4. To know about various metrics for evaluating the prediction techniques.

UNIT I INTRODUCTION TO PREDICTIVE MODELLING **10**

Prediction vs Interpretation – Terminologies – Data Preprocessing - Exploratory Data Analysis - Data Cleanup and Transformation – Data Transformation for Individual Predictors and Multiple Predictors - Dealing with Missing Values - Dealing with Outliers - Adding and Removing Variables - Binning Predictors - The problem of Over-fitting – Model Tuning – Data Splitting – Resampling Techniques – Choosing Final Tuning Parameters – Choosing between Models.

UNIT II PREDICTING A CONTINUOUS VARIABLE **9**

Introduction to Linear Regression - Partial Least Squares – Penalized models- Neural Networks – Support Vector Machine – K – Nearest Neighbors – Naive Bayes.

UNIT III TREES AND OTHER PREDICTIVE MODELS **8**

Introduction to Trees - Classification Trees - Regression Trees – Model Trees – Rule based models - Bagging, Boosting, Random Forest – Modeling using XLMiner.

UNIT IV PREDICTING A DISCRETE VARIABLE **9**

Introduction to classification – Class Predictions – Evaluating Predicted classes - Introduction to Logistic Regression-Building Logistic Regression Model – Linear Discriminant Analysis – Partial Least squares Discriminant Analysis - Nearest Shrunken Centroids - Building Logistic Regression Models using XLMiner.

UNIT V EXPLORATORY VISUALIZATIONS AND MODEL COMPARISON **9**

Visualization for Numeric data - Visualizations for Categorical Data - Post Modeling Exploratory

Visualizations. Model Comparison – Metrics used to evaluate predictive models - Evaluating Fit statistics – Using Historical data to predict future.

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able

CO1. To enumerate various data preprocessing techniques and prepare a dataset for prediction.
CO2. To discuss various familiar models for predicting continuous variable.
CO3. To interpret recent models for continuous variable prediction.
CO4. To explain the techniques used for discrete value prediction.
CO5. To express the result of prediction process using visual representations.
CO6. To compare the different models by using various metrics.

Text Books

1. Max Kuhn, Kjell Johnson, ‒Applied Predictive Modeling‖, Springer, 2016.
2. Jeff Mc Frockman**, "**Machine Learning For beginners: Easy guide of ML, deep learning, data analytics and cyber security in practice‖, 2019.

References

1. Alvaro Fuentes, ‒Hands-On Predictive Analytics with Python‖, Packt Publishing, 2018.
2. Dr. Anasse Bari, Mohamed Chaouchi, Tommy Jung, ‒Predictive Analytics For Dummies‖, John Wiley & Sons, 2014.
3. Vijay Kumar, Mangey Ram, ‒Predictive Analytics Modeling and Optimization‖, CRC Press, 2021.

Web References

1. https://www.coursera.org/learn/predictive-modeling-machine-learning.
2. https://onlinecourses.swayam2.ac.in/imb20_mg19/preview.

20CS514 DEEP LEARNING FOR VISION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce basic computer vision concepts
- To understand the methods and terminologies involved in deep neural network
- To impart knowledge on CNN

- To introduce RNN and Deep Generative model

UNIT I COMPUTER VISION BASICS 9

Introduction to Image Formation, Capture and Representation; Linear Filtering, Correlation, Convolution. Visual Features and Representations: Edge, Blobs, Corner Detection; Visual Features extraction: Bag-of-words, VLAD; RANSAC, Hough transform

UNIT II INTRODUCTION TO DEEP LEARNING 9

Deep Feed-Forward Neural Networks – Gradient Descent – Back-Propagation and Other differentiation Algorithms – Vanishing Gradient Problem – Mitigation – Rectified Linear Unit (ReLU) – Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training – Nestors Accelerated Gradient Descent – Regularization for Deep Learning – Dropout – Adversarial Training – Optimization for Training Deep Models.

UNIT III VISUALIZATION AND UNDERSTANDING CNN 9

Convolutional Neural Networks (CNNs): Introduction to CNNs; Evolution of CNN Architectures: AlexNet, ZFNet, VGG. Visualization of Kernels; Backprop-to-image/ Deconvolution Methods; Deep Dream, Hallucination, Neural Style Transfer; CAM, Grad-CAM.

UNIT IV CNN and RNN FOR IMAGE AND VIDEO PROCESSING 9

CNNs for Recognition, Verification, Detection, Segmentation: CNNs for Recognition and Verification (Siamese Networks, Triplet Loss, Contrastive Loss, Ranking Loss); CNNs for Detection: Background of Object Detection, R-CNN, Fast R-CNN. CNNs for Segmentation: FCN, SegNet. Recurrent Neural Networks (RNNs): Review of RNNs; CNN + RNN Models for Video Understanding: Spatio-temporal Models, Action/Activity Recognition

UNIT V DEEP GENERATIVE MODELS 9

Deep Generative Models: Review of (Popular) Deep Generative Models: GANs, VAEs Variants and Applications of Generative Models in Vision: Applications: Image Editing, Inpainting, Superresolution, 3D Object Generation, Security; Recent Trends: Self-supervised Learning; Reinforcement Learning in Vision;

Total: 45 Periods

COURSE OUTCOMES:

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

CO 1: Implement basic Image processing operations

CO 2: Understand the basic concept of deep learning

CO 3: Design CNN and RNN and Deep generative model

CO 4: Understand the role of deep learning in computer vision applications.

CO 5: Design Deep generative model

TEXT BOOKS

1. Ian Goodfellow Yoshua Bengio Aaron Courville, "Deep Learning", MIT Press, 2017

2. Ragav Venkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press, 2018.

REFERENCES

1. Rajalingappaa Shanmugamani ,Deep Learning for Computer Vision, Packt Publishing, 2018

2.David Forsyth, Jean Ponce, Computer Vision: A Modern Approach, 2002.

3.Modern Computer Vision with PyTorch, V.Kishore Ayyadevara, Yeshwanth Reddy, 2020 Packt Publishing Ltd

4.Goodfellow, Y, Bengio, A. Courville, "Deep Learning", MIT Press, 2016.

5.Richard Szeliski, Computer Vision: Algorithms and Applications, 2010.

6.Simon Prince, Computer Vision: Models, Learning, and Inference, 2012.

7.https://nptel.ac.in/

20CS520 KNOWLEDGE ENGINEERING

L	T	P	C
2	0	2	3

COURSE OBJECTIVES:

- To understand the basics of Knowledge Engineering.
- To discuss methodologies and modeling for Agent Design and Development.
- To design and develop ontologies.
- To apply reasoning with ontologies and rules.
- To understand learning and rule learning.

UNIT I REASONING UNDER UNCERTAINTY 6

Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering.

UNIT II METHODOLOGY AND MODELING 6

Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

UNIT III ONTOLOGIES – DESIGN AND DEVELOPMENT 6

Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching. Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification.

UNIT IV REASONIING WITH ONTOLOGIES AND RULES 6

Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.

UNIT V LEARNING AND RULE LEARNING 6

Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning.

Total: 30 Periods

PRACTICAL EXERCISES: 30 Periods

1. Perform operations with Evidence Based Reasoning.
2. Perform Evidence based Analysis.
3. Perform operations on Probability Based Reasoning.
4. Perform Believability Analysis.

5. Implement Rule Learning and refinement.

6. Perform analysis based on learned patterns.

7. Construction of Ontology for a given domain.

COURSE OUTCOMES:

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

CO1: Understand the basics of Knowledge Engineering.

CO2: Apply methodologies and modelling for Agent Design and Development.

CO3: Design and develop ontologies.

CO4: Apply reasoning with ontologies and rules.

CO5: Understand learning and rule learning.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016. (Unit 1 – Chapter 1 / Unit 2 – Chapter 3,4 / Unit 3 – Chapter 5, 6 / Unit 4 - 7 , Unit 5 – Chapter 8, 9)

REFERENCES:

1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.

2. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.

3. John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000.

4. King , Knowledge Management and Organizational Learning , Springer, 2009.

5. Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1st Edition,2001.

20CS522 **COGNITIVE SCIENCE**

L	T	P	C
2	0	2	3

COURSE OBJECTIVES:

- To know the theoretical background of cognition.
- To understand the link between cognition and computational intelligence.
- To explore probabilistic programming language.

- To study the computational inference models of cognition.
- To study the computational learning models of cognition.

UNIT I PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE 6

Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing –Cognitive Neuroscience – Perception – Decision – Learning and Memory – Language Understanding and Processing.

UNIT II COMPUTATIONAL INTELLIGENCE 6

Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making –Learning – Language – Vision.

UNIT III PROBABILISTIC PROGRAMMING LANGUAGE 6

WebPPL Language – Syntax – Using Javascript Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations –Enumeration

UNIT IV INFERENCE MODELS OF COGNITION 6

Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis – Algorithms for Inference.

UNIT V LEARNING MODELS OF COGNITION 6

Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models– Learning (Deep) Continuous Functions – Mixture Models.

30 PERIODS

PRACTICAL EXERCISES

1.Demonstration of Mathematical functions using WebPPL.

2. Implementation of reasoning algorithms.

3. Developing an Application system using generative model.

4. Developing an Application using conditional inference learning model.

5. Application development using hierarchical model.

6. Application development using Mixture model.

30 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will be able to:
CO1: Understand the underlying theory behind cognition.

CO2:Connect to the cognition elements computationally.

CO3: Implement mathematical functions through WebPPL.

CO4:Develop applications using cognitive inference model.

CO5:Develop applications using cognitive learning model.

TOTAL: 60 PERIODS

TEXT BOOK:

1. Vijay V Raghavan,Venkat N.Gudivada, VenuGovindaraju, C.R. Rao, Cognitive Computing: Theory and Applications: (Handbook of Statistics 35), Elsevier publications, 2016

2. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley Publications, 2015

3. Robert A. Wilson, Frank C. Keil, "The MIT Encyclopedia of the Cognitive Sciences",The MIT Press, 1999.

4. Jose Luis Bermúdez, Cognitive Science -An Introduction to the Science of the Mind, Cambridge University Press 2020

REFERENCES:

1. Noah D. Goodman, Andreas Stuhlmuller, "The Design and Implementation of Probabilistic Programming Languages", Electronic version of book, https://dippl.org/.

2. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, "Probabilistic Models of Cognition", Second Edition, 2016, https://probmods.org/.

DATA SCIENCE

		L	T	P	C
20CS510	**DATA WAREHOUSE AND MINING**	**3**	**0**	**0**	**3**

Course Objective:

1. To understand data warehouse concepts, architecture, business analysis and tools.
2. To understand data pre-processing and data visualization techniques.
3. To study algorithms for finding hidden and interesting patterns in data.
4. To understand and apply various classification and clustering techniques using tools.
5. To understand Multidimensional Analysis and Descriptive Mining.

UNIT I DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP) **9**

Basic Concepts - Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors - Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

UNIT II DATA MINING – INTRODUCTION **9**

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

UNIT III DATA MINING - FREQUENT PATTERN ANALYSIS **9**

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi-Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns.

UNIT IV CLASSIFICATION AND CLUSTERING **9**

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines. Clustering Techniques – Cluster analysis- Partitioning Methods - Hierarchical Methods – Density Based Methods - Grid Based Methods – Evaluation of clustering.

UNIT V MINING OBJECT, SPATIAL, MULTIMEDIA, TEXT AND WEB DATA **9**

Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web - Applications and Trends in Data Mining.

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able

CO1. To demonstrate the basics of designing a Data warehouse system and perform business analysis with OLAP tools.

CO2. To discuss about various data preprocessing techniques.

CO3. To explain various techniques applied for mining frequent patterns.

CO4. To summarize the working of various classification algorithms.

CO5. To apply various clustering methods applicable for mining different types of dataset.

CO6. To demonstrate how to apply data mining principles and techniques for real time application.s

Text Book

1. Jiawei Han and Micheline Kamber, ‐Data Mining Concepts and Techniques‖, Third Edition, Elsevier, 2012.

References

1. Alex Berson and Stephen J.Smith, ―Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.
2. K.P. Soman, Shyam Diwakar and V. Ajay, ‐Insight into Data Mining Theory and Practice‖, Eastern Economy Edition, Prentice Hall of India, 2006.
3. Ian H.Witten and Eibe Frank, ‐Data Mining: Practical Machine Learning Tools and Techniques‖, Elsevier, Second Edition.

Web References

1. https://www.edx.org/learn/data-warehouse.
2. https://www.udemy.com/topic/data-warehouse/.
3. https://onlinecourses.nptel.ac.in/noc21_cs06/preview.

20CS511 DATA SCIENCE USING R

L	T	P	C
3	0	0	3

Course Objective:

1. Understand the fundamental algorithmic concepts of data science.
2. Implement data analytics concepts using R.
3. Apply the different types of modeling methods for analyzing the data.
4. Deploy the visualization techniques to predict the future set.
5. Understand the various multivariate data matrix plots.

UNIT I INTRODUCTION TO DATA SCIENCE **9**

Data science process roles, stages in data science project working with data from files working with relational databases exploring data managing data cleaning and sampling for modeling and validation introduction to NoSQL.

UNIT II MODELING METHODS **9**

Choosing and evaluating models mapping problems to machine learning, evaluating clustering models, validating models cluster analysis K means algorithm, Naive Bayes Linear and logistic regression.

UNIT III INTRODUCTION TO R **9**

Reading and getting data into R ordered and unordered factors arrays and matrices lists and data frames reading data from files probability distributions statistical models in R manipulating objects data distribution Sentiment Analysis Approach Neutral, Negative, Positive Comparative Analysis Testing in R test Test workflow.

UNIT IV MAP REDUCE **9**

Introduction distributed file system algorithms using mapreduce, MatrixVector Multiplication by Map Reduce Hadoop Understanding the Map-Reduce architecture Writing Hadoop Map Reduce Programs Loading data into HDFS Executing the Map phase Shuffling and sorting Reducing phase execution.

UNIT V DATA VISUALIZATION **9**

Documentation and deployment producing effective presentations Introduction to graphical analysis plot() function displaying multivariate data matrix plots Scatter Plot Histogram Bar & Stack Bar Chart Box Plot Area Chart Heat Map Correlogram Polarity Plot multiple plots in one window exporting graph using graphics parameters. Case studies.

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able to

CO1. Understand the fundamental concepts of data science.
CO2. Analyze fundamental algorithmic ideas to process data.
CO3. Implement the sentiment analysis approach using R language.
CO4. Identify the purpose of Map Reduce and HDFS.
CO5. Apply different types of visualization techniques to predict the future set.
CO6. Perform simple arithmetic and statistical operations in R.

Text Book

1. Nia Zumel and John Mount, Practical Data Science with R, Manning Publications, 2019.

References

1. Hadley Wickham and Garett Grolemund, R for Data Science, O Reilly, 2017
2. Jure Leskovec, Anand Rajaraman and Jeffrey D. Ullman, Mining of Massive Datasets, Cambridge University Press, Third Edition 2020.
3. Boris Lubinsky, Kevin T. Smith, and Alexey Yakubovich, Professional Hadoop Solution, Wiley, 2015.
4. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort and Abhijit Dasgupta, Practical Data Science Cookbook, Packt Publishing Ltd., 2017.

20CS512 **INFORMATION RETRIEVAL**

L	T	P	C
3	0	0	3

Course Objective:

1. The course enables student to understand the basics of Information Retrieval.
2. Students are expected to understand machine learning techniques for text classification and clustering.
3. Students should understand various search engine system operations.
4. Students should be able to apply IR principles to locate relevant information large collections of data.
5. Students should understand to learn different techniques of recommender system.

UNIT I INTRODUCTION TO IR AND WEB SEARCH **9**

Introduction, Data vs Information Retrieval, Logical view of the documents, Architecture of IR System. The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

UNIT II BASIC IR MODELS **9**

Classes of Retrieval Model, Boolean model, Term weighting mechanism – TF, IDF, TF-IDF weighting, Cosine Similarity, Vector space model , Probabilistic models (the binary independence model ,Language models; • KL-divergence; • Smoothing), Non-Overlapping Lists, Proximal Nodes Mode

UNIT III TEXT CLASSIFICATION AND CLUSTERING **9**

A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.

UNIT IV WEB RETRIEVAL AND WEB CRAWLING **9**

The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures –Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations -- Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

UNIT V RECOMMENDER SYSTEM **9**

Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models.

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able to

CO1. Students will get the understanding of different Information retrieval model.
CO2. Students will get to know about evaluation methods of the information retrieval model.
CO3. Apply appropriate method of classification or clustering.
CO4. Design and implement innovative features in a search engine.
CO5. Design and implement a recommender system.
CO6. Students will understand how statistical models of text can be used for other IR applications.

Text Books

1 Ricardo Baeza-Yates and Berthier Ribeiro-Neto, ―Modern Information Retrieval: T Concepts and Technology behind Search, Second Edition, ACM Press Books, 2016.

2 Ricci, F, Rokach, L. Shapira, B.Kantor, ―Recommender Systems Handbook, Second Edition, 2017.

References

1. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, ―Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2016.
2. Christopher D Manning, Prabhakar Raghavan, Hinrich Schutze, An Introduction to Information Retrieval By Cambridge University Press, England, 2019.
3. David A. Grossman, OphirFrieder, Information Retrieval – Algorithms and Heuristics, Springer, 2nd Edition(Distributed by Universal Press), 2014
4. R. Baeza-Yates and B. Ribeiro Neto,―Modern Information Retrieval: The Concepts and Technology behind Search‖, Second Edition, Addison Wesley, 2011

Web References

1. https://cse.iitkgp.ac.in/~pabitra/course/ir06/ir06.html.
2. https://www.coursera.org/courses?query=information%20retrieval.
3. https://www.cse.iitk.ac.in/pages/CS657.html.
4. https://www.udemy.com/course/information-retrieval-and-mining-massive-data-sets/.

20CS513	INFORMATION SCIENCE AND ETHICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamentals of information storage technology and basic components
- To work with Information Systems (IS) enables new approaches to improve efficiency and efficacy of business models.
- To understand the underlined technologies of web search engines.
- To recognize the ethical issues when applying data science to real world problems.
- To learn about the ethical aspects of data science, including privacy, plagiarism, intellectual property rights, piracy, security and confidentiality.

UNIT I Introduction to Information Storage Technology 9

Introduction to Information Systems, Evolution of Storage Technology, Data Center Infrastructure, Challenges in Data Storage and Management, Data Storage Infrastructure, Storage Systems Environment: Components of a Storage System Environment: Disk drive components, Disk Drive Performance, Logical Components.

UNIT II Architecture & Design of Information System 9

Architecture, Development and maintenance of Information Systems, Centralized and Decentralized Information Systems, Factors of success and failure, Role and advantages of Transaction Processing System, Management Information System, Expert Systems and Artificial Intelligence, Executive Support Systems and Strategic Information Systems.

UNIT II Web Search 9

Introduction, Web Crawler, Web Indexing, Link Analysis, Learning to Rank, Future of Web Search, Recommender Systems, Content Based-Filtering.

UNIT IV Introduction to Data Science Ethics 9

The Rise of Data Science (Ethics), Right and Wrong Data Science Ethics Equilibrium- The FAT Flow Framework for Data Science Ethics. Ethical Data Gathering- Privacy as a Human Right- Privacy Mechanisms, Case study: Backdoors and Messaging Encryption-Dating, Happiness, and Ads, Ethical Data preprocessing - Defining and Measuring Privacy.

UNIT V Ethical Modeling 9

Privacy Preserving Data Mining, Discrimination-Aware Modelling Predicting Recidivism and

Redlining, Comprehensible Models and Explainable AI, Including Ethical Preferences: Self Driving Cars. Ethical Evaluation: Ethical Measurement, Ethical Interpretation of the Results, Ethical Reporting.

Total: 45 Periods

COURSE OUTCOMES:

- Ability to understand the logical and physical components of a Storage System Environment
- Ability to understand understanding of role, advantages and components of an Information System.
- Ability to analyze the various searching methods and search engines.
- Ability to identify potential harms of data collections, aggregation, and analysis typically found in applied data science contexts.
- Ability to interpret professional code of ethics relevant to the data science profession.

Text Books

1. G.Somasundaram, A.Shrivastava, "Information Storage and Management: Storing, Managing and Protecting Digital Semester Information in Classic, Virtualized and Cloud Environment", 2nd Edition, Wiley publication, 2012.
2. Management Information Systems, Effy OZ, Thomson Leaning/Vikas Publications.

Reference Books

1. Michael Witting, Andreas Witting, "Amazon Web Services in Action", Manning Publication Corporation, Second Edition 2019.
2. Management Information System, David Kroenke, Tata Mc Graw Hill Publication.
3. Tales Rachel, DAVID MARTENS, "Data Science Ethics Concepts, Techniques and Cautionary", Oxford university press, 2021.
4. Mike Loukides, Hilary Mason and DJ Patil,"Ethics and Data Science",O'Reilly Media; 1st edition (25 July 2018).

20CS516	**DATA SECURITY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objective:

1. Course introduces the fundamental concepts of cryptography techniques necessary for the protection of data.
2. Students are expected to acquire knowledge about various malicious programs, threats and operating system security.
3. Students should be understand the protection of data in database by various techniques.
4. Students should be able to understand the protection of data in networks and its challenges.
5. Students should be able to understand the security policies in organization and ethical issues in data security.

UNIT I INTRODUCTION **9**

Overview of computer security, Security concepts, Need of Security- Threats- Deliberate software attacks, Deviation in quality of service, Attacks- malicious code, brute force, Timing attack, sniffers-Elementary Cryptography: Substitution Ciphers- Transpositions-The Data Encryption Standard-The AES Encryption Algorithms-Public Key Encryptions,-Uses of Encryption.

UNIT II PROGRAM SECURITY **9**

Viruses and Malicious Code- Secure Programs, Non-malicious Program Errors, viruses and other malicious code, Targeted Malicious code, control Against Program Threats. Operating Systems Security: Access Control, File Protection, User Authentication, Security Policies, Models of Security.

UNIT III DATABASE SECURITY **9**

Data base Security-Security requirements-Reliability and integrity-Sensitive data-Inference-multilevel database- proposals for multilevel security, AI frames, Data leakage, Homographic learning.

UNIT IV SECURITY IN NETWORK **9**

Threats in Network-Network Security Controls-security threat analysis-Firewalls-Intrusion Detection Systems-Types of Intrusion Detection system -Secure E-Mail, Federated learning and differential privacy, privacy in AI medical, AI fairness.

UNIT V ADMINSTERING SECURITY **9**

Security Planning-Risk Analysis-Organizational Security policies-Physical Security. Legal Privacy and Ethical Issues in Computer Security: Protecting Programs and data-Information and the law- Rights of Employees and Employers- Software failures-Computer Crime, Praia- Ethical issues in Computer Security-case studies of Ethics.

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able to

CO1. Familiarize with security goals, attacks, and different types of ciphers.

CO2. Gain knowledge in malicious codes and viruses affecting data.

CO3. Analyze security in network.

CO4. Analyze security in database.

CO5. Learn different legal and ethical issues.

Text Books

1 B. A. Forouzan & D Mukhopadhyay , Cryptography and Network Security., McGraw Hill, 2nd edition,2010.

2 Bernard Menezes, Network security and Cryptography, Cengage Learning India, 2011.

3 Bishop, Computer Security: Art and Science, Pearson Education, 2019.

References

1. William Stallings, Cryptography and Network Security: Principles and Practice, 5th edition, Pearson Education, 2011.
2. A. Kahate, Cryptography and Network Security, TMH.

Web References

1 https://cse.iitkgp.ac.in/~pabitra/course/ir06/ir06.html.

2 https://www.coursera.org/courses?query=information%20retrieval.

3 https://www.cse.iitk.ac.in/pages/CS657.html.

4 https://www.udemy.com/course/information-retrieval-and-mining-massive-data-sets/.

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20CS517 DATA ANALYTICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To study the basic inferential statistics and sampling distribution.
- To understand the concept of estimation of parameters using fundamental tests and testing of hypotheses.
- To understand the techniques of analysis of variance.
- To gain knowledge in predictive analytics techniques.
- To perform a case study with any available sample data sets.

UNIT I INFERENTIAL STATISTICS I 9

Populations – samples – random sampling – probability and statistics Sampling distribution – creating a sampling distribution – mean of all sample means – standard error of the mean – other sampling distributions Hypothesis testing – z-test – z-test procedure – statement of the problem – null hypothesis – alternate hypotheses – decision rule – calculations – decisions - interpretations

UNIT II INFERENTIAL STATISTICS II **9**

Why hypothesis tests? – Strong or weak decisions – one-tailed and two-tailed tests – case studies Influence of sample size – power and sample size. Estimation – point estimate – confidence interval – level of confidence – effect of sample size

UNIT III T-TEST **9**

t-test for one sample – sampling distribution of t – t-test procedure – degrees of freedom – estimating

the standard error – case studies t-test for two independent samples – statistical hypotheses – sampling distribution – test procedure – p-value – statistical significance – estimating effect size – meta analysis t-test for two related samples

UNIT IV ANALYSIS OF VARIANCE 9

F-test – ANOVA – estimating effect size – multiple comparisons – case studies Analysis of variance with repeated measures Two-factor experiments – three f-tests – two-factor ANOVA – other types of ANOVA Introduction to chi-square tests

UNIT V PREDICTIVE ANALYTICS 9

Linear least squares – implementation – goodness of fit – testing a linear model – weighted resampling Regression using StatsModels – multiple regression – nonlinear relationships – logistic regression – estimating parameters – accuracy Time series analysis – moving averages – missing values – serial correlation – autocorrelation Introduction to survival analysis

TOTAL: 45 PERIODS

COURSE OUTCOME

- Understand the concept of sampling
- Apply the knowledge to derive hypotheses for given data
- Demonstrate the skills to perform various tests in the given data
- Ability to derive inference using Predictive Analytics
- Perform statistical analytics on a data set

TEXT BOOKS

1. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.

2. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014. [Unit V]

REFERENCES

1. David Spiegelhalter, “The Art of Statistics: Learning from Data”, Pelican Books, 2020.

2. Peter Bruce, Andrew Bruce, and Peter Gedek, “Practical Statistics for Data Scientists”, Second Edition, O’Reilly Publishers, 2020.

3. Charles R. Severance, “Python for Everybody: Exploring Data in Python 3”, Shroff Publishers, 2017.

4. Bradley Efron and Trevor Hastie, “Computer Age Statistical Inference”, Cambridge University Press, 2016.

NETWORK AND CLOUD

20CS518 WIRELESS NETWORK L T P C

3 0 0 3

Course Objective:

1. To understand the concept about Wireless networks, protocol stack and standards.
2. To understand and analyse the network layer solutions for Wireless networks.
3. To study about fundamentals of 3G Services, its protocols and applications.
4. To have in depth knowledge on internetworking of WLAN and WWAN.
5. To learn about evolution of 4G, 5G Networks, its architecture and applications.

UNIT I WIRELESS LAN **9**

Introduction-WLAN technologies: - IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee, 6LoWPAN, WirelessHART.

UNIT II MOBILE NETWORK LAYER **9**

Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network: Routing: Destination Sequence distance vector, IoT: CoAP.

UNIT III 3G OVERVIEW **9**

Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3GPP Architecture, User equipment, CDMA2000 overview- Radio and Network components, Network structure, Radio Network, TD-CDMA, TD – SCDMA.

UNIT IV INTERNETWORKING BETWEEN WLANS AND WWANS **9**

Internetworking objectives and requirements, Schemes to connect WLANS and 3G Networks, Session Mobility, Internetworking Architecture for WLAN and GPRS, System Description, Local Multipoint Distribution Service, Multichannel Multipoint Distribution System.

UNIT V 4G AND BEYOND **9**

Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, IMS Architecture, LTE, Advanced Broadband Wireless Access and Services, MVNO,5G-Application-features and challenges.

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able to

CO1. Conversant with the latest 3G/4G networks and its architecture.

CO2. Design and implement wireless network environment for any application using latest wireless protocols and standards.

CO3. Ability to select the suitable network depending on the availability and requirement.

CO4. Implement different type of applications for smart phones and mobile devices with latest network strategies.

CO5. Analysis multipath propagation and 4G Wireless networks.

CO6. Implement different type of applications for smart phones and mobile devices with latest network strategies.

Text Books

1. Jochen Schiller, ‖Mobile Communications‖, Second Edition, Pearson Education 2012.
2. Vijay Garg, ―Wireless Communications and networking‖, First Edition, Elsevier 2007.

References

1. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband‖, Second Edition, Academic Press, 2008.
2. Anurag Kumar, D.Manjunath, Joy kuri, ―Wireless Networking‖, First Edition, Elsevier 2011.
3. Simon Haykin , Michael Moher, David Koilpillai, ―Modern Wireless Communications, First Edition, Pearson Education 2013.

		L	T	P	C
20CS519	**BLOCK CHAIN**	**3**	**0**	**0**	**3**

Course Objective:

1. To learn the fundamentals of Block chain.
2. To obtain knowledge about technologies of Block chain.
3. To incorporate the models of Block chain- Ethereum.

4. To learn the models of Hyperledger Fabric.

5. To acquire knowledge about the diverse ways of communicating with I/O devices and standard I/O Interfaces.

UNIT I INTRODUCTION 9

Basic Cryptographic primitives used in Block chain –Secure- Collision Resistant hash functions - Digital signature - Public key cryptosystems - Zeroknowledge proof systems - Need for Distributed Record Keeping - Modelling faults and adversaries- Byzantine Generals problem - Consensus algorithms and their scalability problems - Why Nakamoto Came up with Block chain based crypto currency.

UNIT II TECHNOLOGIES BORROWED IN BLOCKCHAIN 9

Technologies Borrowed in Block chain –hash pointers- Consensus- Byzantine Models of fault tolerance- Digital cash etc.- Bitcoin block chain - Wallet - Blocks - Merkley Tree - hardness of mining - Transaction verifiability - Anonymity - forks - Double spending - Mathematical analysis of properties of Bitcoin - Bitcoin- the challenges and solutions.

UNIT III MODELS FOR BLOCKCHAIN 9

Models f-GARAY model -RLA Model -Proof of Work (PoW) as random oracle - Formal treatment of consistency- Liveness and Fairness - Proof of Stake (PoS) based Chains -Hybrid models (PoW + PoS) - Bitcoin scripting language and their use.

UNIT IV ETHEREUM 9

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 contractsComparing Bitcoin scripting vs. Ethereum Smart Contracts- Some attacks on smart contracts.

UNIT V HYPERLEDGER FABRIC 9

Hyperledger fabric- the plug and play platform and mechanisms in permissioned block chain - Beyond Crypto currency – applications of block chain in cyber security- integrity of information- E-Governance and other contract enforcement mechanisms - Limitations of block chain as a technology and myths vs reality of block chain technology.

Total : 45 Periods

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

CO1. Define and Explain the fundamentals of Block chain.

CO2. Illustrate the technologies of Block chain.

CO3. Describe the models of Block chain.

CO4. Analyze and demonstrate the Ethereum.

CO5. Analyze and demonstrate Hyperledger fabric.

CO6. Use smart contract in real world applications.

Text Books

1. S.Shukla,M.Dhawan,S.Sharma,S. Venkatesan –Blockchain Technology: Cryptocurrency and Applications‖ ,Oxford University Press, 2019 .
2. Arvind Narayanan, Joseph Bonneau,Edward Felten,Andrew Miller and Steven Goldfeder, ‖Bitcoin and cryptocurrency technologies: a comprehensive introduction‖, Princeton University Press, 2016.

References

1. Joseph Bonneau et al, SoK: –Research perspectives and challenges for Bitcoin and cryptocurrency‖, IEEE Symposium on security and Privacy, 2015.
2. J.A.Garay et al, –The bitcoin backbone protocol - analysis and applications‖, EUROCRYPT 2015, Volume 2.
3. R.Pass et al, –Analysis of Blockchain protocol in Asynchronous networks‖, EUROCRYPT, 2017.
4. Pass et al,‖ Fruitchain- a fair blockchain‖, PODC, 2017.

Web References

1. https://www.nptel.ac.in/courses/106105184/
2. https://www.tutorialspoint.com/blockchain/index.htm
3. https://medium.com/moatcoin/part-1-blockchain-simplified-notesnptel-71b876f5d300
4. https://www.javatpoint.com/blockchain-tutorial
5. https://intellipaat.com/blog/tutorial/blockchain-tutorial/

20CS521	CLOUD SECURITY	L	T	P	C
		3	0	0	3

Course Objective:

1. Understand core cloud computing concepts and fundamental principles, including standard delivery models and service designs.
2. Understand the foundational security practices that are required to secure modern cloud computing infrastructures.
3. Understand the differences between traditional data security practices and cloud-based data security methodologies.
4. Understand standard cloud security network designs and architecture models.
5. Understand the complexity of cloud threat actors and techniques used to attack a cloud computing infrastructure.

UNIT I INTRODUCTION **9**

Introduction to Cloud Computing and Security: Understanding Cloud Computing - The IT Foundation for Cloud- overview of Security Architecture, Cloud Computing Architecture: Cloud Reference Architecture-Control over Security in the Cloud Model- Cloud Deployment & Services Models- Key Examples.

UNIT II SECURING THE CLOUD: ARCHITECTURE **9**

Cloud Computing: Security Concerns- Risk Tolerance- Legal and Regulatory Issues, Security Requirements for the Architecture-Security Patterns and Architectural Elements-Cloud Security Architecture-Key Strategies for Secure Operation.

UNIT III DATA SECURITY AND KEY STRATEGIES **9**

Overview of Data Security in Cloud Computing-Common Risks with Cloud Data Security- Data Encryption: Applications and Limits- Errors with Data Encryption- Cloud Data Security: Sensitive Data Categorization, Cloud Data Storage-Roach Motel Syndrome, Overall Strategy: Effectively Managing Risk, Overview of Security Controls, Overview of Security Controls, The Limits of Security Controls, Best Practices, Security Monitoring.

UNIT IV SECURITY CRITERIA **9**

Private Clouds: Motivation and Overview-Security Implications: Shared versus Dedicated Resources, Security Criteria for Ensuring a Private Cloud - Network Considerations- Data Center Considerations- Operational Security Considerations- Regulation, Selecting a CSP: Overview of Assurance, Overview of Risks, Security Criteria- Revisiting Defense-in-depth- Additional Security relevant Criteria.

UNIT V INFORMATION SECURITY FRAMEWORK AND CLOUD OPERATION **9**

Evaluating Cloud Security, Checklists for Evaluating Cloud Security- Foundational Security Business Considerations- Defense-in-depth- Operational Security, Operating a Cloud: From Architecture to Efficient and Secure Operations, Bootstrapping Secure Operations, Security Operations Activities- Business Continuity, Backup, and Recovery- Managing Changes in Operational Environments - Information Security Management - Vulnerability and Penetration Testing, Security Monitoring and Response.

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able to

CO1. Describe the security architecture of cloud computing and security service models.
CO2. Analyse the Strategies for Secure Operation the cloud architecture and list the security requirements.
CO3. Explain different key strategies for data security and apply the best practice models in real time application.
CO4. Apply the security model for cloud application with network, data and security considerations.
CO5. Develop an information security framework model for cloud operation.
CO6. Understand the regulatory requirements needed to secure data in the cloud and the difficulties in meeting those requirements.

Text Book

1. Vic (J.R.) Winkler, ―Securing the Cloud: Cloud Computer Security Techniques and Tactics‖, Elsevier, 2011.

References

1. Sushil Jajodia, Krishna Kant, ―Secure Cloud Computing‖, Elsevier,2014.
2. Curtis Franklin, Jr. ,Brian J. S. Chee, ―Securing the Cloud: Security Strategies for the Ubiquitous Data Center‖, CRC Press, 2019.

Web References

1. https://www.coursera.org/learn/cloud-computing-security

		L	T	P	C
20CS523	**CLOUD STORAGE INFRASTRUCTURE**	**3**	**0**	**0**	**3**

Course Objective:

1. Critically appraise the opportunities and challenges of information management in complex business environments.
2. Evaluate information storage management design in a cloud environment and how it relates

to the business objectives of an organization.

3. Analyze the role technology plays in the design of a storage solution in a cloud architecture.

4. Investigate how a global storage solution can be optimized so that it can be delivered successfully from the cloud.

5. Analyze how best to provide reliable access to information both locally and remotely using storage technologies.

UNIT I INTRODUCTION **9**

Importance of data storage - Business issues and IT challenges - Business and IT opportunities - opportunity for Cloud, Virtualization and Data Storage Networking - Server and Storage I/O Fundamentals - I/O connectivity and Networking Fundamentals - IT Clouds - Virtualization - Virtualization and Storage Services - Data and Storage Access.

UNIT II INFRASTRUCTURE RESOURCE MANAGEMENT **9**

Managing Data Infrastructures for Cloud and Virtual Environments - Introduction to Infrastructure resource management - understanding and managing IT Resources - Service offerings - Categories - and Technology Alignment - Gaining Situational Awareness and control - From SRM - E2E SRA - Search and eDiscovery - Performance and Capacity Planning - Data Movement and Migration.

UNIT III DATA AND STORAGE NETWORK SECURITY **9**

Being Secure without Being Scared - Eliminating Blind Spots, Gaps in Coverage, or Dark Territories - Security Threat Risks Challenges - Taking Action to resources - Securing Networks- Securing Storage - Virtual Servers, Physical Servers and Desktops - Security Clouds - Disposing of Digital Assets and Technology - Security Checklist.

UNIT IV OPTIMIZATION OF CLOUD STORAGE **9**

Global storage management locations, scalability, operational efficiency. Global storage distribution; terabytes to petabytes and greater. Policy based information management; metadata attitudes; file systems or object storage.

UNIT V SERVER VIRTUALIZATION AND CONNECTIVITY **9**

Virtual Servers - Inside Virtual Servers and Virtual Machines - Virtual Desktop Infrastructures - Cloud and Virtual Servers - Networking Challenges - I/O and Networking Bits and Bytes, Decoding Encoding, I/O and Networking Fundamentals - Virtual Servers - I/O Networking Devices - Converged and Unified Networking - Local Networking - Enabling Distance - Cloud virtualization and management topics - Configuring for reliability, availability and Serviceability (RAS).

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able to

CO1. Understand the basics of data storage, Virtualization and storage services

CO2. Analyze the infrastructures for Cloud and Virtual Environments

CO3. Evaluate the storage network security

CO4. Understand the optimization of cloud storage

CO5. Understand server Virtualization and Connectivity

CO6. Analyse how best to provide reliable access to information both locally and remotely using cloud storage technologies.

Text Books

1. Greg Schulz, ―Cloud and Virtual Data Storage Networking‖, Auerbach Publications [ISBN: 978-1439851739], 2012.

2. EMC, ―Information Storage and Management‖ Wiley; 2nd Edition [ISBN: 978-0470294215], 2012.

References

1. Volker Herminghaus, Albrecht Scriba, ―Storage Management in Data Centers‖ Springer; edition [ISBN: 978-3540850229]. 2009

2. Marty Poniatowski, ―Foundations of Green IT‖ Prentice Hall; 1 edition [ISBN: 978-0137043750], 2009

3. Klaus Schmidt, ―High Availability and Disaster Recovery‖ Springer; edition [ISBN: 978-3540244608], 2006

Web References

1. https://nptel.ac.in/courses/106/105/106105167/#

20CS524	**CLOUD STRATEGY PLANNING AND MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objective:

1. Strategically assess how cloud computing enables IT Transformation and business value in an organization.

2. Analyze the role that cloud computing can play in the business process..

3. Critically appraise how the incorporation of cloud computing in an IT strategy can deliver on strategic business objectives.

4. Evaluate how cloud computing and Service Oriented Architecture (SOA) can deliver business agility.

5. Implement IT governance to manage business realization from cloud IT services.

UNIT I ACHIEVING BUSINESS VALUE FROM IT TRANSFORMATION 9

Moving to a cloud architecture and strategy to achieve business value. BPM, IS, Porter‘s Value chain model and BPR as a means of delivering business value; Developing Business Strategy: Investigate business strategy models to gain competitive advantage for organizations, SWOT/PEST, Economies of scale, Porter‘s 3 Strategies and 5 Competitive Forces, D‘Aveni‘s hyper competition models.

UNIT II STRATEGIC IT LEADERSHIP IN THE ORGANIZATION 9

Emphasize the roles of the strategic IS/IT leaders such as Chief Information Officer (CIO) and the Chief Technology Officer (CTO) in planning and managing IT Strategic development in the organization.

UNIT III PLANNING A CLOUD COMPUTING BASED IT STRATEGY 9

Develop an IT strategy to deliver on strategic business objectives in the business strategy. IT Project planning in the areas of ITaaS, SaaS, PaaS and IaaS are essential in delivering a successful strategic IT Plan.

UNIT IV SOA AND BUSINESS AGILITY 9

Shared services delivered by a Service Oriented Architecture (SOA) in a Private or Public Cloud. Services, Databases and Applications on demand. The effect on Enterprise Architecture and its traditional frameworks such as Zachman and The Open Group Architecture Framework (TOGAF).

UNIT V BENEFIT REALIZATION AND IT GOVERNANCE 9

Managing resources (people, process, technology), to realize benefit from Private/Public Cloud IT services (IaaS, PaaS, PraaS, SaaS), Gartner's 5 pillars of benefit realization. IT governance as a service in measuring the delivery of IT Strategy from Cloud IT Services using Sarbannes Oxley (CobiT) and other commonly-used approaches.

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able to

CO1. Understand the concepts and technological advances fueling the rapid adoption of cloud computing today.

CO2. This course provides the students with the skills and knowledge required to plan and manage a Cloud Computing strategy within an organization.

CO3. Assess the importance of strategic IT Leadership for an organization.

CO4. Identify the role of the strategic use of information technology in a business enterprise.

CO5. This course will enable students to evaluate the strategic value of Cloud Computing using IT Governance and Compliance.

Text Books

1. Andy Mulholland, Jon Pyke, Peter Finger, –Enterprise Cloud Computing - A Strategy Guide for Business and Technology Leaders‖, Meghan Kiffer [ISBN: 0929652290], 2010.

2. Arnold J Cummins, –Easiest Ever Guide to Strategic IT Planning‖ http://strategicitplanningguide.com/

References

1. David S. Linthicum, –Cloud Computing and SOA Convergence in Your Enterprise‖, Addison Wesley [ISBN: 0136009220], 2009.

2. Charles Babcock, –Management Strategies for the Cloud Revolution‖, 1st Ed., Tata McGraw/Hill [ISBN: 0071740759], 2010.

3. Mark I. Williams 2010, A Quick Start Guide to Cloud Computing: Moving Your Business into the Cloud, Kogan page.

Web References

1. –Whitepapers and news for the CIO‖ www.cio.com.
2. –Gartner Research Website‖ www.gartner.com.

20CS525 SOFTWARE DEFINED NETWORK

L	T	P	C
3	0	0	3

Course Objective:

1. To learn the fundamentals of software defined networks.
2. To understand the separation of the data plane and the control plane.
3. To study about the SDN Programming.
4. To study about the various applications of SDN.
5. To study industrial deployment use-cases of SDN.

UNIT I INTRODUCTION **9**

History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Date Planes.

UNIT II OPEN FLOW & SDN CONTROLLERS **9**

Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor- Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts

UNIT III DATA CENTERS **9**

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE

UNIT IV SDN PROGRAMMING **9**

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications

UNIT V SDN **9**

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able to

CO1. Analyze the evolution of software defined networks.
CO2. Express the various components of SDN and their uses.
CO3. Explain the use of SDN in the current networking scenario.
CO4. Discuss the major requirements of the design of an SDN protocol.
CO5. Design and develop various applications of SDN.
CO6. Analyse the performance of the SDN network by using verification and troubleshooting techniques.

Text Books

1. Paul Goransson and Chuck Black, ―Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, ―SDN: Software Defined Networks, O'Reilly Media, 2013.

References

1. Siamak Azodolmolky, ―Software Defined Networking with Open Flow, Packet Publishing, 2013.
2. Vivek Tiwari, ―SDN and Open Flow for Beginners‖, Amazon Digital Services, Inc., 2013.
3. Fei Hu, Editor, ―Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

Web References

1. https://www.coursera.org/learn/sdn

20CS533	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

Course Objective:

1. The course enables student to understand the basics of Internet of things and protocols.
2. Students are expected to acquire about various IOT-related protocols.
3. Students should understand the Raspberry PI platform, that is widely used in IoT applications.
4. Students should understand to develop IoT infrastructure for popular applications.
5. Students should be able to understand the concepts of Web of Things.

UNIT I INTRODUCTION TO INTERNET OF THINGS 9

Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.

UNIT II IoT PROTOCOLS 9

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security.

UNIT III DESIGN AND DEVELOPMENT 9

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

UNIT IV DOMAIN SPECIFIC APPLICATIONS OF IOT 9

IoT applications for Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications-Home automation, Industry applications, Surveillance applications, Other IoT application.

UNIT V WEB OF THINGS 9

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence.

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able to

CO1. Understand general concepts of Internet of Things (IoT).

CO2. Analyze various protocols for IoT.

CO3. Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi.

CO4. Analysis and Evaluate design issues in IoT applications.

CO5. Understand Web of Things over IoT applications using web technologies.

CO6. Design a PoC of an IoT system using Rasperry Pi/Arduino.

Text Books

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017.

2. Simone Cirani, Gianluigi Ferrari, Marco Picone, Internet of Things: Architectures, Protocols and Standards, John Wiley and Sons Ltd, United States, 1st Edition, 2018.

References

1. Arshdeep Bahga, Vijay Madisetti, Internet of Things – A hands-on approach, Universities Press, 2015.

2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-onApproach)", 1st Edition, VPT, 2014.

3. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.

4. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895.

Web References

1. https://www.udemy.com/course/internet-of-things-iot-for-beginners-getting-started/.
2. https://onlinecourses.nptel.ac.in/noc21_cs17/preview.
3. https://online.stanford.edu/courses/xee100-introduction-internet-things.
4. https://www.coursera.org/courses?query=iot%20internet%20of%20things.

20CS501 MACHINE LEARNING

L	T	P	C
3	**0**	0	**3**

Course Objective:

1. To understand the basic concepts of machine learning and probability theory.
2. To appreciate supervised learning and their applications.
3. To understand unsupervised learning like clustering and EM algorithms.
4. To understand the theoretical and practical aspects of probabilistic graphical models.
5. To learn other learning aspects such as reinforcement learning, representation learning, deep learning, neural networks and other technologies.

UNIT I INTRODUCTION **9**

Introduction: Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation- Machine Learning – Types of Machine Learning – Supervised Learning – Unsupervised Learning – Basic Concepts in Machine Learning – Machine Learning Process – Weight Space – Testing Machine Learning Algorithms.

UNIT II SUPERVISED LEARNING **9**

Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component, Regression, Partial Least squares Week - Linear Classification, Logistic Regression, Linear Discriminant Analysis - Perceptron, Discriminant Functions – Probabilistic Generative Models – Probabilistic Discriminative Models – Laplace Approximation – Bayesian Logistic Regression – Common Classification Algorithms – k-Nearest Neighbors – Decision Trees – Random Forest model – Support Vector Machines.

UNIT III UNSUPERVISED LEARNING **9**

Mixture Models and EM – K-Means Clustering –Spectral Clustering – Hierarchical Clustering – The Curse of Dimensionality – Dimensionality Reduction – Principal Component Analysis – Latent Variable Models (LVM) – Latent Dirichlet Allocation (LDA).

UNIT IV GRAPHICAL MODELS **9**

Gradient Boosting, Random Forests, Multi-class Classification, Naive Bayes, Bayesian Networks, Undirected Graphical Models, HMM, Variable Elimination, Belief Propagation- Conditional Independence – Markov Random Fields – Learning – Naive Bayes Classifiers – Markov Model – Hidden Markov Model.

UNIT V ADVANCED LEARNING **9**

Reinforcement Learning – Representation Learning – Neural Networks – Active Learning – Ensemble Learning – Optional videos (RL framework, TD learning, Solution, Methods, Applications).

Total Hours: 45

Course Outcomes:

CO1. Choose and implement classification or regression algorithms for an application using an open source tool.

CO2. Implement probabilistic discriminative and generative algorithms for an application and analyze the results.

CO3. Use a tool to implement typical clustering algorithms for different types of applications.

CO4. Design and implement an HMM for a sequence model type of application.

CO5. Implement appropriate learning algorithms for any real time application using an open source tool.

CO6. Identify applications suitable for different types of machine learning with suitable justification.

Text Book

1. Ethem Alpaydin, ―Introduction to Machine Learning‖, 4th Edition, Prentice Hall of India, 2020.

References

1. Christopher Bishop, ―Pattern Recognition and Machine Learning‖, Springer, 2011.

2. Kevin P. Murphy, ―Machine Learning: A Probabilistic Perspective‖, MIT Press, 2012.

3. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective‖, Second Edition, CRC Press, 2014.

4. Tom Mitchell, ―Machine Learning‖, McGraw-Hill, 2017.

5. Trevor Hastie, Robert Tibshirani, Jerome Friedman, ―The Elements of Statistical Learning‖, Second Edition, Springer, 2008.

6. Fabio Nelli, ―Python Data Analytics with Pandas, Numpy, and Matplotlib‖, Second Edition, Apress, 2018.

NPTEL Course:

Course ID **:** noc23_cs98
Course Title **:** Introduction To Machine Learning
No of Weeks **:** 12 Weeks
Instructor **:** Prof. Balaraman Ravindran , IIT Madras

Course Contents:

Week 0: Probability Theory, Linear Algebra, Convex Optimization - (Recap)

Week 1: Introduction: Statistical Decision Theory - Regression, Classification, Bias Variance

Week 2: Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component Regression, Partial Least squares

Week 3: Linear Classification, Logistic Regression, Linear Discriminant Analysis

Week 4: Perceptron, Support Vector Machines

Week 5: Neural Networks - Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation

Week 6: Decision Trees, Regression Trees, Stopping Criterion & Pruning loss functions, Categorical Attributes, Multiway Splits, Missing Values, Decision Trees - Instability Evaluation Measures

Week 7: Bootstrapping & Cross Validation, Class Evaluation Measures, ROC curve, MDL, Ensemble Methods - Bagging, Committee Machines and Stacking, Boosting

Week 8: Gradient Boosting, Random Forests, Multi-class Classification, Naive Bayes, Bayesian Networks

Week 9: Undirected Graphical Models, HMM, Variable Elimination, Belief Propagation

Week 10: Partitional Clustering, Hierarchical Clustering, Birch Algorithm, CURE Algorithm, Density-based Clustering

Week 11: Gaussian Mixture Models, Expectation Maximization

Week 12: Learning Theory, Introduction to Reinforcement Learning, Optional videos (RL framework, TD learning, Solution Methods, Applications)

20CS504	DEEP LEARNING	L	T	P	C
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Course Objective:

1. To present the mathematical, statistical and computational challenges of building neural networks.
2. Gain knowledge in Machine Learning Basics.
3. Understand and apply Optimization on Deep Models and Networks.
4. Understand and analyze Recurrent and Recursive Networks.
5. Understand the representation of neural networks in machine learning.

UNIT I INTRODUCTION **9**

Introduction : Historical Trends in Deep Learning - Linear Algebra: Scalars - Vectors - Matrices - Tensors - Matrices - Norms – Eigen decomposition - Probability and Information Theory: Random variable and distributed Probability - Bayes Rule - Information Theory and structured probabilistic models.

UNIT II MACHINE LEARNING BASICS **9**

Numerical Computation: Overflow and Underflow - Gradient based Optimization – Constrained Optimization - Learning Algorithms: Capacity - Overfitting - Under fitting - Bayesian Classification - Supervised - unsupervised algorithms - Building machine learning algorithm.

UNIT III ADVANCED NEURAL NETWORKS **9**

Deep Feed forward Networks : Gradient based learning - Hidden Units – Transformation - Architectural design – Back Propagation algorithms - Regularization for deep learning: Dataset Augmentation - Noise Robustes –Semi supervised learning -Multitask learning - Adserial training.

UNIT IV OPTIMIZATION ON DEEP MODELS **9**

Optimization for training Deep Models: Challenges in Neural Networks optimization - Basic Algorithms - Algorithms Adaptive learning Rates - Approximate Second Order Methods - Optimization Strategies and Meta Algorithms -Convolutional Networks: Motivation - Structured Output - Unsupervised features – Neuro scientific basics for Convolutional Networks.

UNIT V RECURRENT AND RECURSIVE NETWORKS **9**

Computational graphs - Recurrent Neural networks - Bidirectional RNN - Deep Recurrent Networks- Echo State Networks - Practical Methodology - Applications: Large Scale Deep Learning – Computer Vision - Speech Recognition - Natural language Processing, Case studies in classification, Regression and deep networks.

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able

CO1. To understand the Basic fundamentals Deep learning and Machine Learning Algorithms.

CO2. To apply the concepts and meta-cognitive of soft computing and Soft computing techniquesto solve character recognition, pattern classification, regression.

CO3. To analyze Deep learning Mathematical Models.

CO4. To Evaluate Recurrent and Recursive Networks and Natural language Processing.

CO5. To Design the Deep Feed forward Networks.
CO6. To explore the deep learning applications.

Text Book

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, Cambridge University Press, 2017.

References

1. Duda, R.O., Hart, P.E., and Stork, D.G. Pattern Classication. Wiley-Interscience. 2nd Edition.2001.
2. Theodoridis, S. and Koutroumbas, K. Pattern Recognition. Edition 4. Academic Press, 2008.
3. Russell, S. and Norvig, N. Articial Intelligence: A Modern Approach. Prentice Hall Series in Articial Intelligence. 2003.
4. Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press. 1995.
5. Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning. Springer. 2001.
6. Duda, R.O., Hart, P.E., and Stork, D.G. Pattern Classication. Wiley-Interscience. 2nd Edition.2001

Course ID : noc23_cs110
Course Title : Deep Learning
No of Weeks : 12 Weeks
Instructor : Prof. Sudarshan Iyengar, IIT Ropar
Prof. Padmavati , Punjab Engineering College

Course Contents:

Week 1 : (Partial) History of Deep Learning, Deep Learning Success Stories, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm

Week 2 : Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feedforward Neural Networks, Representation Power of Feedforward Neural Networks

Week 3 : FeedForward Neural Networks, Backpropagation

Week 4 : Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Eigenvalues and eigenvectors, Eigenvalue Decomposition, Basis

Week 5 : Principal Component Analysis and its interpretations, Singular Value Decomposition

Week 6: Autoencoders and relation to PCA, Regularization in autoencoders, Denoising autoencoders, Sparse autoencoders, Contractive autoencoders

Week 7 : Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout

Week 8 : Greedy Layerwise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization

Week 9 : Learning Vectorial Representations Of Words

Week 10: Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks

Week 11: Recurrent Neural Networks, Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs

Week 12: Encoder Decoder Models, Attention Mechanism, Attention over images

20CS503 **NATURAL LANGUAGE PROCESSING**

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Course Objective:

1. To learn the fundamentals of natural language processing.
2. To understand the use of CFG and PCFG in NLP.
3. To understand the role of semantics of sentences and pragmatics.
4. To apply the NLP techniques to ML applications.
5. To understand the basis of semantic analysis and discourse analysis and drives it machine translation.

UNIT I OVERVIEW AND LANGUAGE MODELING **9**

Origins and Challenges of NLP – Language and Grammar - Processing Indian Languages – NLP Applications – Information Retrieval – Language Modeling – Various Grammar based Language Models – Statistical Language Model.

UNIT II WORD LEVEL ANALYSIS **9**

Regular Expressions – Finite State Automata – Morphological Parsing – Spelling Error Detection and correction – Words and Word classes – Part of Speech Tagging.

UNIT III SYNTACTIC ANALYSIS **9**

Grammars (e.g. Formal/Chomsky hierarchy, DCGs, systemic, case, unification, stochastic) - Parsing (top-down, bottom-up, chart (Earley algorithm), CYK algorithm) - Automated estimation of probabilistic model parameters (inside-outside algorithm) - Data Oriented Parsing - Grammar formalisms and tree banks - Efficient parsing for context-free grammars (CFGs) - Statistical parsing and probabilistic CFGs (PCFGs) - Lexicalized PCFGs.

UNIT IV SEMANTIC ANALYSIS AND DISCOURSE PROCESSING **9**

Meaning Representation – Lexical Semantics – Ambiguity – Word Sense Disambiguation – Cohesion – Reference Resolution – Discourse Coherence and Structure - Pragmatic Analysis.

UNIT V NATURAL LANGUAGE GENERATION AND MACHINE TRANSLATION **9**

Architecture of NLG Systems– Generation Tasks and Representations – Application of NLG – Problems in Machine Translation – Characteristics of Indian Languages – Machine Translation Approaches – Translation involving Indian Languages.

Total : 45 Periods

Course Outcomes:

At the end of the course, students will be able

CO1. To demonstrate the basics of language modeling.

CO2. To explain about the various phases of language processing.

CO3. To discuss the approaches for analyzing the syntax and semantics in NLP.

CO4. To summarize the approaches to discourse, generation, dialogue and summarization within NLP.

CO5. To associate current methods for statistical approaches to machine translation.

CO6. To differentiate semantic and discourse in terms of NLP.

Text Books

1. Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and Information Retrieval‖, Oxford University Press, 2011.
2. Daniel Jurafsky and James H. Martin, ―Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition‖, Prentice Hall, 2020.

References

1. Nitin Indurkhya, Fred J.Damerau, ―Handbook of Natural language Processing‖, Second Edition, CRC Press, 2010.
2. James Allen, ―Natural Language Understanding‖, Addison Wesley, 2008.
3. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python, First Edition, OReilly Media, 2012.

Web References

1 https://nptel.ac.in/courses/106/105/106105158/.

2 https://www.coursera.org/specializations/natural-language-processing.

Course ID : noc23_cs80
Course Title : Natural Language Processing
No of Weeks : 12 Weeks
Instructor : Prof. Pawan Goyal | IIT Kharagpur

Course Contents:

Week 1: Introduction and Basic Text Processing

Week 2: Spelling Correction, Language Modeling

Week 3: Advanced smoothing for language modeling, POS tagging

Week 4: Models for Sequential tagging – MaxEnt, CRF

Week 5: Syntax – Constituency Parsing

Week 6: Dependency Parsing

Week 7: Distributional Semantics

Week 8: Lexical Semantics

Week 9: Topic Models

Week 10: Entity Linking, Information Extraction

Week 11: Text Summarization, Text Classification

Week 12: Sentiment Analysis and Opinion Mining

20CS520 **SOCIAL NETWORK ANALYSIS** **L T P C**
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Course Objectives:

1. To understand fundamentals of social networks and basic graph theory principles.
2. To understand how apply various network metrics and measures
3. To understand the different network models and their behaviour of real-world networks.
4. To understand the community structures within networks and apply algorithms for community detection.
5. To understand how networks evolve over time, how information spreads in networks, and the principles of network resilience and robustness.

UNIT I INTRODUCTION TO SOCIAL NETWORK ANALYSIS 9

Introduction Social Network - Historical Background of SNA - Importance and Applications in Various Domains (Business, Engineering, Sociology). - Graph Theory Fundamentals: Nodes, Edges, Graphs, Directed vs. Undirected Networks.

UNIT II NETWORK METRICS AND MEASURES 9

Degree, Density, and Distance Measures - Centrality Measures: Degree, Betweenness, Closeness, and Eigenvector Centrality - Clustering Coefficient and Transitivity - Components: Connected Components in Undirected Graphs, Strongly and Weakly Connected Components in Directed Graphs.

UNIT III NETWORK MODELS AND THEORIES 9

Random Networks: Erdős-Rényi Model - Small-World Networks: Watts-Strogatz Model - Scale-Free Networks: Barabási-Albert Model - Structural Holes and Weak Ties Theory - Homophily and Heterophily.

UNIT IV COMMUNITY DETECTION AND GROUP STRUCTURES 9

Concepts of Communities in Networks - Modularity and Its Optimization - Algorithms for Community Detection: Girvan-Newman, Louvain, Infomap - Role of Overlapping and Hierarchical Communities.

UNIT V SOCIAL NETWORK DYNAMICS 9

Network Growth and Evolution - Information Spread in Networks: Concepts of Threshold and Cascading - Epidemic Models: SIR, SIS - Resilience and Robustness of Networks.

Course Outcomes:

CO1: Explain the key principles of social network analysis

CO2: Apply graph theory fundamentals to break down networks into their core components, distinguishing between directed and undirected networks.

CO3: Effectively use network metrics such as degree, centrality, and clustering coefficients to interpret the characteristics and importance of nodes within a network

CO4: Implement and critically assess various network models

CO5: Integrate the principles and methods learned to analyze real-world networks

Text Books

1. Stanley Wasserman and Katherine Faust , “Social Network Analysis: Methods and Applications", Cambridge University Press, 1994.
2. David Easley and Jon Kleinberg, “Networks, Crowds, and Markets:Reasoning About a Highly Connected World”, Cambridge University Press (2010)
3. Christina Prell, “Social Network Analysis -History, Theory and Methodology” , Sage Publications Ltd, 2011.

References Books

1. Stephen P Borgatti, Martin G. Everett, and Jeffrey C. Johnson - "Analyzing Social Networks" – Second Edition – SAGE Publications - 2018

Course ID : noc23_cs106
Course Title : Social Network Analysis
No of Weeks : 12 Weeks
Instructor : Prof. Tanmoy Chakraborty, Delhi

Course Contents:

Week 1: Introduction ; Tutorial 1: Introduction to Python/Colab ;
Tutorial 2: Introduction to NetworkX - Part I

Week 2: Network Measures ; Tutorial 3: Introduction to NetworkX - Part II

Week 3: Network Growth Models

Week 4: Link Analysis

Week 5: Tutorial 4: Graph Visualization Tools ; Community Detection - Part I

Week 6: Community Detection - Part II

Week 7: Link Prediction

Week 8: Cascade Behavior and Network Effects

Week 9: Anomaly Detection

Week 10: Introduction to Deep Learning ; Graph Representation Learning - Part I

Week 11: Graph Representation Learning - Part II ; Tutorial: Coding on Graph Representation Learning

Week 12: Applications and Case Studies ; Conclusion