Curriculum for UG Degree Course in

BE COMPUTER SCIENCE & ENIGINEERING (ARTIFICIAL INTELLIGENGE & MACHINE LEARNING)

Regulation 2022

CHENNAI INSTITUTE OF TECHNOLOGY
(Autonomous)

Document Version

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1.1	24/04/2024	Dr.R.Gowri		

Section 1: General Course Structure

A. Definition of Credit:

1 Hour Lecture (L) per week	1 Credit
1 Hour Tutorial (T) per week	1 Credit
1 Hour Practical (P) per week	0.5 Credit

B. Structure of Program

S. No.	Category	Credits
1	Humanities & Social Science Courses (HSMC)	14
2	Basic Science Courses (BSC)	24
3	Engineering Science Courses (ESC)	14
4	Program Core Courses (PCC)	68
5	Professional Elective Courses (PEC)	18
6	Open Elective Courses (OEC)	06
7	Employability Enhancement Skills (EES)	23
8	Mandatory Course (MC)	0
	TOTAL	**167**

C. Course code and definition

Code	Definition
L	Lecture
T	Tutorial
P	Practical
C	Credits
<CS>	Professional core courses
<CS> PE	Professional Elective courses
<CS> OE	Open Elective Courses
<CS> MC	Mandatory Courses

- **Course level coding scheme:** Four-digit number used as suffix with the Course Code for identifying the level of the course. Thousand's place denotes regulation number (we use "3" for 2022-23 Regulation) Digit at hundred's place signifies the semester in which course is offered. Last two digits represent the serial order of course within the semester. For example, 3101, 3102, … are courses offered during first semester.

D. Category-wise Courses

Humanities & Social Science Courses (HSMC)

S. No.	Course Title	Semester	L-T-P-C
1	Communicative English - I	I	3-0-0-3
2	Communicative English - II	II	2-0-0-4
3	Heritage of Tamils /தமிழர மரபு	III	1-0-0-1
4	தமிழரும் தொழில் நுட்பமும் /Tamils and Technology	IV	1-0-0-1
5	Professional Ethics and Universal Human Values	VII	3-0-0-3
	Total Credits		**12**

Basic Science Courses (BSC)

S. No.	Course Title	Semester	L-T-P-C
1	Matrices and Calculus	I	3-1-0-4
2	Engineering Physics	I	3-0-0-3
3	Engineering Chemistry	I	3-0-0-3
4	Physics and Chemistry Laboratory	I	0-0-4-2
5	Probability and Statistics	II	3-1-0-4
6	Linear Algebra	III	3-1-0-4
7	Discrete Mathematics	IV	3-1-0-4
		Total Credits	**24**

Engineering Science Courses (ESC)

S. No.	Course Title	Semester	L-T-P-C
1	Problem Solving using Python	I	3-0-0-3
2	Problem Solving using Python Laboratory	I	0-0-4-1
3	Digital Principles and Computer Organization	II	3-0-2-4
4	Engineering Graphics	II	0-0-4-2
5	Fundamentals of Data Science and Analytics	III	3-0-2-4
		Total Credits	**14**

Program Core Courses (PCC)

S. No.	Course Title	Semester	L-T-P-C
1	Application Development Practices	II	3-0-2-4
2	Programming and Data Structures using C	II	3-0-2-4
3	Advanced Data Structures and Algorithms	III	3-0-2-4
4	Modern Database Technology	III	3-0-2-4
5	Web Technology	III	3-0-2-4
6	Advanced Java Programming	III	3-0-2-4
7	Artificial Intelligence	IV	3-0-2-4
8	Operating Systems	IV	3-0-2-4
9	Machine learning	IV	3-0-2-4
10	Computer Networks	IV	3-0-2-4
11	Web Frameworks	IV	3-0-2-4
12	Computing Theory and Compiler Design	V	3-0-0-3
13	Natural language processing	V	3-0-0-3
14	Big Data Analytics	V	3-0-2-4
15	Core Course Project-I	V	0-0-2-1
16	Parallel programming through python	VI	2-0-2-4
17	Generative AI	VI	3-0-2-4
18	Deep learning for Vision	VI	2-0-0-4
19	Core Course Project-II	VI	0-0-2-1
		Total Credits	**68**

Professional Elective courses

S. No.	Course Title	Semester	L-T-P-C
1	Professional Elective – I	V	3-0-2-3
2	Professional Elective – II	V	3-0-2-3
3	Professional Elective – III	V	3-0-2-3
4	Professional Elective – IV	VI	3-0-2-3
5	Professional Elective – V	VI	3-0-2-3
6	Professional Elective – VI	VI	3-0-2-3
		Total Credits	**18**

Open Elective Courses (OEC)

S. No.	Course Title	Semester	L-T-P-C
1	Open Elective – I	VI	3-0-0-3
2	Open Elective – II	VII	3-0-0-3
		Total Credits	**6**

Mandatory Course (MC)

S. No.	Course Title	Semester	L-T-P-C
1	Environmental Sciences and Sustainability	II	2-0-0-0
2	Introduction to Women and Gender Studies	III	2-0-0-0
		Total Credits	**0**

E. Induction Program

- ***Catapult*** is a dynamic week-long event designed for our incoming first-year students, offering an immersive introduction to the diverse array of clubs and activities across the college campus. In addition to familiarizing them with our labs and Centers of Excellence (COEs), Catapult aims to acclimate first-year students to college life, ensuring they feel at ease with the forthcoming experiences of their four-year journey.
- This initiative fosters meaningful connections between seniors and juniors, providing a platform for them to explore departmental projects and engage in collaborative activities, thereby enhancing camaraderie and knowledge sharing within the college community.

F. Evaluation Scheme

a. For Theory Courses:

The weightage of Internal assessment is 40% and for End Semester Exam is 60%
The student has to obtain at least 50% marks individually both in internal assessment and end semester exams to pass

b. For Practical Courses:

The weightage of Internal assessment is 60% and for End Semester Exam is 40%
For Theory cum Lab
The student has to obtain at least 50% marks individually both in internal assessment and end semester exams to pass.

c. For Theory Cum Practical Courses:

The weightage of Internal assessment is 50% and for End Semester Exam is 50%
The student has to obtain at least 50% marks individually both in internal assessment and end semester exams to pass

Note: The internal assessment is based on the student's performance in 3 Internal Assessment (IA) exams, quizzes, assignments, class performance, attendance, etc.

d. For Project works:

Assessment of project works comprises three internal reviews and an end-of-semester evaluation. Internal reviews, worth 40 marks in total, encompass assessment criteria such as Project Synopsis/Proposal Evaluation, Methodology and Design of Existing System, Feasibility of Project Proposal, Planning of Project Work, and Team Work. At the conclusion of the semester, 20 marks are designated for assessing the quality of the report, while the remaining 40 marks are reserved for evaluating performance in viva-voce, demonstration of the work, and other relevant factors.

G. Learning Beyond Class Room

a. Students should be encouraged to visit Centers of Excellences (COEs) in the campus and learn additional technical skills
b. Students should be encouraged to participate in internal / external competitions, hackathons, etc. on a regular basis

Section 2: Semester wise Structure and Curriculum for UG Course in BE CSE AIML)

Semester I							
S. No	**Theory/ Practical / T&P**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	T	IP2101	Induction Program				
2	T	HS2101	Communicative English - I	3	0	0	3
3	T	MA2102	Matrices and Calculus	3	1	0	4
4	T	PH2103	Engineering Physics	3	0	0	3
5	T	CH2104	Engineering Chemistry	3	0	0	3
6	T	CS2105	Problem Solving using Python	3	0	0	3
7	T	ES2106	Employability Enhancement Skills - I	3	0	0	3
8	P	BS2107	Physics and Chemistry Laboratory	0	0	4	2
9	P	CS2108	Problem Solving using Python Laboratory	0	0	4	2
10	p	HS2109	Communicative English Laboratory -I	0	0	1	1
						Total	**24**

Semester II							
S. No	**Theory/ Practical / T&P**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	T	MA2201	Probability and Statistics	3	1	0	4
2	T&P	HS2201	Communicative English - II	3	0	2	4
3	T&P	AM2201	Application Development Practices	3	0	2	4
4	T&P	AM2202	Programming and Data Structures using C	3	0	2	4
5	T&P	AM2203	Digital Principles and Computer Organization	3	0	2	4
6	p	ME2211	Engineering Graphics	0	0	4	2
7	p	ES2201	Employability Enhancement Skills - II	0	0	2	1
8	T	GE2201	Environmental Sciences and Sustainability	2	0	0	0
						Total	**23**
Semester III							
S. No	**Theory/ Practical / T&P**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	T	MA2301	Linear Algebra	3	1	0	4
2	T&P	AM2301	Advanced Data Structures and Algorithms	3	0	2	4
3	T&P	AM2302	Modern Database Technology	3	0	2	4
4	T&P	AM2303	Web Technology	3	0	2	4
5	T&P	AM2304	Fundamentals of Data Science and Analytics	3	0	2	4
6	T&P	AM2305	Advanced Java Programming	3	0	2	4
7	P	ES2301	Employability Enhancement Skills - III	0	0	2	1
8	T	MC2301	Introduction to Women and Gender Studies - Mandatory Course – 1I	2	0	0	0
9	T	HS2301	HERITAGEOFTAMILS/ தமிழரும ரபு	1	0	0	1
						Total	**26**

Semester IV							
S. No	**Theory/ Practical / T&P**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	T	MA2401	Discrete Mathematics	3	1	0	4
2	T&P	AM2401	Operating Systems	3	0	2	4
3	T&P	AM2402	Machine learning	3	0	2	4
4	T&P	AM2403	Computer Networks	3	0	2	4
5	T&P	AM2404	Web Frameworks	3	0	2	4
6	T&P	AM2405	Artificial Intelligence	3	0	2	4
7	P	ES2401	Employability Enhancement Skills - IV	0	0	2	1
8	T	HS2401	தமிழரும் தொழில் நுட்பமும் /Tamils and Technology	2	0	0	1
						Total	**26**

Semester V							
S. No	**Theory/ Practical / T&P**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	T	AM2501	Computing Theory and Compiler Design	3	0	0	3
2	T	AM2502	Natural language processing	3	0	0	3
3	T&P	AM2503	Big Data Analytics	3	0	2	4
4	T&P		Professional Elective-I	2	0	2	3
5	T&P		Professional Elective-II	2	0	2	3
6	T&P		Professional Elective-III	2	0	2	3
7	p	AM2504	Core Course Project –I	0	0	2	1
8	p	ES2501	Employability Enhancement Skills V	0	0	2	1
						Total	**21**

Semester VI							
S. No	**Theory/ Practical / T&P**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	T&P	AM2601	Parallel programming through Python	2	0	2	3
2	T&P	AM2602	Generative Artificial Intelligence	3	0	2	4
3	T&P	AM2603	Deep Learning For Vision	2	0	2	3
4	T &P		Professional Elective- IV	2	0	2	3
5	T&P		Professional Elective-V	2	0	2	3
6	T		Open Elective I	3	0	0	3
8	P	AM2604	Core Course Project-II	0	0	2	1
						Total	**21**

Semester VII							
S. No	**Theory/ Practical / T&P**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	T	HS2701	Professional Ethics and Universal Human Values	3	0	0	3
2	T&P		Professional Elective-VI	2	0	2	3
3	T		Open Elective-II	3	0	0	3
4	p	ES4701	Internship	0	0	8	4
5	P	ES2702	Project Phase-I	0	0	12	6
						Total	**19**

Semester VII							
S. No	**Theory/ Practical / T&P**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	P	ES801	Project Phase-II	0	0	12	6
						Total	6

Semester I

Course Code	COMMUNICATIVE ENGLISH - I	L	T	P	C
HS2101		3	0	0	3

COURSE OBJECTIVES:

- To enhance vocabulary competency.
- To learn to use basic grammatical structures in suitable contexts.
- To identify syntax errors in a written text.
- To make learners write instructions, recommendations, and product descriptions.
- To develop learners' ability to write summaries, articles, blogs, definitions and essays.

Course Description

This course designed to improve students' proficiency in spoken and written English for effective communication in various contexts. Emphasis is placed on building vocabulary, enhancing grammar knowledge, improving pronunciation, and fostering confidence in using English for daily communication.

Prerequisites

- A Basic understanding of English grammar and vocabulary

Unit I Introduction to Effective Communication 1

What is effective communication? Why is communication critical for excellence during Study, research, and work? What are the seven C's of effective communication?

Fundamentals of communication 8

Vocabulary – Synonyms & Antonyms and One Word Substitutes, **Grammar** – Parts of spESh Tenses and Active and Passive Voice, Writing – E-mail writing, Letter of Introduction and Paragraph Writing

Unit II Definitions and Instructions 9

Vocabulary – Abbreviation & Acronyms. Word Forms (Prefixes and Suffixes), **Grammar** – Question Types Prepositions and Imperatives. **Writing** – Instructions and Definitions

Unit III Description of a Process / Product 9

Vocabulary – Homonyms & Homophones, Phrasal Verbs and Compound Nouns., **Grammar** – Adjectives, Degrees of Comparison and Articles., **Writing** – Product Description, Process Description and Recommendations

Unit IV – Decoding Non-Verbal Data 9

Vocabulary – Fixed & Semi-fixed expressions, Discourse Markers and Collocation, **Grammar** – Possessive & Relative Pronouns and Punctuation. **Writing** – Decoding Pictorial Data

Unit V Exposition 9

Vocabulary – Cause & Effect Expressions, Content words and Function Words., **Grammar** – Negation, Types of Sentences & Error Spotting **Writing** – Descriptive Essay, Argumentative Essay & Repository Essays.

Theory: 45PERIODS

Course Format

Lectures and discussions, Hands-on training, Guest lectures by English Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes, Assignments/ Project, 2IAs, Model, Final Examination

COURSE OUTCOMES:

OUTCOMES: upon completion of this course, learners will be able

- To use appropriate words in a professional context
- To gain an understanding of basic grammatical structures and use them in the right context.
- To communicate and write without syntax errors.
- To write recommendations, instructions, and product descriptions.
- To write summaries, articles, blogs, definitions, and essays.

Text Books:

1.English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English,

Anna University, (2020 edition)

2.English for Science & Technology Cambridge University Press, 2021.Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

References:

1. Technical Communication – Principles And Practices By Meenakshi Raman &Sangeeta Sharma,

Oxford Univ. Press, 2016, New Delhi.

2. A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.

TOTAL: 45PERIODS

Course Code	MATRICES AND CALCULUS	L	T	P	C
MA2102		3	1	0	4

COURSE OBJECTIVE

- To develop the use of matrix algebra techniques that is needed by engineers for Practical applications
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications

Course Description

This course provides an in-depth study of matrices and calculus, focusing on the fundamental concepts, techniques, and applications of both matrices and calculus

Prerequisites

A solid understanding of algebra, trigonometry, and pre-calculus is required.

UNIT I MATRICES **9 + 3**

Eigen values and Eigen vectors of a real matrix – Characteristic equation – Properties of Eigen values and Eigen vectors–Cayley- Hamilton theorem Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation –Nature of quadratic forms– Applications: Stretching of an elastic membrane.

UNIT II DIFFERENTIAL CALCULUS **9 + 3**

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Logarithmic differentiation – Applications: Maxima and Minima of functions of one variable.

UNIT III FUNCTIONS OF SEVERAL VARIABLES **9 + 3**

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables –Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications: Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

UNIT IV INTEGRAL CALCULUS **9 + 3**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals -Applications: Hydrostatic force and pressure, Arc length, Areas of surface of revolution.

UNIT V MULTIPLE INTEGRALS **9 + 3**

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 and triple integrals – Applications: Moments and centres of mass, moment of inertia.

Theory: 60 PERIODS

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by Maths Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES

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

CO1: Recalling the matrix algebra methods for solving the practical problems.
CO2: Apply differential calculus tools in solving various application problems.
CO3: Extending the differential calculus ideas on several variable functions.
CO4: Understanding different methods of integration in solving practical problems.
CO5: Developing the multiple integral ideas in solving areas, volumes and other practical problems.

TEXTBOOKS

1. Kreyszig.E," Advanced Engineering Mathematics", John Wiley and Sons, 10thEdition, New delhi,2016.

2. Grewal.B.S., "Higher Engineering Mathematics", Hanna publishers, NewDelhi,44thEdition,2018.

3. James Stewart,"Calculus: EarlyTranscendentals", Cengage Learning ,8th Edition, New Delhi ,2015. [For Units II&IV-Sections1.1, 2.2,2.3, 2.5,2.7 (Tangents problems only), 2.8,3.1to3.6, 3.11,4.1,4.3, 5.1(Area problems only),5.2,5.3,5.4(excluding net change theorem),5.5, 7.1- 7.4and 7.8

REFERENCES

1. Anton. H, Bivens.IandDavis. S, "Calculus ", Wiley,10thEdition,2016
2. Bali.N., Goyal.M.and Watkins.C, "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), NewDelhi,7thEdition,2009.
3. Jain.R.K.and Iyengar.S.R.K., "Advanced Engineering Mathematics", Narosa Publications,
4. NewDelhi,5th Edition,2016.
5. Narayanan. S.and Manicavachagam Pillai.T.K."Calculus" Volume I and II, S. Viswanathan Publishers Pvt.Ltd. Chennai,2009.
6. Ramana.B.V.,"HigherEngineeringMathematics",McGrawHillEducationPvt.Ltd, NewDelhi,2016.
7. Srimantha Pal and Bhunia.S.C," Engineering Mathematics "OxfordUniversityPress,2015.
8. Thomas.G.B.Hass. J, andWeir.M. D,"Thomas Calculus", 14thEdition, PearsonIndia,2018.

TOTAL: 60 PERIODS

Course Code	ENGINEERING PHYSICS	L	T	P	C
PH2103		3	0	0	3

COURSE OBJECTIVE

- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of Properties of matter and its applications.
- To introduce the basics of Fibre optics.
- To motivate the students towards the applications of Laser.
- To equip the students to be successfully understand the importance of quantum physics.

Course Description

This course typically provides students with a strong foundation in physics principles and their application to engineering problems. It emphasizes problem-solving skills, critical thinking, and the ability to apply theoretical concepts to real-world engineering situations.

Prerequisites

- Mathematics
- Physics

UNIT I MECHANICS **9**

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kineticenergy and moment of inertia - theorems of M.I – moment of inertia of continuous bodies (Ring, Disc)-moment of inertia of diatomic molecule - torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule - Gyroscope - Torsional pendulum.

UNIT II PROPERTIES OF MATTER **9**

Elasticity- Hooke's law - Relationship between three moduli of elasticity (quantitative) – stress - strain diagram – Poisson's ratio - Factors affecting elasticity – bending of beams - Bending moment – Depression of a cantilever: theory and experiment - Young's modulus by uniform bending and non-uniform bending: theory and experiment - I-shaped girders.

UNIT III FIBRE OPTICS **9**

Reflection and refraction of light waves – interference – Michelson interferometer - Theory of air wedge and experiment - total internal reflection - Fiber optics: Principle, Numerical aperture and acceptance angle – types of optical fibers (material, refractive index, mode)- fiber optic communication - losses associated with optical fibers - fiber optic sensors: pressure and displacement - medical endoscope.

UNIT IV LASER **9**

Theory of laser - characteristics - Spontaneous and stimulated emission - Components of Laser- Pumping methods - Optical Resonator – Active medium and Active c entre - Einstein's coefficients - population inversion – Types of laser - Nd-YAG laser, CO_2 laser, Semiconductor lasers: homo junction and hetero junction laser – Applications of lasers in industry and military.

UNIT V QUANTUM MECHANICS **9**

Photons and light waves - Electrons and matter waves – Compton effect: theory and experimental verification - Concept of wave function and physical significance - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization – Free particle - particle in an infinite potential well: 1D,2D and 3D Boxes – Barrier penetration and quantum tunneling(qualitative) - Tunneling microscope.

Course Format

Lectures and discussions, Hands-on training and projects, Guest lectures by industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES

After completion of this course, the students should be able to

- Understand the importance of mechanics.
- Express their knowledge in properties of matter.
- Demonstrate a strong foundational knowledge in fibre optics.
- Comprehend and apply laser principles.
- Understand the importance of quantum physics.

Theory: 45 PERIODS

TEXT BOOKS

1. D. Kleppner and R. Kolenkow. An Introduction to Mechanics. McGraw Hill Education (IndianEdition), 2017.
2. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics,McGraw-Hill
3. (Indian Edition), 2017.
4. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai publishers, 2009

REFERENCES

1. R. Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition), 2009.
2. K. Thyagarajan and A. Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.

3. D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.

Searls and Zemansky. University Physics, 2009

TOTAL: 45 PERIODS

Course Code	ENGINEERING CHEMISTRY	L	T	P	C
CH2104		3	0	0	3

COURSE OBJECTIVE

- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To impart knowledge on the basic principles and preparatory methods of non-material's.
- To facilitate the understanding of different types of fuels, their preparation, properties andcombustion characteristics.
- To familiarize the students with the operating principles, working processes and applicationsof energy conversion and storage devices.
- To be conversant with the principles electrochemistry, electrochemical cells, emf and applications of emf measurements, Principles of corrosion control

UNIT I WATER AND ITS TREATMENT **9**

Water: Sources and impurities, Water quality parameters: Definition and significance of pH, hardness, alkalinity, TDS, COD and BOD. Desalination of brackish water: Reverse Osmosis. Boiler troubles: Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming &foaming. Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External Treatment Ion exchange demineralization and zeolite process.

UNIT II NANO CHEMISTRY **9**

Basics: Distinction between molecules, Nano materials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of Nano materials: Definition, properties and uses of – Nano particle, Nano cluster, Nano rod, nanowire and nanotube. Preparation of Nano materials: laser ablation, and electro spinning. An application of Nano material's in medicine, agriculture, energy, electronics and catalysis.

UNIT III FUELS AND COMBUSTION **9**

Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate, Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking – octane number, diesel oil – cetane number; Power alcohol and biodiesel. Combustion of fuels: Introduction: Calorific value – higher and lower calorific values, Theoretical calculation of calorific value; Flue gas analysis – ORSAT Method. CO_2 emission and carbon foot print.

UNIT IV ENERGY SOURCES AND STORAGE DEVICES **9**

Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery – dry cell, Secondary battery – lead acid batteryand lithium-ion-battery; Electric vehicles-working principles; Fuel cells: H_2-O_2 fuel cell.

UNIT V ELECTRO CHEMISTRY AND CORROSION **9**

Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes –Calomel electrode – electrochemical series – significance Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion

– factors influencing corrosion – corrosion control – sacrificial anode and impressed cathodic current methods.

Theory: 45 PERIODS

Course Format

Lectures and discussions, Hands-on training and projects, Guest lectures by industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

OUTCOMES: At the end of the course, the students will be able:

CO1: To infer the quality of water from quality parameter data and propose suitable treatmentmethodologies to treat water.
CO2: To identify and apply basic concepts of nano science and nanotechnology in designing thesynthesis of nano v materials for engineering and technology applications.
CO3: To apply the knowledge of phase rule and composites for material selection requirements.
CO4: To recommend suitable fuels for engineering processes and applications.
CO5: To recognize different forms of energy resources and apply them for suitable applications inenergy sectors.

TEXT BOOKS:

1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, DhanpatRai PublishingCompany (P) Ltd, New Delhi, 2018.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, NewDelhi, 2008.
3. S.S. Dara, "A text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.

REFERENCES:

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and
2. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
4.ShikhaAgarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.
5.O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

TOTAL: 45 PERIODS

Course Code	PROBLEM SOLVING USING PYTHON	L	T	P	C
CS2105		3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of algorithmic problem statements.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures-lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

Identification of Computational Thinking, Algorithms, building blocks of algorithms (statements, state, control flow, functions), Algorithmic representation (pseudo code, flowchart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string and list; variables, expressions, statements, tuple assignment, Boolean values and operators, precedence of operators, comments.

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS 9

Conditionals: conditional (if), alternative (if-else), chained conditional (if-else if-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing-list comprehension, List as arrays.

UNIT V FILES, MODULES & PACKAGES 9

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, Modules, Packages.

Theory: 45PERIODS

Course Format

Lectures and discussions, Hands-on training and projects, Guest lectures by industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

OUTCOMES: On completion of the course, students will be able to:

CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs.
CO3: Implement programs in Python using conditionals loops and functions for solving problems.
CO4: Process compound data using Python data structures.
CO5: Utilize Python packages in developing software applications.

TEXT BOOKS:

1. Reema Thareja "Python Programming Using Problem Solving Approach" 2 nd Edition, Oxford University Press,2017.
2. AllenB.Downey, "ThinkPython: HowtoThinklikeaComputerScientist",2ndEdition, O'ReillyPublishers,2016.
3. KarlBESher, "ComputationalThinking: ABeginner'sGuidetoProblemSolvingandProgramming",1stEdition, BCSLearning&DevelopmentLimited,2017.

REFERENCES:

1. "Introduction to Computation and Programming Using Python: With Applications to Computational Modelling and Understanding Data", ThirdEdition, MITPress,2021
2. Paul Deitel and HarveyDeitel, "Python for Programmers", Pearson Education,1st Edition,2021.
3. GVenkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists",1st Edition, Notion Press, 2021.
4. Eric Matthes,"Python Crash Course,A Hands on Project Based Introduction to Programming", 2nd Edition, No Starch Press,2019.https://www.python.org/
5. Martin C. Brown, "Python: The Complete Reference",4th Edition, Mc-GrawHill,2018.

TOTAL: 45 PERIODS

Course Code	EMPLOYABILITY ENHANCEMENT SKILLS- I	L	T	P	C
ES2106		3	0	0	3

Course Objectives:

- To categorize, apply and use thought process to understand the concepts of Quantitative methods to enhance problem solving skills.
- To prepare and explain the fundamentals related to various possibilities with numeric ability and probabilities related to quantitative aptitude.
- To critically evaluate numerous possibilities related to puzzles.

UNIT I NUMBERS **9**

Introduction - Classification of numbers- Formation of Numbers (Small & Large) –Place Value – Face Value – Divisibility Rule – Prime, Composite Numbers - Prime Factorization- Number of factors – Number of factors (Odd & Even) –Sum of factors – Successors and Predecessors – Greatest Integer Value - Vedic Mathematics- Trailing Zeroes- Unit Digits–Remainder Theorem- Real Number - Rational Numbers: Integers, Fractions – Comparison of Numbers - Operations on fractions- Scientific Notation

UNIT II PROBLEMS ON LETTERS, NUMBERS AND SYMBOLS **9**

Factors and Multiples, LCM and HCF- Relationship between LCM and HCF - Factorial- Simplification- VBODMAS – Square, Square Root – Cube, Cube Root – Exponents & Powers (Surds and Indices) - Sequence & Series: Arithmetic Progression -Geometric Progression- Special Progression, Letter Series, Number Series, Alpha-Numeric Series, Continuous Pattern Series

UNIT III VERBAL AND NON - VERBAL REASONING **9**

Verbal Reasoning - Analogy: Completing the Analogous pair, Direct Analogy, Choosing the Analogous pair, Double Analogy, Choosing a Similar Word, Detecting Analogies, Multiple word Analogy, Number Analogy, Alphabet Analogy – Classification: Odd Words and Numerals – Coding and Decoding: Letter, Number, Symbol, Matrix, Substitution, Deciphering Message Word, Number and Symbols Non - Verbal Reasoning Figure Series –Missing figure, Incorrect figure – Analogy: Similarity Related Pair, Similarity Related figures, unrelated figures, Group of figures.

UNIT IV RATIO AND PROPORTION **9**

Introduction - Ratio – Proportion: Direct and Indirect – Unitary Method- Problems on Ages – Chain Rule- Partnership - Mixture or Allegation-Time and Work: Individual, Group, Efficiency, Wages - Pipes and Cistern: Inlet, Outlet, and Leakage.

UNIT V PERCENTAGE **9**

Introduction – Percentages in real life – Profit and Loss – Discount - Simple Interest – Compound Interest – Relationship between Simple Interest and Compound Interest – Overhead Expenses and GST

Theory: 45 PERIODS

Course Outcomes:

Outcomes: upon completion the student will be able to

- Understand and improve the arithmetic ability and properties of numbers that we use in day to day life

- Understand the logic behind the formation of numbers, alphabets series.
- Can think logically to apply the reasoning methods and evaluate complex relationships between the variables and numbers
- Apply the concept of ratios and proportion in ages and partnership problems
- Can apply the short cuts of the mathematical tricks to reduce the time duration in problem solving

TEXT BOOKS:

1. "Quantitative Aptitude for Competitive Examinations" by R.S. Aggarwal – 2022"
2. "Teach Yourself Quantitative Aptitude" by Arun Sharma – 2017
3. "A modern approach verbal and non -verbal reasoning" by R.S. Aggarwal – 2017

REFERENCE BOOKS

1. "Shortcuts in Mathematics" by Akhilesh Khare – 2016
2. "Vedic maths for competitive exams" by Ravi Shankar – 2016
3.. "Quantitative Aptitude for Competitive Examination" by Abhijit Guha – 2017

TOTAL: 45 PERIODS

Course Code	Physics and Chemistry lab	L	T	P	C
BS2107		0	0	4	2

PHYSICS LABORATORY: (Any Five experiments to be conducted)

COURSE OBJECTIVES:

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student as an active participant in each part of all lab exercises.

List of Experiments

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Non-uniform bending - Determination of Young's modulus
3. Uniform bending – Determination of Young's modulus
4. Laser- Determination of the wave length of the laser using grating
5. Air wedge - Determination of thickness of a thin sheet/wire
6. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids

COURSE OUTCOMES:

OUTCOMES: Upon completion of the course, the students should be able to

CO1: Understand the functioning of various physics laboratory equipment.
CO2: Use graphical models to analyze laboratory data.
CO3: Use mathematical models as a medium for quantitative reasoning and describing physical reality.
CO4: Access, process and analyze scientific information.
CO5: Solve problems individually and collaboratively.

CHEMISTRY LABORATORY: **(Any Five experiments to be conducted)**

COURSE OBJECTIVES:

- To inculcate experimental skills to test basic understanding of water quality parameters, suchas, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electro analytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nano particles

List of Experiments

1. Determination of types and amount of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of chloride content of water sample by Argento metric method.
4. Determination of strength of given hydrochloric acid using pH meter.
5. Determination of HCl acid using conductivity meter.
6. Conduct o metric titration of barium chloride against sodium sulphate (precipitation titration)
7. Estimation of iron content of the given solution using potentiometer.

COURSE OUTCOMES:

CO1: To analyze the quality of water samples with respect to their acidity, alkalinity, hardness.
CO2: To learn the amount of chloride present in the water sample by quantitative analysis.
CO 3: To quantitatively analyze the impurities in solution by electro analytical techniques.

TOTAL: 30 PERIODS

Course Code	PROBLEM SOLVING USING PYTHON LABORATORY	L	T	P	C
CS2108		0	0	4	2

COURSE OBJECTIVES:

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:

1. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
2. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.
3. Scientific problems using Conditionals and Iterative loops.
4. Implementing real-time/technical applications using Lists, Tuples.
5. Implementing real-time/technical applications using Sets, Dictionaries.
6. Implementing programs using Functions.
7. Implementing programs using Strings.
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling.
10. Implementing real-time/technical applications using Exception handling
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race.

COURSE OUTCOMES:

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

CO 1: Develop algorithmic solutions to simple computational problems

CO2: Develop and execute simple Python programs.

CO3 Implement programs in Python using conditionals loops and functions for solving problems.

CO4: PROCESS compound data using Python data structures.

CO5: Utilize Python packages in developing software applications.

TEXT BOOKS:

1. Reema Thareja “Python Programming Using Problem Solving Approach” 2 nd Edition, Oxford University Press, 2017.
2. Allen B. Downey, “Think Python: How to Think like a Computer Scientist”, 2nd Edition,
3. O’Reilly Publishers, 2016.
4. Karl BESher, “Computational Thinking: A Beginner's Guide to Problem Solving and
5. Programming”,1st Edition, BCS Learning& Development Limited, 2017.

REFERENCES:

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition,
2. 2021.
3. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”, 1st Edition, Notion Press, 2021.
4. John V Guttag, "Introduction to Computation and Programming Using Python: With
5. Applications to Computational Modeling and Understanding Data ‘’, Third Edition, MIT Press, 2021

TOTAL: 30 PERIODS

Course Code		L	T	P	C
HS2109	**COMMUNICATIVE ENGLISH LABORATORY I**	0	0	2	1

COURSE OBJECTIVES:

- To improve the communicative competence of learners
- To learn to use basic grammatical structures in everyday communication.
- To listen and comprehend meaning in reference to the context.
- To acquire lexical competence and understand their meaning in a text
- To develop learners' ability to read complex texts, summaries, articles, blogs, definitions, essays, and user manuals.

Module I – Speaking **20**

Self-Introduction, Introducing Others, Product Description and Sales, Narrating Personal Experience, Panel Discussion, Just a Minute, and Movie Review

Module II – Listening **5**

Best of TED Talks, Podcasts, Celebrity Interviews, SpESh by Native Speakers, and Short Films

Module III – Reading **5**

Brochure, User Manual, Biography, Autobiography, Novel, Short Story, News Paper, Gadget Review, and Blogs

Course Outcome:

Outcome: At the end of the course, learners will be able

CO1: To introduce oneself and others.
CO2: To narrate and discuss ideas
CO3: To describe and communicate persuasively.
CO4: To understand a conversation and reply accordingly.
CO5: To read and infer the denotative and connotative meanings of technical and non-technical texts.

Text Books:

Effective Communication Skill, Kulbhusan Kumar, R S Salaria, Khanna Publishing House.

References:

1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)
2. Learning to Communicate–Dr.V. Chellammal, Allied Publishing House,

TOTAL: 30 PERIODS

Semester II

Course Code	PROBABILITY AND STATISTICS	L	T	P	C
MA2201		3	1	0	4

COURSE OBJECTIVES:

The main objectives of this course are to:

- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquire the knowledge of testing of hypothesis for small and large samples this plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture?
- To apply the statistical tools in engineering problems and quality control.

Course Description

Probability and Statistics is an introductory course designed to provide students with a solid foundation in probability theory and statistical analysis.

Prerequisites

Basic algebra skills and familiarity with mathematical notation

UNIT I ONE DIMENSIONAL RANDOM VARIABLES 12

Probability –Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (excluding proof.

UNIT III TESTING OF HYPOTHESIS 12

Sampling distributions – Estimation of parameters – Statistical hypothesis – Large sample tests based on Normal distribution for single mean and difference of means – Tests based on t, Chi - square and F distributions for mean, variance – Contingency table (test for independent) – Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS 12

One way and two way classifications – Completely randomized design – Randomized block design – Latin square design.

UNIT V STATISTICAL QUALITY CONTROL 12

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits – Acceptance sampling.

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

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

CO1. Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.

CO2. Understand the basic concepts of two dimensional random variables and apply in engineering applications.

CO3. Apply the concept of testing of hypothesis for small and large samples in real life problems.

CO4. Apply the basic concepts of classifications of design of experiments in the field of agriculture.

CO5. Develop skills to analyze quality related data using advanced statistical methods.

Text Books:

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
3. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.

References:

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
2. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
5. Gupta S.C. and Kapoor V.K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.

YouTube Resources:

Jhan Academy: Khan Academy's Statistics and Probability playlist covers a wide range of topics, from basic probability concepts to advanced statistical analysis. The videos are well-explained and suitable for beginners.

StatQuest with Josh Starmer: StatQuest offers concise and informative videos on various statistical concepts and techniques. The channel covers topics such as hypothesis testing, regression analysis, and probability distributions, with visualizations to aid understanding.

Professor Leonard: Professor Leonard provides comprehensive lectures on mathematics and statistics topics, including probability theory and statistical analysis. The videos are detailed and cover both theory and practical applications.

jbstatistics: jbstatistics offers tutorials on statistics concepts, techniques, and software tools like R and SPSS. The channel covers topics such as probability, hypothesis testing, regression analysis, and more, with clear explanations and examples.

Dr Nic's Maths and Stats: Dr Nic's Maths and Stats provides tutorials on probability and statistics topics, including probability distributions, confidence intervals, and hypothesis testing. The videos are aimed at undergraduate students and cover core concepts in depth.
Ben Lambert: Ben Lambert offers tutorials on statistics and econometrics topics, including probability theory, regression analysis, and time series analysis. The channel covers both theoretical concepts and practical applications using statistical software.
Brian Veitch: Brian Veitch provides tutorials on statistics topics, including probability theory, sampling distributions, and hypothesis testing. The videos are designed to supplement university-level statistics courses and cover key concepts in detail.
The Organic Chemistry Tutor: While primarily focused on chemistry, The Organic Chemistry Tutor also offers tutorials on mathematics and statistics topics. The channel covers probability, statistics, and calculus concepts, with clear explanations and example problems.

TOTAL:60 PERIODS

Course Code	COMMUNICATIVE ENGLISH II	L	T	P	C
HS2201		3	0	2	4

COURSE OBJECTIVES:

- To engage learners in meaningful language activities to improve their LSRW skills
- To enhance learners' awareness of general rules of writing for specific audiences
- To help learners understand the purpose, audience, contexts of different types of writing
- To develop analytical thinking skills for problem solving in communicative contexts
- To demonstrate an understanding of job applications and interviews for internship and placements

UNIT I MAKING COMPARISONS **9**

Listening – Evaluative Listening: Advertisements, Product Descriptions, - Audio/ video; Listening and filling a Graphic Organizer (Choosing a product or service by comparison) Speaking–Marketing a product, Persuasive SpESh Techniques. Reading-Reading advertisements, user manuals, brochures; Writing – Letter to the editor; Compare and Contrast Essay; Grammar – Mixed Tenses, Impersonal passive voice; Prepositional phrases Vocabulary –Contextual meaning of words

UNIT II EXPRESSING CAUSAL RELATIONSIN SPEAKING AND WRITING **9**

Listening- Listening to longer technical talks and completing–gap filling exercises. Listening technical information from podcasts– Listening to process / event descriptions to identify cause & effects - Speaking – Describing and discussing the reasons of accidents or disasters based on news reports. Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints; Problem solution Essay Grammar – Subject-Verb agreement, Infinitive and Gerunds Vocabulary – Adverbs.

UNIT III PROBLEM SOLVING **9**

Listening– Listening to / Watching movie scenes / documentaries depicting a technical problem and suggesting solutions. Speaking – Group Discussion (based on case studies), - techniques and Strategies, reading – Case Studies, excerpts from literary texts, news reports etc., Writing – Check lists, Argumentative Essay Grammar – Error correction; If conditional sentences Vocabulary-Compound Words, Sentence Completion.

UNIT IV REPORTING OF EVENTS AND RESEARCH **9**

Listening – Listening Comprehension based on news reports – and documentaries – Precise writing, Summarizing, speaking – Interviewing, presenting an oral report, Mini presentations on select topics; Reading – Newspaper articles; Writing –Industrial visit Report, accident Report, Survey Report Grammar– Reported SpESh, Modals Vocabulary– Conjunctions-use of prepositions.

UNIT V REPORTING OF EVENTS AND RESEARCH **9**

Listening – Listening to TED Talks, Presentations, Formal job interviews, (analysis of the interview performance); Speaking – Participating in a Role-play, (interview /telephone interview), virtual interviews, making presentations with visual aids; Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing –Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses Vocabulary–Idioms.

Theory: 45 PERIODS

List of Exercises:

1. Listening /Reading Comprehension
2. Introducing Oneself
3. Summary of a Podcast
4. Mini Presentation on General topic (ICT tools)

5. Autobiography of a famous Personality

6. Narrating an unforgettable event

7. Drafting an Email (printed format)

8. Developing a story using given Vocabulary

9. Group Discussion

10. Mock Interview

PRACTICAL: 30 PERIODS

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:
OUTCOMES: At the end of the course, learners will be able
CO1: To compare and contrast products and ideas in technical texts.

CO2: To identify cause and effects in events, industrial processes through technical texts

CO3: To analyse problems in order to arrive at feasible solutions and communicate them orally and in the written format.

CO4: To report events and the processes of technical and industrial nature.

CO5: To present their opinions in a planned and logical manner, and draft effective resumes incontext of job search.

TEXT BOOKS:

1. English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2. English for Science & Technology Cambridge University Press 2021. Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCE BOOKS:

1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, NewDelhi.
3. Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003
4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

TOTAL: 75 PERIOD

Course Code	APPLICATION DEVELOPMENT PRACTICES	L	T	P	C
AM2201		3	0	2	4

Course Objectives:

- To understand the web programming using Hypertext Markup Language (HTML)
- To develop responsive websites using Cascading Style Sheets (CSS)
- To implement interactive and dynamic effects on webpages using JavaScript.
- To develop dynamic web applications using Document Object Model (DOM).
- To develop dynamic web applications with Asynchronous JavaScript and deployment in a Git Hub repository.

Unit I– HTML **9**

Introduction to HTML – HTML Document Structure - Text Elements – Lists - Images and Attributes– Hyperlinks-Structuring Page-Semantic HTML

Unit II– CSS **9**

Introduction to CSS - Inline, Internal and External CSS - Styling Text - Combining Selectors -Class and ID Selectors - Working with Colors - Styling Hyperlinks – Layouts: Float, FlexboxandCSS Grid– Web Design Rules and Frameworks

Unit III – JavaScript **9**

Introduction to JavaScript–Variables- Data Types –Operators- Strings and Template Literals if / else Statements - switch Statement-Statements and Expressions – Functions – Arrays –Classes and Objects-Loops

Unit IV– DOM **9**

Introduction to DOM– DOM and Events Fundamentals –JavaScript: Behind the Scene.

Unit V– Asynchronous JavaScript and Deployment **9**

Asynchronous JavaScript: Promises, ASYNC/AWAIT and AJAX – Deployment – Setting UpGit and Gi tHub– Git Fundamentals-Pushing to Git Hub

Theory:45 PERIODS

List of Experiments

a. Design a web page using HTML basic tags.
b. Develop website with suitable contents and links.
c. Design webpages using lists and tables.
d. Build a web client-side Login, Registration form and Dashboard with drop down menus.
e. Develop a HTML form and validation using HTML 5 features.
f. Create a website using HTML:
   To embed an image map in a web page.
   To fix the hot spots.

Show all the related information when the hotspots are clicked, apply style specification in HTML page using CSS.

g. Develop dynamic web application using HTML, CSS and JavaScript.

Practical: 30 PERIODS

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

Course Outcomes:

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

CO1: Build responsive real-world websites with HTML

CO2: Apply styling to HTML content using CSS

CO3: Implement dynamic behaviour using Java Script

CO4: Update the user interface via DOM API

CO5: Deploy the web page using Git

Text Books:

1. Jennifer Niederst Robbins., "Learning Web Design, A beginner's guide to HTML, CSS, JavaScript, and Web Graphics", O'Reilly Media,5th Edition,2018.
2. Responsive Web Design with HTML5 and CSS: Build future-proof responsive websites using the latest HTML5 and CSS techniques, 4th Edition, Ben Frain, 2023.
3. JavaScript: The Definitive Guide: Master the World's Most-Used Programming Language 7th Edition by David Flanagan

Reference Books:

1. Deitel and Deitel and Nieto, —Internet and World Wide Web - How to Program, Prentice Hall, 6th Edition, 2020**.**
2. HTML and CSS :Design and Build Webs, Jon Duckett ,Wiley, 2011.

On line Resources:

1.https://www.udemy.com/course/design-and-develop-a-killer-website-with-html5-and-css3

Web References:

1. https://developer.mozilla.org/en-US/docs/Web/HTML
2. https://developer.mozilla.org/en-US/docs/Web/CSS
3. https://developer.mozilla.org/en-US/docs/Learn/JavaScript
4. https://www.w3schools.com/js

TOTAL: 75 PERIODS

Course Code	PROGRAMMING AND DATA STRUCTURES USING C	L	T	P	C
AM2202		3	0	2	4

COURSE OBJECTIVES:

- To learn the features of C
- To learn the basics of array, function,
- To apply the concepts of pointers, and structure
- To explore the concepts of linear data structures
- To explore the applications of linear data structures

UNIT I BASICS OF C PROGRAMMING 9

Introduction to programming paradigms – Applications of C Language - Structure of C program- C programming: Data Types - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/output statements, Assignment statements – Decision-making statements - Switch statement - Looping statements – Pre-processor directives- Compilation process.

UNIT II ARRAYS AND FUNCTION 9

Introduction to Arrays: Declaration, Initialization – One-dimensional array – Two-dimensional arrays - String operations: length, compare, concatenate, copy – Selection sort, linear and binary search. Modular programming - Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion, Binary Search using recursive functions- Parameter passing: Pass by value, Pass by reference.

UNIT III POINTERS AND STRUCTURES 9

Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Structure - Nested structures – Pointer and Structures – Array of structures – Self-referential structures – Dynamic memory allocation - Storage classes and Visibility.

UNIT IV LINEAR DATA STRUCTURES – LIST 9

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation –– singly linked lists - circularly linked lists - doubly-linked lists – applications of lists – Polynomial Manipulation – All operation (Insertion, Deletion, Merge, Traversal)

UNIT V LINEAR DATA STRUCTURES – STACKS, QUEUES 9

Stack ADT – Evaluating arithmetic expressions - other applications - Queue ADT – circular queue implementation – Double-ended Queues – applications of queues

Theory:45 PERIODS

PRACTICAL EXERCISES

1. Simple C Programs

2. Using if and Switch Constructs Programs

3. Looping Statements Problems

4. Functions and Recursive Programs

5. Arrays, Strings, and Matrices Programs

6. Pointers and Arrays Programs

7. Stacks, Queues, Expression Evaluation Programs

8. Infix to Postfix Conversion

9. Linked List Programs: List, Merging Lists, Linked List, Single Linked List, Double Linked List, Header Linked List, Insertion and Deletion of Linked List, Traversing a Linked List.

Practical: 30 PERIODS

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

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

CO1: Develop the programming skills to solve given problems.

CO2: Use arrays and functions in C programming.

CO3: Apply the concept of Pointers and Structures in solving problems.

CO4: Write functions to implement linear data structure operations.

CO5: Apply appropriate linear data structure for solving a given problem.

TEXTBOOKS:

1. Pradip Dey and Manas Ghosh, —Programming in C, Second Edition, Oxford University Press, 2011.

2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, —Fundamentals of Data Structures in C, Second Edition, University Press, 2008.

REFERENCES:

1. Mark Allen Weiss, —Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 1996

2. Alfred V. Aho, John E. Hopcroft, and Jeffrey D. Ullman, —Data Structures and Algorithms, Pearson Education, 1983.

3. Robert Kruse, C.L. Tondo, Bruce Leung, Shashi Mogalla, —Data Structures and Program Design in C, Second Edition, Pearson Education, 2007

4. Jean-Paul Tremblay and Paul G. Sorenson, —An Introduction to Data Structures with Applications, Second Edition, Tata McGraw-Hill, 1991.

TOTAL: 75 PERIODS

Course Code	DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION	L	T	P	C
AM2203		3	0	2	4

COURSE OBJECTIVES:

- To analyze and design combinational circuits.
- To analyze and design sequential circuits
- To understand the basic structure and operation of a digital computer.
- To study the design of data path unit, control unit for processor and to familiarize with the hazards.
- To understand the concept of various memories and I/O interfacing.

UNIT I COMBINATIONAL LOGIC **9**

Combinational Circuits – Karnaugh Map - Analysis and Design Procedures – Binary Adder – Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexers - Demultiplexers

UNIT II SYNCHRONOUS SEQUENTIAL LOGIC **9**

Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit Implementation-Registers – Counters.

UNIT III COMPUTER FUNDAMENTALS **9**

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation–Instruction and Instruction Sequencing–Addressing Modes, Encoding of Machine Instruction –Interaction between Assembly and High Level Language.

UNIT IV PROCESSOR **9**

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Micro programmed Control– Pipelining– Data Hazard–Control Hazards.

UNIT V MEMORY AND I/O **9**

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface–Interrupt I/O– Interconnection Standards: USB, SATA.

Theory:45PERIODS

PRACTICAL EXERCISES:

1. Verification of Boolean theorems using logic gates.
2. Design and implementation of combinational circuits using gates for arbitrary functions.
3. Implementation of 4-bitbinaryadder/ subtractor circuits.
4. Implementation of code converters.
5. Implementation of BCD adder, encoder and decoder circuits
6. Implementation of functions using Multiplexers.
7. Implementation of the synchronous counters
8. Implementation of a Universal Shift register.
9. Simulator based study of Computer Architecture

Practical: 30PERIODS

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:
OUTCOMES: Upon completion, the students will be able to:

CO1: Design various combinational digital circuits using logic gates
CO2: Design sequential circuits and analyze the design procedures
CO3: State the fundamentals of computer systems and analyze the execution of an instruction
CO4: Analyze different types of control design and identify hazards
CO5: Identify the characteristics of various memory systems and I/O communication

TEXT BOOKS

1. M.Morris Mano, Michael D. Ciletti, "Digital Design with an Introduction to the Verilog HDL, VHDL, and System Verilog", Sixth Edition, Pearson Education, 2018.
2. David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware / Software Interface", Sixth Edition, Morgan Kaufmann / Elsevier, 2020.

REFERENCES

1. Carl Hamacher, Zvonko Vranesi C, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill,2012.

2. William Stallings, "Computer Organization and Architecture –Designing for Performance", Tenth Edition, Pearson Education, 2016.
3. M.Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2016.

TOTAL: 75 PERIODS

Course Code	ENGINEERING GRAPHICS LABORATORY	L	T	P	C
ME2211		0	0	4	2

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- The students will learn the introduction of Engineering graphics, various equipment used, various scales, dimensions and BIS codes used while making drawings for various streams of engineering disciplines.
- The students will learn projection of lines and projection of planes.
- The students will learn the projection of solid and development of surface
- The students will understand 3D projections. They will have understanding of isometric and oblique projections.
- The students will have understanding of perspective projections,
- The students will learn computer aided drafting.

LIST OF EXPERIMENTS FOR ENGINEERING GRAPHICS-

1. Lettering, Dimensioning and lines
2. Types of Scales
3. Curves and Special Curves
4. Projection of Lines
5. Projection of Planes
6. Development of surface
7. Section of Solids
8. Isometric Projection
9. Oblique Projection
10. Perspective Projection
11. Conversion of 3D to 2D figures
12. Interfacing and introduction to CAD software
13. 2D modelling using CAD software
14. 3D modelling using CAD software

Practical: 30PERIODS

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Use BIS conventions and specifications for engineering drawing.

CO2: Construct the curves and special curves.

CO3: Solve practical problems involving projection of lines.

CO4: Draw the orthographic, isometric and perspective projections of simple solids.

CO5: Draw the Conversion of 3D to 2D figures

TEXTBOOKS:

1. Engineering Drawing by N.D. Bhatt, 53rd Ed., Charotar Publishing House Pvt. Ltd., Gujarat,2017.

REFERENCES:

1. Engineering Drawing by P.S. Gill, S.K Kataria &Sons, NewDelhi 2013.
2. Technical Drawing with Engineering Graphics by Frederick E. Giesecke, ShawnaLockhart, Marla Goodman, and Cindy M. Johnson,15th Ed., Prentice Hall, USA,2016
3. Engineering Drawing by M.B. Shah and B.C. Rana, 3rd Ed., Pearson Education, NewDelhi, 2009.
4. AutoCAD2017forEngineers&Designers by Sham Tickoo,, Dream tech Press 2016

Course Code	EMPLOYABILITY ENHANCEMENT SKILLS II	L	T	P	C
ES2201		0	0	2	1

COURSE OBJECTIVES:

- To monitor, realise and create idea for problem solving.
- To analyse and examine the problems related to quantitative aptitude.
- To critically evaluate numerous possibilities related to puzzles.

UNIT I TIME AND DISTANCE **9**

Introduction – Speed Late / Early / Usual Time – Average Speed – Chasing – Problems on Train: Crossing Pole, Crossing Platform, Train moving in same and different direction–Boats and Streams: Up stream, Downstream –Clock–Calendar

UNIT I I PROBABILITY AND STATISTICS **9**

Introduction – Algebra of Events – Addition theorem of Probability – Permutation and Combinations – Problems based on choosing the objects – Statistics: Range – frequency, Arithmetic Mean–Median - Mode-Variance-Standard Deviation–Measures of Dispersion
–Co efficient of Variation.

UNIT III ARITHMETIC AND LOGICAL REASONING **9**

Introduction – Mathematical Operations – Blood Relations: Direct, Indirect, Coded Problem Son Cubes and Dices: Face identification – Folding and cutting Images Counting technique offigures– Distance& Direction

UNIT IV APPLIED MATHEMATICS 9

Mensuration(2D&3D): Square, Rectangle, Triangle, Circle, Parallelogram, Rhombus, Trapezoid, Quadrilateral, Cube, Cuboid, Cylinder, Cone, Sphere, Miscellaneous–Trigonometry: Ratio, Identities, Heights and Distances - Algebra-Logarithm-Geometry

UNITV – VERBAL AND LOGICAL REASONING 9

Introduction – Venn Diagram – Syllogism – Data Sufficiency – Decision Making – Puzzle: Number Puzzle, Letter Puzzle–Ranking Test–Data Arrangement: Linear, Circular, Miscellaneous–Critical Reasoning.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

OUTCOMES: upon completion, the student will be able to

CO1: Use their logical thinking and analytical abilities to solve reasoning questions from company specific and other competitive tests.

CO2: Solve questions related to permutation & combinations and probabilities from company specific and other competitive tests.

CO3: Understand and solve puzzle related questions from specific and other competitive tests.

TEXT BOOKS:

1. "Quantitative Aptitude for Competitive Examinations" by R. S. Aggarwal–2022"
2. "Teach Yourself Quantitative Aptitude" by Arun Sharma –2017
3. "A modern approach verbal and non-verbal reasoning by R.S. Aggarwal–2017

REFERENCE BOOKS

1. "Shortcuts in Mathematics" by Akhilesh Khare –2016
2. "Vedic maths for competitive exams" by Ravi Shankar – 2016
3. "Quantitative Aptitude for Competitive Examination" by AbhijitGuha –2017

Semester III

Course Code	LINEAR ALGEBRA	L	T	P	C
MA2301		3	2	0	4

COURSE OBJECTIVES:

- To find the basis and dimension of vector space
- To obtain the matrix of linear transformation and its Eigenvalues and eigenvectors
- To find orthonormal basis of inner product space and find least square approximation
- To find Eigen values of a matrix using numerical techniques and perform matrix decomposition
- To solve QR and LU decomposition and to learn the applications of linear algebra in computer Science.

UNIT I VECTOR SPACES 12 (9+3)

Real and Complex fields - Vector spaces over Real and Complex fields - Subspace - Linear space - Linear independence and dependence - Basis and dimension.

UNIT II LINEAR TRANSFORMATION 12 (9+3)

Linear transformation - Rank space and null space - Rank and nullity - Dimension theorem -Matrix representation of linear transformation – Eigen values and eigenvectors of linear transformation

UNIT- III INNER PRODUCT SPACES 12 (9+3)

Inner product and norms - Properties - Orthogonal, Ortho normal vectors - Gram Schmidt ortho normalization process - Least square approximation.

UNIT IV EIGEN VALUE PROBLEMS AND MATRIX DECOMPOSITION 12 (9+3)

Eigen value Problems: Power method, Jacobi rotation method - Singular value decomposition - QR decomposition.

UNIT V APPLICATIONS OF LINEAR ALGEBRA 12(9+3)

Singular value decomposition and principal component analysis - Introduction to their applications in image processing and machine learning - Coding and Decoding - Least Square solutions

THEORY: 60 PERIODS

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by Maths Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

OUTCOMES: After the completion of the course the student will be able to

CO1: Find the basis and dimension of vector space

CO2: Obtain the matrix of linear transformation and its Eigenvalues and eigenvectors

CO3: Find orthonormal basis of inner product space and find least square approximation

CO4: Find Eigen values of a matrix using numerical techniques and perform matrix decomposition

CO5: Learning the applications in Image processing, Machine learning, and Cryptography

TEXTBOOKS:

1. Friedberg A.H, Insel A.J. and Spence L, Linear Algebra, Prentice Hall of India, New Delhi, 2004.

2. Faires J.D. and Burden R., Numerical Methods, Brooks/Cole (Thomson Publications), New Delhi, 2002.

REFERENCES:

1. Kumaresan S, Linear Algebra - A geometric approach, Prentice Hall of India, New Delhi, Reprint, 2010.

2. StrangG, Linear Algebra and its applications, Thomson(Brooks/Cole) NewDelhi, 2005.

3. Gerald C.F. and Wheatley P.O, Applied Numerical Analysis, Pearson Educations, New Delhi, 2002.

4. SundarapandianV, NumericalLinearAlgebra, PrenticeHallofIndia, NewDelhi,2008.

5. Richard Branson, Matrix Operations, Schaum's outline series, 1989

6. Bernard Kolman, David R. Hill, Introductory Linear Algebra, Pearson Educations, New Delhi, First Reprint, 2009.

7. RC Gonzalez and R E Woods, Digital Image Processing

TOTAL: 60PERIODS

Course Code	ADVANCED DATA STRUCTURES AND ALGORITHMS	L	T	P	C
AM2301		3	0	2	4

COURSE OBJECTIVES:

The main objectives of this course are to:

- To understand the different concepts in nonlinear data structures using various tree.
- To understand the concept using Graph and hashing techniques.
- To Illustrate the basic notations, algorithms and divide and conquer algorithms.
- To know the concepts and apply in problem solutions using dynamic programming and greedy techniques.
- To illustrate the methods using backtracking and branch and bound techniques.

UNIT I: INTRODUCTION TO NONLINEAR DATA STRUCTURES – TREES 9

Tree ADT – tree traversals – Binary Tree ADT – expression trees – applications of trees – binary search tree ADT – Threaded Binary Trees - AVL Trees – B-Tree – B+ Tree – Heap – Applications of heap.

UNIT II: GRAPHS AND HASHING TECHNIQUES **9**

Definition – Representation of Graph – Types of graphs – Breadth-first traversal – Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs. Hashing - Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

UNIT III: FOUNDATION OF ALGORITHM ANALYSIS **9**

Complexity Notations - Big-O, Big-Omega, Big-Theta and others, Complexity Analysis techniques - Basic Algorithms - Algorithm for GCD, Fibonacci Number and analysis of their time and space complexity, Searching Algorithms - Sequential Search and its analysis, Sorting Algorithms - Bubble Sort, Selection Sort, and their Analysis Divide and Conquer – Binary Search, Min-Max Finding and their Analysis, Sorting Algorithms - Merge Sort and Analysis, Quicksort and Analysis, Randomized Quicksort and its Analysis.

UNIT IV: DYNAMIC PROGRAMMING & GREEDY ALGORITHM **9**

Introduction, The Principle of Optimality, Problem Solving using Dynamic Programming – Knapsack problem, All Points Shortest path, Matrix chain multiplication. General Characteristics of greedy algorithms, Problem solving using Greedy Algorithm - Activity selection problem, Knapsack Problem, Minimum Spanning trees - Kruskal's algorithm, Prim's algorithm.

UNIT V: BACKTRACKING & BRANCH AND BOUND ALGORITHM **9**

Backtracking Algorithm – n-Queen's Problem – Hamiltonian Circuit problem – Subset-Sum problem. Branch and bound Algorithm – Assignment problem – Knapsack problem – Traveling salesman problem.

Theory: 45 PERIODS

PRACTICAL EXERCISES:

For the laboratory work, students should implement the following algorithms in C/C++/python and perform their analysis for time and space complexity.

1. Implementation of Binary Tree and operations
2. Implementation of AVL Trees
3. Implementation of Heaps using Priority Queues

4. Implementation of Graph traversal
5. Basic iterative algorithms GCD algorithm, Fibonacci Sequences, Sequential and Binary Search.
6. Basic iterative sorting algorithms: Bubble Sort, Selection Sort, Insertion Sort.
7. Binary Search with Divide and conquer approach.
8. Merge Sort, Heapsort, Quicksort, Randomized Quick Sort.
9. Selection Problem with divide and Conquer approach
10. Fractional Knapsack Problem, Job sequencing with deadline, Kruskal's algorithm, Prim's algorithm, Dijkstra's Algorithm
11. Implement the dynamic programming algorithms.
12. Algorithms using Backtracking approach. Design based Problems (DP)/Open Ended Problem:
13. From the given string find maximum size possible palindrome sequence
14. Explore the application of Knapsack in human resources selection and courier loading system using dynamic programming and greedy algorithm, BRTS route design, considering traffic, traffic on road, and benefits

Practical :30 PERIODS

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by Industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES: At the end of this course, the students will be able to:

CO1: Demystify the concepts of Tree data structure

CO2: Delineate the use of graph and hashing technique

CO3: Elucidate the basic notations, algorithms

CO4: Apply the dynamic programming and greedy techniques to solve the problem

CO5: Demonstrate backtracking and branch and bound algorithms

REFERENCES

1**.** Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to algorithms", Third Edition. The MIT Press, 2009.

2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekiaran, "Computer Algorithms", Second Edition, Silicon Press, 2007.

3. Kleinberg, Jon, and Eva Tardos, "Algorithm Design", Addison-Wesley, First Edition, 2005

4. R.C.T. Lee, S.S. Tseng, R.C. Chang and T. Tsai (2006), Introduction to Design and Analysis of Algorithms A strategic approach, McGraw Hill, India.

5. Allen Weiss (2009), Data structures and Algorithm Analysis in C++, 2nd edition, Pearson Education, New Delhi.

TOTAL: 75 PERIODS

Course Code	MODERN DATABASE TECHNOLOGY	L	T	P	C
AM2302		3	0	2	4

COURSE OBJECTIVES

- Describe the fundamental elements of relational database management systems
- Explain the basic concepts of entity-relationship model, relational database design, and transactions
- Learn to create and write queries using PostgreSQL
- Distinguish the different types of databases namely distributed and NoSQL databases
- To understand the different models involved in database security and their applications in real-time world to protect the database

UNIT I RELATIONAL DATABASES 9

Purpose of Database System – Views of data – Data Models – Database System Architecture – Keys – Relational Algebra – SQL fundamentals – Creating Database, Alter Database, creating tables with constraints, Alter Tables, Insert, select with aggregation functions, order by, and group by, different types of joins, nested queries, update and delete. Create and alter views.

UNIT II DATA BASE DESIGN AND TRANSACTIONS 9

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – Normalization. Transaction Concepts – ACID Properties – Schedules – Serializability – Transaction support in SQL – Need for Concurrency – Concurrency control – Two Phase Locking- Timestamp.

UNIT III OBJECT- RELATIONAL DATABASE MANAGEMENT SYSTEMS 9

Postgre SQL: Features of Postgre SQL, Basics, Data Types, Querying & Filtering Data, Managing Tables, Modifying Data, Conditionals, Control Flow, Transactions & Constraints, working with JOINS & Schemas, Roles & Permissions, working with Sets, Sub query & CTEs, User-defined Functions, Important In-Built Functions

UNIT IV: DISTRIBUTED AND NOSQL DATABASES 9

Distributed Databases: Architecture, Data Storage, Transaction Processing, Query processing and optimization – NoSQL Databases: Introduction – CAP Theorem – Document-Based NoSQL Systems and MongoDB – MongoDB Data Model – MongoDB Distributed Systems Characteristics – Key-value Stores – Column Based Systems – Graph Databases.

UNIT V: DATABASE SECURITY 9

Security issues – Access control based on privileges – Role-Based Access Injection control – SQL – Statistical Database security – Flow control – Encryption and Public Key infrastructures – Challenges.

Theory: 45 PERIODS

PRACTICAL EXERCISES

1. Create a database table, add constraints (primary key, unique, check, Notnull), insert rows, update and delete rows using SQL DDL and DML commands.
2. Query the database tables using different 'where' clause conditions and also implement aggregate functions.
3. Query the database tables and explore subqueries and join operations. Execute complex transactions and realize DCL and TCL commands.
4. Write SQL Triggers for insert, delete, and update operations in a database table. Create View and index for database tables with a large number of records.
5. Installation of PostgreSQL.

6. Create a database table, insert rows, update and delete rows using Postgre SQL an open-source Object-Relational Database Management Systems (ORDBMS).
7. Installation of No SQL database like Mongo DB.
8. Create Document, column, and graph-based data using No SQL database tools.
9. Develop a simple GUI-based database application and incorporate all the above-mentioned features.
10. Case Study using any of the real-life database applications

Practical: 30 PERIODS

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by Industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES

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

CO1: Construct SQL Queries using relational algebra

CO2: Design database using ER model, normalize the database and construct queries to handle transaction processing

CO3: Construct SQL Queries using PostgreSQL

CO4: Use the data control, definition, and manipulation languages of the NoSQL databases

CO5: Design and Implement secure database systems.

TEXT BOOKS

1. Silberschatz, A., Korth, H. F., and Sudarshan, S. Database System Concepts, McGraw-Hill, 7th Edition. 2019.
2. Elmasri, R., & Navathe, S. B. Fundamentals of database systems, 7th Edition, Pearson Education, 2017.
3. PostgreSQL Documentation
4. MySQL Workbench Documentation

REFERENCE BOOKS

1. C. J. Date, A. Kannan, S. Swamynathan, "An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006
2. Raghu Ramakrishnan, Johannes Gehrke "Database Management Systems", Fourth Edition, McGraw Hill Education, 2015
3. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Sixth Edition, Pearson Education, 2015

TOTAL: 75 PERIODS

CourseCode	WEB TECHNOLOGY	L	T	P	C
AM2303		3	0	2	4

Course Objectives:

- To understand the representation of Web data and the processing of web elements.
- To understand the advanced Java Script concepts in terms of functional programming.
- To develop a web application using java script-based frameworks.
- To understand the mechanism of web applications development using python
- To develop a micro-service-based application using Spring Boot and Hibernate.

UNIT I XML **9**

Representing Web Data: XML-Documents and Vocabularies-Versions and Declaration- Namespaces-DOM based XML processing Event-oriented Parsing: SAX-Transforming XML Documents-Selecting XML Data: XPATH-Template based Transformations: XSLT-Displaying XML Documents in Browsers.

UNIT II– Advanced Java Script **9**

Functional Programming in Java script- Functional Declaration, Anonymous Function and Function Expression Return and Undefined, Arrow Function- String Methods- Iterating over String- String methods: char at & char Code at, Index Of- Error Handling in Java script- Javas cript try catch- Console in Javascript- what is JSON- parse () JSON Java script- Difference between JSON and XML.

UNIT III Node.js and Express.js **9**

Introduction to Server side programming – Multi-tier architecture - Node.Js architecture – npm – Development environment – API. Express JS and features – Routing – HTTP request and response – Middleware – Error Handling.

UNITIV PYTHON FRAMEWORKS **9**

Introduction to framework son Python –Flask and Django Django: Creating web application – handle request and response – views and templates – Forms and generic views – SQL Alchemy

UNITV SPRING BOOT AND HIBERNATE **9**

Introduction to Spring Boot – Creating Project – Spring Initializer – Download and Install STS IDE – Spring Boot Example – Spring Boot CLI - Spring Boot Annotations - Spring Boot Application Properties - Spring Boot Starter Web - Spring Boot AOP

Hibernate – Hibernate Architecture - Hibernate with eclipse – Hibernate web application example – Hibernate Log4j – Hibernate Inheritance Mapping – Hibernate and Spring Integration.

Theory:45 PERIODS

PRACTICAL EXERCISES:

- Project– Simple weather application
- Project–URL shortener Application using SQL.
- Project-Flight Ticket Booking

Create a web application for flight ticket booking. Use any tech stack for the backend and db.

Type of Users

User

Admin

User Use Cases

Login

Sign up

Searching for flights based on date and time

Booking tickets on a flight based on availability (assuming the defaults at count is 60)

My Booking-> to list out all the ebookings made by that user

Logout

Admin Use Cases

Login (Separate login for Admin)

Add Flights
Remove flights
View all the booking based on flight number and time

Practical: 30 PERIODS

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by Industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

Course Outcomes:

Outcomes: Upon completion of the course, students will be able to:
CO1: Represent the Web data to enable the Web elements processing.

CO2: Develop Java Script concepts in terms of functional programming.

CO3: Develop a Web Application using java script- based frameworks.

CO4: Develop strong Web Applications using python.

CO5: Develop robust Java Applications using Spring boot and hibernate.

Textbooks:

1. Jonathan Wexler, "Get Programming with Node.js", Manning Publications, 2019.
2. BeginningNode.js, Express & Mongo DB Development, Greg Lim, 1st Edition,2019.

On line Resources:

1. Django documentation-https://docs.djangoproject.com/en/4.2/
2. Mongo DB documentation-https://www.mongodb.com/docs/
3. Spring boot documentation -https://spring.io/guides/gs/spring-boot/
4. Hibernate documentation - https://hibernate.org/

TOTAL:75PERIODS

Course Code	Fundamental s of Data Science	L	T	P	C
AM2304		3	0	2	4

COURSE OBJECTIVES

Will gain knowledge in the basic concepts of Data Analysis

- To acquire skills in data preparatory and pre-processing steps
- To understand the mathematical skills in statistics
- To learn the tools and packages in Python for data science
- To gain understanding in classification and Regression Model
- To acquire knowledge in data interpretation and visualization techniques

UNIT I INTRODUCTION TO DATA SCIENCE 8

Need for data science – Benefits and uses – Facets of data – Data science process – Setting the research goal – retrieving data – Cleansing, Integrating, and Transforming data – Exploratory data analysis – Build the models – Presenting and building applications.

UNIT II DESCRIPTIVE ANALYTICS 10

Frequency distributions – Outliers –interpreting distributions – graphs – averages - describing variability – Interquartile range – Variability for qualitative and ranked data - Normal distributions – z scores –correlation – Scatter plots – Regression – Regression line – least squares regression line – Standard error of estimate – Interpretation of r2 – Multiple regression equations – Regression toward the mean.

UNIT III PYTHON FOR DATA HANDLING 09

Basics of Num Py arrays –aggregations –computations on arrays –comparisons, masks, Boolean logic – fancy indexing –structured arrays –Data manipulation with Pandas – Visualization with mat plot lib – line plots –scatter plots –visualizing errors –density and contour plots –histograms, binnings, and density –three-dimensional plotting –geographic data –data analysis using stats models and sea born – graph plotting using Plotly –interactive data visualization using Bokeh.

UNIT IV INFERENTIAL STATISTICS 09

Populations – samples – random sampling – Sampling distribution- standard error of the mean - Hypothesis testing – z-test – z-test procedure - t-test for one sample – sampling distribution of t – t-test procedure – t-test for two independent samples – p-value – statistical significance – t-test for two related samples. F-test – ANOVA – Two-factor experiments – three f-tests – two-factor ANOVA – Introduction to chi-square tests.

UNIT V PREDICTIVE ANALYTICS 09

Linear least squares – implementation – goodness of fit – testing a linear model – weighted resampling. Regression using StatsModels – multiple regression – nonlinear relationships – logistic regression – estimating parameters – Time series analysis – moving averages – missing values – serial correlation – autocorrelation. Introduction to survival analysis.

Theory: 45 PERIODS

PRACTICAL EXERCISES

Tools: Python, NumPy, SciPy, Matplotlib, Pandas, stats models, seaborn, plot Ly, bokeh Working with NumPy arrays

1. Working with Pandas data frames

2. Basic plots using Matplotlib

3. Frequency distributions, Averages, Variability

4. Normal curves, Correlation and scalper plots, Correlation coefficient

5. Regression

6. Z-test

7. T-test

8. ANOVA

9. Building and validating linear models

10. Building and validating logistic models

11. Time series analysis

: **Practicals: 30 PERIODS**

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by Industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES

OUTCOMES: At the end of the course Students will be able to:

CO1: Apply the skills of data inspecting and cleansing

CO2: Determine the relationship between data dependencies using statistics

CO3: Can handle data using primary tools used for data science in Python

CO 4: Represent the useful information using mathematical skills

CO5: Can apply the knowledge for data describing and visualization using tools.

TEXT BOOKS

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.

2. Robert S. WiSe and John S. Wise, "Statistics", Eleventh Edition, Wiley Publications, 2017. 3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.

REFERENCES

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014

2. Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare, "Fundamentals of Data Science", CRC Press, 2022.

3. Chirag Shah, "A Hands-On Introduction to Data Science", Cambridge University Press, 2020.

4. Vineet Raina, Srinath Krishnamurthy, "Building an Effective Data Science Practice: A Framework to Bootstrap and Manage a Successful Data Science Practice", A press, 2021.

TOTAL: 75 PERIODS

Course Code	ADVANCED JAVA PROGRAMMING	L	T	P	C
AM2305		3	0	2	4

COURSE OBJECTIVES:

The main objectives of this course are to:

- To understand Object Oriented Programming concepts and basics of Java programming language.
- To know the principles of packages, inheritance, and interfaces.
- To develop a Java application with threads and generics classes.
- To define exceptions and use I/O streams.
- To understand the fundamentals of collection framework and JDBC connectivity and implement in small applications.

UNIT I FUNDAMENTALS OF JAVA 9

Overview of Object-Oriented Programming – Features of Object-Oriented Programming – Java Buzzwords **–** The Java Programming Environment – Data Types, Variables, constants – Operators – Mathematical Functions and Constants – Conversions between Numeric Types – Casts – Parentheses and Operator Hierarchy – Enumerated Types – Control flow Statements – Arrays – Programming Structures in Java.

UNIT II IMPLEMENTATION OF OOP CONCEPTS 9

Defining classes in Java – Constructors -Methods -Access specifiers – Static members – Java Doc comments – Overloading Methods – Objects as Parameters – Returning Objects – Static, Nested and Inner Classes. Inheritance: Basics – Types of Inheritance -Super keyword - Method Overriding – Dynamic Method Dispatch – Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access – Importing Packages – Interfaces.

UNIT III EXCEPTION HANDLING AND MULTITHREADING 9:

Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User-defined Exception. Multithreaded Programming: Java Thread Model – Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication- Suspending – Resuming, and Stopping Threads – Multithreading.

UNIT IV I/O, GENERICS, STRING HANDLING 9

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods, String Buffer Class & String Builder class.

UNIT V COLLECTIONS FRAMEWORK & DATABASE CONNECTIVITY 9

Collections Framework-Auto boxing -For-Each Style for Loop-Collection Interfaces-Collection Interface-List Interface-Set Interface-Sorted Set Interface-Collection Classes-Array List Class-**Linked List** Class-HashSet Class-Linked Hash Set Class-Tree Set Class-Enum Set Class-Accessing a Collection via an Iterator-Using an Iterator-The For-Each Alternative to Iterators-Storing User-Defined Classes in Collections-Working with Maps-The Map Interfaces-The Map Classes-Arrays-Accessing databases using JDBC connectivity - DAO

Theory :45 PERIODS.

PRACTICAL EXERCISES

1. Write a program to demonstrate the use of multi-dimensional arrays and looping constructs.
2. Write a program to demonstrate the application of String handling functions.
3. Write a program to demonstrate the use of Inheritance.
4. Write a program to demonstrate the application of user-defined packages and sub-packages.

5. Write a program to demonstrate the use of Java Exception handling methods.
6. Write a program to demonstrate the use of threads in Java.
7. Demonstrate with a program the use of File handling methods in Java.
8. Demonstrate the use of Java collection frameworks in reducing application development time.
9. Write a program to register students' data using JDBC with MySQL Database.
10. Develop applications to demonstrate the features of generics classes.
11. Develop a mini-project for any application using Java concepts.
12. Lab Requirements for a batch of 30 students:
13. Operating Systems: Linux/Windows
14. FrontEnd Tools: Eclipse IDE/Netbeans IDE

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by Industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

CO1: Apply the concepts of classes and objects to solve simple problems.

CO2: Develop programs using inheritance, packages, and interfaces.

CO3: Make use of exception handling mechanisms and multithreaded model to solve real-world problems.

CO4: Build Java applications with I/O packages, string classes, Collections, and generics concepts.

CO5: Develop small applications with collection framework elements and manipulate with the SQL database.

TOTAL: 75 PERIODS

TEXT BOOKS:

1. Herbert Schildt, “Java: The Complete Reference”, 11th Edition, McGraw Hill Education, New Delhi, 2019.
2. Cay S. Horstmann, “Core Java Fundamentals”, Volume 1, 11th Edition, Prentice Hall, 2018.

REFERENCES:

1. Paul Deitel Harvey Deitel, Java, How to Program.Printice Hall,2016

TOTAL: 75 PERIODS

Course Code	Employability Enhancement Skills – III:	L	T	P	C
ES2301	**Professional Communication and Teamwork Skills**	0	0	2	1

Course Objectives:

- To familiarize students with various forms of communication.
- To develop effective team communication skills.
- To enhance stakeholder communication skills.
- To cultivate ethical communication practices.
- To explore digital communication tools and trends.

Unit 1: Introduction to Communication - Verbal Communication Skills: - Written Communication Skills - Nonverbal Communication - Interpersonal Communication

Unit 2: Characteristics of Effective Teams - Team Building and Group Cohesion - Conflict Resolution - Decision Making in Teams - Cross-Cultural Communication

Unit 3: Stakeholder Communication - Presentation Skills - Effective Meetings - Feedback and Evaluation

Unit 4: Professional Codes of Conduct - Integrity in Communication - Addressing Ethical Challenges - Analyzing real-world ethical communication dilemmas

Unit 5: Digital Communication Tools - Social Media and Networking - Emerging Trends in Communication

Course Outcomes: upon completion, students will be able to

CO1: Demonstrate proficiency in various forms of communication.

CO2: Exhibit strong team communication skills.

CO3: Display competence in stakeholder communication.

CO4: Apply ethical communication principles.

CO5: Utilize digital communication tools effectively.

Textbooks:

1. Sharon J. Gerson and Steven M. Gerson. "Technical Communication: Process and Product", Pearson, 2014
2. Karl A. Smith. “Teamwork and Project Management”, McGraw-Hill Education, 2013
3. Charles E. Harris Jr., Michael S. Pritchard, and Michael J. Rabins. "Engineering Ethics: Concepts and Cases", Cengage Learning, 2012
4. Christoph Meinel and Harald Sack. "Digital Communication: Communication, Multimedia, Security", Springer, 2014

5. References

1. Katherine L. Adams and Gloria J. Galanes. "Communicating in Groups: Applications and Skills", McGraw Hill Education, 2018
2. Lawrence Holpp. "Managing Teams: Strategies for Success", McGraw Hill, 1998.
3. Caroline Whitbeck (ed) "Ethics in Engineering Practice and Research", Cambridge University Press, 2011

Semester IV

Course Code	DISCRETE MATHEMATICS	L	T	P	C
MA2401		3	1	0	4

COURSE OBJECTIVES:

- To familiarize the applications of algebraic structures.
- To introduce most of the basic terminologies used in computer science courses and the application of ideas to solve practical problems.
- To understand the graph models and basic concepts of graphs.
- To study the characterization and properties of trees and graph connectivity.
- To extend students' logical and mathematical maturity and ability to deal with abstraction, and understand the concepts and significance of Boolean algebra, widely used in computer science and engineering.

Unit I: Algebraic Structures **12 (9+3)**

Semigroup – Monoids – Groups – Subgroups – Abelian groups – Lagrange's theorem – Rings (examples only) – Integral domain – Fields – Definition and examples.

Unit II: Combinatorics **12 (9+3)**

Introduction to Basic Counting Principles, Formulae behind nPr, nCr - Balls and Pins problems - PigeonHole Principle - Recurrence relations – Generating Functions - Introduction to Proof Techniques - Mathematical Induction

Unit III: Basic Graph Theory **12 (9+3)**

Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments

Unit IV: Trees, Planar Graph, and Colouring of a Graph **12 (9+3)**

Trees; Planar graphs, Euler's formula, dual of a planer graph, independence number and clique number, chromatic number, statement of Four-color theorem

Unit V: Logic and Boolean Algebra **12 (9+3)**

Propositional calculus - propositions and connectives, syntax; Semantics - truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility - natural deduction system and axiom system; Soundness and completeness. Introduction of Boolean algebra, truth table, basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map

Theory: 60 Periods

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by Maths Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

Course Outcomes:

After the completion of the course, the student will be able to

CO1: Have an understanding in identifying structures on many levels.

CO2: Understand the concepts of combinatorics.

CO3: Understand the concepts of graph theory and its applications.

CO4: Understand the importance of the natural applications of trees and apply the graph coloring concepts in partitioning problems.

CO5: Learn logic and Boolean algebra and use these concepts to solve problems.

Textbooks:

1. Rosen. K. H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2017.
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", 5th Edition, Pearson Education Asia, Delhi, 2013.
2. Koshy. T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.
3. Lipschutz. S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
4. Gilbert Strang, "Introduction to Linear Algebra".
5. R. A. Brualdi, "Introductory Combinatorics", North-Holland, New York.
6. N. Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice Hall, Englewood Cliffs.

Total: 60 Periods

Course Code	OPERATING SYSTEMS	L	T	P	C
AM2401		3	0	2	4

COURSE OBJECTIVES:

- To understand processes and threads.
- To analyze scheduling algorithms and process synchronization.
- To understand the concept of deadlocks.
- To analyze various memory management schemes.
- To be familiar with I/O management and file systems.
- To be familiar with the basics of virtual machines and Mobile OS like iOS and Android.

Unit I Introduction **9**

Computer System - Elements and organization; Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures – Operating System Services - User Operating System Interface - System Calls – System Programs - Design and Implementation - Structuring methods.

Unit II Process Management **9**

Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads - Multithread Models – Threading issues; Process Synchronization - The Critical-Section problem - Synchronization hardware – Semaphores – Mutex - Classical problems of synchronization - Monitors; Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

Unit III: Memory Management **9**

Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Page Replacement - Allocation of Frames –Thrashing.

Unit IV: Storage Management **9**

Mass Storage system – Disk Structure - Disk Scheduling and Management; File-System Interface - File concept - Access methods - Directory Structure - Directory organization - File system mounting - File Sharing and Protection; File System Implementation - File System Structure - Directory implementation - Allocation Methods - Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.

Unit V Virtual Machines and Mobile OS **9**

Virtual Machines – History, Benefits, and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android.

Theory: 45 PERIODS

Practical Exercises:

Installation of Windows operating system

1. Illustrate UNIX commands and Shell Programming
2. Process Management using System Calls: Fork, Exit, Getpid, Wait, Close
3. Write C programs to implement various CPU Scheduling Algorithms
4. Illustrate the interprocess communication strategy
5. Implement mutual exclusion by Semaphore
6. Write C programs to avoid Deadlock using Banker's Algorithm
7. Write a C program to Implement Deadlock Detection Algorithm
8. Write C program to implement Threading

9. Implement the paging Technique using C program
10. Write C programs to implement the following Memory Allocation Methods
    a. First Fit
    b. Worst Fit
    c. Best Fit
11. Write C programs to implement various Page Replacement Algorithms
12. Write C programs to Implement the various File Organization Techniques
13. Implement the following File Allocation Strategies using C programs
    a. Sequential
    b. Indexed
    c. Linked
14. Write C programs for the implementation of various disk scheduling algorithms

Practical:30 PERIODS

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by Industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

Outcomes: Upon completion, the students will able to

CO1: Analyze various scheduling algorithms and process synchronization.

CO2: Explain deadlock prevention and avoidance algorithms.

CO3: Compare and contrast various memory management schemes.

CO4: Explain the functionality of filesystems, I/O systems, and Virtualization.

CO5: Compare iOS and Android Operating Systems.

Textbooks:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 10th Edition, John Wiley and Sons Inc., 2018.
2. Andrew S. Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.

References:

1. Ramaz Elmasri, A. Gil Carrick, David Levine, “Operating Systems – A Spiral Approach”, Tata McGraw Hill Edition, 2010.
2. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
3. Achyut S. Godbole, Atul Kahate, “Operating Systems”, McGraw Hill Education, 2016.

Total: 75 PERIODS

Course Code	MACHINE LEARNING	L	T	P	C
AM2402		3	0	2	4

COURSE OBJECTIVES:

- To understand the basic concepts of machine learning.
- To understand and build supervised learning models.
- To understand and build unsupervised learning models.
- Study Learn the basics of deep learning using neural networks
- Learn the basics of optimization searching and reinforcement learning methods.

UNIT I INTRODUCTION TO MACHINE LEARNING 9

Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik- Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.

UNIT II SUPERVISED LEARNING 9

Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random Forests.

UNIT III ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING 9

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization

UNIT IV NEURAL NETWORKS 9

Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.

UNIT V OPTIMISATION AND REINFORCEMENT LEARNING 9

Dimensionality Reduction- Linear Discriminate Analysis, Principal Components Analysis, Factor Analysis, Independent Component Analysis. Optimization and Search – Going Downhill, Least-Squares optimization, Conjugate Gradients, Exploitation and Exploration, Simulated Annealing. Evolutionary Learning – Genetic Algorithms, Genetic Operators, Reinforcement Learning, Markov Decision Processes, Markov Chain Monte Carlo (MCMC) Methods.

Theory:45 Periods

PRACTICAL EXERCISES:

1. 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.

2. 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.

3. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

4. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file and compute the accuracy with a few test data sets.

5. Implement naïve Bayesian Classifier model to classify a set of documents and measure the accuracy, precision, and recall.

6. Write a program to construct a Bayesian network to diagnose CORONA infection using standard WHO Data Set.

7. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using the k-Means algorithm. Compare the results of these two algorithms.

8. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.

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

10. Implement the financial risk analysis using Monte Carlo method.

Practical: 30 PERIODS

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by Industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

OUTCOMES: At the end of this course, the students will be able to:

CO1: Explain the basic concepts of machine learning.

CO2: Construct supervised learning models.

CO3: Construct unsupervised learning algorithms.

CO4: Build neural network models

CO5: Build optimization searching and reinforcement models.

TEXT BOOKS:

1. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Fourth Edition, 2020.

2. Stephen Marsland, “Machine Learning: An Algorithmic Perspective, “Second Edition”, CRC Press, 2014.

REFERENCES:

1. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.

2. Tom Mitchell, “Machine Learning”, McGraw Hill, 3rd Edition, 1997.

3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, “Foundations of Machine Learning”, Second Edition, MIT Press, 2012, 2018.

4. Ian Good fellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016

5. Sebastain Raschka, Vahid Mirjalili, “Python Machine Learning”, Packt publishing, 3rd Edition, 2019.

TOTAL: 75 PERIODS

Course Code	COMPUTER NETWORKS	L	T	P	C
AM2403		3	0	2	4

COURSE OBJECTIVES:

- To understand the concept of layering in networks.
- To understand the functions of protocols of each layer of the TCP/IP protocol suite.
- To know the end-to-end flow of information.
- To learn the functions of the network layer and the various routing protocols.
- To familiarize with the functions and protocols of the Transport layer.

Unit 1: DATA COMMUNICATION COMPONENTS 9

Introduction: Data Communications, Networks, Network Types, Network Models: Protocol Layering, TCP/IP Protocol Suite, OSI Model Introduction to Physical Layer: Data and signals Digital Transmission, Bandwidth Utilization: Multiplexing and Spectrum Spreading. Switching: Introduction, Circuit Switched Networks, Packet Switching.

Unit 2 DATA LINK LAYER AND MEDIUM ACCESS CONTROL 10

Introduction to Data Link Layer. Error Detection and Correction: Introduction, Block Coding, Cyclic Codes, Checksum Data Link Control: DLC Services, Data-Link Layer Protocols Media Access Control. Wired LANs: Ethernet-Ethernet Protocol, Standard Ethernet: Characteristics, Addressing.

Unit 3 NETWORK LAYER 9

Introduction to Network Layer: Network Layer Services, Packet Switching, Network Layer Performance, IPV4 Addresses Network Layer Protocols: Internet Protocol, ICMPV4, Unicast Routing: Introduction, Routing algorithms, Unicast routing protocols: Internet Structure, Routing Information Protocol (RIP) Next Generation IP: IPV6 Addressing, IPV6 Protocol, Transition from IPV4 to IPV6

Unit 4 TRANSPORT LAYER 9

Introduction to Transport Layer. Transport Layer Protocols Transport Layer Protocols: Introduction, User Datagram Protocol, Transmission Control Protocol.

Unit 5: APPLICATION LAYER 9

Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.

Theory:45 PERIODS

Practical Exercises

Learn to use commands like tcp dump, net stat, if config, ns lookup and trace route. Capture ping and trace route PDUs using a network protocol analyzer and examine.

1. Write a HTTP web client program to download a web page using TCP sockets.
2. Applications using TCP sockets like: a) Echo client and echo server b) Chat
3. Simulation of DNS using UDP sockets.
4. Use a tool like Wireshark to capture packets and examine the packets.
5. Write a code simulating ARP/RARP protocols.
6. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
7. Study of TCP/UDP performance using Simulation tool.
8. Simulation of Distance Vector/Link State Routing algorithm.
9. Simulation of an error correction code (like CRC)

Practical: 30 PERIODS

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by Industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

Outcomes: Upon completion students will able to

CO1 - Apply the fundamentals of communication in networking aspects.

CO2 - Analyze the various protocols in Physical, Data Link, Network, Transport, and Application layers and their mechanisms.

CO3 - Design functional aspects for network applications.

CO4 - Develop programs that demonstrate the operations of physical, Data Link, Network, Transport layer**s.**

CO5 - Develop programs that demonstrate the operations of Application layers.

Textbooks:

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw Hill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.
3. Computer Networks – A Systems Approach, 4th Edition, Larry L. Peterson and Bruce S. Davie, Elsevier

Reference Books:

1. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.
2. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

E-Book:

An Introduction to Computer Networks Peter L Dordal First-2020 intro net works.cs.luc.edu/current/ComputerNetworks

TOTAL: 75 PERIODS

Course Code	WEB FRAMEWORKS	L	T	P	C
AM2404		3	0	2	4

Course Objectives:

- To build scalable web applications using Angular
- To import and export functionalities of modules using Angular
- To create reusable Ui components using React
- To manage state of the application more efficiently using React Hook
- To containerize the applications using Docker and Kubernetes

UNIT I– ANGULARV 12 **9**

Introduction to Angular– Typescript (Arrays, Functions, classes) –JS vsTS – Angular CLI Installation– Components – Data Binding – Routing on Angular - Directives

UNIT II– ANGULAR MODULES AND MATERIAL **9**

Angular Modules–HTTP client, Forms Module–Angular Service Files–Dependency Injection– Angular Material – Connecting Angular with Back End

UNIT III – REACT V 18 **9**

Introduction to React– Setting development environment–create app – JSX syntax –properties and states – components – React routing – API request

UNIT IV– REACT HOOKS **9**

React Hooks–useState–useEffect–useCallback–useMemo–useContext–useReducer– Introduction to React Native

UNIT V– CONTAINERIZATION **9**

Introduction to Image and Container–Docker–Containers–DockerImages, Dockerfile, Docker Network – Docker Compose - Kubernetes

Theory: 45 PERIODS

PRACTICAL EXERCISES:

1. Project– Create an angular app with n components and add routing
2. Project–Add functionalities, validation and database with above components
3. Project– Create Login System using React
4. Project–Create Flight Management system

Practical: 30 PERIODS

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by Industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

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

CO1: Build scalable web applications using Angular

CO2: Import and export functionalities of modules using Angular

CO3: Create reusable UI components using React

CO4: Manage state of the application more efficiently using React Hook

CO5: Containerize the applications using Docker and Kubernetes

TEXT BOOKS:

1. NateMurray,FelipeCoury,AriLerner,CarlosTaborda,"TheNgbook—The CompleteBook on Angular"
2. The Road to React, Robin Wieruch,2023.
3. The Docker Book: Containerization is the new virtualization, JamesTurnbull,2014.
4. The Kubernetes Book, NigelPoulton,2023.

ONLINERESOURCES:

1. https://angular.io/docs
2. https://react.dev/
3. https://react.dev/reference/react
4. https://docs.docker.com/
5. https://kubernetes.io/docs/home/

TOTAL: 75 PERIODS

Course Code	ARTIFICIAL INTELLIGENCE	L	T	P	C
AM2405		3	0	2	4

COURSE OBJECTIVES:

The main objectives of this course are to:

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.

UNIT I INTRODUCTION 9

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

UNIT II PROBLEM SOLVING METHODS 9

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing - Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games

UNIT III KNOWLEDGE REPRESENTATION AND DECISIONS 9

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information. Making Simple Decisions: Combining Beliefs and Desires under Uncertainty, the Basis of Utility Theory, Utility Functions, Multi-attribute Utility Functions and Decision Networks, The Value of Information.

UNIT IV SOFTWARE AGENTS AND COMPLEX DECISIONS 9

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems. Making Complex Decisions: Sequential Decision Problems, Value Iteration, Policy Iteration, Partially Observable MDPs (Markov Decision Processes), Decisions with Multiple Agents.

UNIT V APPLICATIONS 9

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – SpESh Recognition – Robot – Hardware – Perception – Planning – Moving.

Theory: 45 PERIODS

PRACTICAL EXERCISES:

1. Implementation of Uninformed search algorithms (BFS, DFS)

2. Implementation of Informed search algorithms (A*, memory-bounded A*)

3. Develop a python program to simulate the agent with suitable environment to decide the numbers of papers to be purchased by observing the stock history and prize.

4. Develop a python program to simulate the hierarchical controller environment with the agent to plan and move to the right location.

5. Write a python program to represent a priority queue environment and agent to support the Multiple Path Pruning

6. Write a python program to simulate the crossword puzzle problem with 10 words that satisfy suitable constraints in a domain.

7. Write a program to construct a Bayesian Network from given data.

8. Write a program to infer from the Bayesian Network.

9. Write a python program to simulate the crossword puzzle problem by assuming the static ordering of nodes that satisfy suitable constraints in a domain and apply any heuristic search strategy.

10. Write a python program to simulate the crossword puzzle problem that satisfies suitable constraints with any stochastic search strategy and conflict resolution.

11. Write a python program to simulate a knowledge base with a list of clauses in order to make top-down inference, also creates a dictionary that maps each atom into the set of clauses with that atom in the head.

12. Write a python program to demonstrate the belief network for making an uncertain decision.

. **Practical: 30 PERIODS**

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by Industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

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

.**CO1:** Use appropriate search algorithms for any AI problem

CO2: Represent a problem using first order and predicate logic

CO3: Provide the apt agent strategy to solve a given problem

CO4: Design software agents to solve a problem

CO5: Design applications for NLP that use Artificial Intelligence.

TEXT BOOKS:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2009.
2. Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

REFERENCES:

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc.; First Edition, 2008

2. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.

3. William F. Clocksin and Christopher S. Mellish," Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.

4. Gerhard Weiss, "Multi Agent Systems", Second Edition, MIT Press, 2013.

TOTAL:75 PERIODS

Course Code	Employability Enhancement Skills – IV:	L	T	P	C
ES2401	Leadership and Project Management Skills	0	0	2	1

Course Objectives:

- To understand leadership within the context of project management.
- To differentiate between leadership and management roles.
- To learn project initiation processes and setting SMART objectives.
- To build high-performing teams through motivation, empowerment, and effective communication.
- To develop skills in project planning, estimation, resource allocation, risk management, and scheduling.

Unit 1: Understanding Leadership - Introduction to Project Management - Leadership vs. Management - Project Initiation - Setting SMART Objectives

Unit 2: Building High-Performing Teams - Motivation Theories - Empowering Team Members - Leadership Communication - Handling Team Conflicts

Unit 3: Work Breakdown Structure (WBS) - Estimation Techniques - Gantt Charts and Network Diagrams - Resource Allocation - Risk Management

Unit 4: Leading Project Teams - Monitoring and Controlling Progress - Change Management - Quality Management - Stakeholder Communication

Unit 5: Project Closure Activities - Lessons Learned - Celebrating Success - Transition Planning

Course Outcomes:

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

CO1: Apply leadership principles to project management scenarios.

CO2: Distinguish between leadership and management functions in project environments.

CO3: Initiate projects effectively by setting SMART objectives.

CO4: Foster high-performing teams through motivation, empowerment, and conflict resolution.

CO5: Proficiently plan, schedule, and manage project activities, resources, risks, and stakeholder communications.

Textbooks

1. Peter G. Northouse. "Leadership: Theory and Practice", SAGE Publications, 2021
2. Patrick Lencioni. "The Five Dysfunctions of a Team: A Leadership Fable", Jossey-Bass, 2011
3. Robert K. Wysocki. "Effective Project Management: Traditional, Agile, Extreme", Wiley, 2019
4. Clifford F. Gray and Erik W. Larson. "Project Management: The Managerial Process", McGraw-Hill Education, 2017
5. Harold Kerzner. "Project Management Case Studies", Wiley, 2008

References

1. Harold Kerzner. "Project Management: A Systems Approach to Planning, Scheduling, and Controlling", 10th edition, Wiley, 2009

2. Gregory P. Shea and Cassie A. Solomon. "Leading Successful Change: 8 Keys to Making Change Work", Gildan Media, LLC, 2013

Total: 30 periods

Semester V

Course Code	Computing Theory & Compiler Design	L	T	P	C
AM2501		3	0	0	3

COURSE OBJECTIVES:

- To understand foundations of computation and construct models of regular expressions and languages.
- To design context free grammar, pushdown automata and Turing machines.
- To understand intermediate code generation.
- To understand run-time environment and implement code generator.
- To learn to implement code optimization.

UNIT – I FORMAL LANGUAGE AND REGULAR EXPRESSIONS 9

Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Applications of Finite Automata to lexical analysis, lex tools – pumping lemma.

UNIT – II CONTEXT FREE GRAMMARS AND PARSING 9

Context free grammars, derivation, parse trees, ambiguity LL(K) grammars and LL(1) parsing Bottom up parsing, handle pruning, LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification – Pushdown Automata – pumping lemma.
Turing Machine – Undecidability

UNIT – III SYNTAX-DIRECTED TRANSLATION AND INTERMEDIATE-CODE GENERATION 9

Syntax directed translation, S-attributed and L-attributed grammars, Intermediate code Generation – abstract syntax tree, translation of simple statements and control flow statements. Context Sensitive features – Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations.

UNIT – IV RUN-TIME ENVIRONMENTS AND CODE GENERATION 9

Storage organization, Storage Allocation Strategies: Static, Stack and Heap allocation – Parameter Passing – Symbol Tables – Dynamic Storage Allocation – Issues in the design of a code generator – Basic Blocks and Flow graphs – Design of a simple Code Generator – Optimal Code Generation for Expressions – Dynamic Programming Code Generation

UNIT – V CODE OPTIMIZATION 9

Principal sources of Optimization – Peep-hole optimization – DAG - Optimization of Basic Blocks – Global Data Flow Analysis – Efficient Data Flow Algorithm – Recent trends in Compiler Design.

TOTAL: 45 PERIODS

Course outcomes:

Upon completion of this course, the student should be able to:

CO1: Construct Finite Automata and write regular expression for any pattern.

CO2: Design context free grammar, Pushdown Automata and Turing Machine for computational functions.

CO3: Understand semantic rules and intermediate code generation.

CO4: Understand run-time environment and implement code generation.

CO5: Apply code optimization techniques.

TEXTBOOKS:

1. John E. Hopcroft, Rajeev M & J D Ullman: "Introduction to Automata Theory Languages &Computation", 3rd Edition, Pearson Education, 2007.
2. Aho, Ullman, Ravisethi: "Compilers Principles, Techniques and Tools", 2nd Edition, Pearson Education, 2009.

REFERENCES:

1. Tremblay J P, Sorenson G P: "The Theory & Practice of Compiler writing", 1st Edition, BSP publication, 2010.
2. Appel W & Andrew G M: "Modern Compiler Implementation in C", 1st Edition, Cambridge University Press, 2003.
3. Louden: "Compiler Construction, Principles & Practice", 1st Edition, Thomson Press, 2006.
4. Sipser Michael: "Introduction to Theory of computation", 1st Edition, Thomson, 2009.

Course Code	NATURAL LANGUAGE PROCESSING (NLP)	L	T	P	C
AM2502		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are to:

1. To learn the mathematical foundations and basics of Natural Language Processing.
2. To understand the text data processing technologies for processing text data.
3. To understand the role of Information Retrieval and Information Extraction in Text Analytics.
4. To acquire knowledge on text data analytics using language models.
5. To learn about NLP Tools and real-time examples of NLP.

UNIT I Introduction to Natural Language Processing **9**

Natural Language Processing – Linguistic Background -– Mathematical Foundations - Morphological Analysis – Tokenization – Stemming - Lemmatization – Boundary Determination.

UNIT II Text Data Analysis **9**

Reading unstructured data - Representing text data - Part of speech tagging – Syntactic representation - Text similarity - WordNet-based similarity - Shallow parsing - Semantic representation.

UNIT III Information Retrieval and Extraction **9**

Information Retrieval: Design features of Information Retrieval Systems-Classical, Nonclassical, Alternative Models of Information Retrieval – Information extraction - Named Entity Recognition Relation Identification - Template filling.

UNIT IV Language Modelling **9**

Language model - Probabilistic Models - n-gram language models- Hidden Markov Model- Topic Modelling - Graph Models -Feature Selection and classifiers -Rule-based Classifiers - Maximum entropy classifier – Clustering-Word and Phrase-based Clustering.

UNIT V NLP Tools and Applications **9**

Tools: Natural Language Tool kit, Apache OpenNLP. Applications of Text Analytics – Applications in social media - Life science - Legal Text – Visualization - Case studies.

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

Theory:45PERIODS

COURSE OUTCOMES:

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

CO1: Understand the mathematical foundations and basics of Natural Language Processing.

CO2: Process the text data at the syntactic and semantic level.

CO3: Extract the key information from Text data.

CO4: Analyze the text content to provide predictions related to a specific domain using language models.

CO5: To design an innovative application using NLP components.

TEXTBOOKS:

1. Christopher D. Manning and Hinrich Schutze, "Foundations of Statistical Natural Language Processing", MIT Press, 1999.
2. Steven Struhl, "Practical Text Analytics: Interpreting Text and Unstructured Data for Business Intelligence", Kogan Page, 2015.
3. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", 1st Edition, O'Reilly Media, 2009.

REFERENCES:

1. Matthew A. Russell, "Mining the Social Web", O'Reilly Media, 2013.
2. Daniel Jurafsky and James H. Martin "Speech and Language Processing", 3rd edition, Prentice Hall, 2009.
3. Nitin Indurkhya, Fred J. Damerau "Handbook of Natural Language Processing", Second Edition, CRC Press, 2010.
4. Daniel Jurafsky and James H. Martin "Speech and Language Processing", 3rd edition, Prentice
5. Hall, 2009.

TOTAL: 45 PERIODS

Course Code	BIG DATA ANALYTICS	L	T	P	C
AM2503		3	0	2	4

COURSE OBJECTIVES:

- To Understand the Big Data Platform and its Use cases
- To Provide the concept of Hadoop framework and HDFS
- To Understand Map-Reduce Jobs and Spark Framework
- To Provide hands on Hadoop Eco System
- To provide Exposure to Data Analytics with R and Spark Shell

COURSE DESCRIPTION:

The course begins with an overview of the fundamental concepts of big data, including the characteristics of big data, challenges associated with its processing and analysis, and the technologies used to manage big data infrastructure. Students will then explore various data processing frameworks, such as Apache Hadoop and Apache Spark, and learn how to leverage them to handle and analyze large-scale datasets efficiently.

PRE- REQUISITES:

- Should have knowledge of one Programming Language (Java preferably)
- Practice of SQL (queries and sub queries), exposure to Linux Environment.

UNIT I INTRODUCTION TO BIG DATA ANALYTICS 9

Data Storage and Analysis: Types of Digital Data, Introduction to Big Data, Evolution, Characteristics of Big Data, Traditional Business Intelligence versus Big Data.

Big Data Analytics: Classification of Analytics, Big Data Analytics important, Typical Analytical Architecture – Requirement for new analytical architecture – Challenges in Big Data Analytics, Top Analytics Tools – Need of big data frameworks. Data Science - Data Scientist - Terminologies used in Big Data Environments.

UNIT II HADOOP FRAMEWORK AND HDFS (Hadoop Distributed File System) 9

Hadoop: History of Hadoop– Requirement of Hadoop Framework - Design principle of Hadoop – Comparison with other system - Hadoop Components – Hadoop 1 vs Hadoop 2 – Hadoop Daemon's – Apache Hadoop, Analysing, Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming.

HDFS: HDFS Concepts, HDFS Commands, Design of HDFS, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

UNIT III MAP REDUCE AND SPARK FRAMEWORK 9

Map Reduce: Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features. Map Reduce Programming: I/O formats, Map side join, Reduce Side Join, Secondary sorting, Pipelining Map Reduce jobs.

Spark Framework

Introduction to GPU Computing, CUDA Programming Model, CUDA API, Simple Matrix, Multiplication in CUDA, CUDA Memory Model, Shared Memory Matrix Multiplication, Additional CUDA API Features.

Unit IV HADOOP ECO SYSTEM 9

Introduction to Hadoop ecosystem technologies: Hadoop Echo System, Hadoop Streaming, Infosphere Big Insights and Big Sheets. Scripting language: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Serialization: AVRO, Co-ordination: Zookeeper. Hive: Hive Shell, Hive Services, Hive Metastore,

Comparison with Traditional Databases, HiveQL, Tables, QueryingData and User Defined Functions.HBase: HBasics, Concepts, Clients, Example, Hbase Versus RDBMS.Big SQL: Introduction. Streaming: Flink, Storm.

UNIT V: DATA ANALYTICS **9**

Data Analytics with R: Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Regression Model, Clustering, Collaborative Filtering, Associate Rule Making, Decision Tree, Big Data Analytics with BigR.

Data Analysis with Spark Shell: Writing Spark Application - Spark Programming in Scala, Python, R, Java - Application Execution.

Spark SQL and GraphX: SQL Context – Importing and Saving data – Data frames – using SQL – GraphX overview – Creating Graph – Graph Algorithms.

Spark Streaming: Overview – Errors and Recovery – Streaming Source – Streaming live data with spark.

Recent Trends in Big Data Analytics.

Theory :45 Periods

Practical Experiments

1. HDFS Commends Map Reduce Program to show the need of Combiner
2. Map Reduce I/O Formats-Text, key-value Map ReduceI/O Formats –Nline, Multiline
3. Sequence file Input/output Formats Secondary sorting
4. Distributed Cache & Map Side Join, reduce side Join Building and Running a Spark Application Word count in Hadoop and Spark Manipulating RDD
5. Inverted Indexing in Spark Sequence alignment problem in Spark Implementation of Matrix algorithms in Spark SparkSql programming, Building Spark Streaming application

Practical: 30 Periods

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

OUTCOMES upon completion he students will be able to:

CO1: Identify Big Data and its Business Implications.
CO2: Understand the concept of Hadoop framework and HDFS
CO3: Understand the Map-Reduce Jobs and Spark Framework
CO4: Analyze Info phere Big Insights Big Data Recommendations.
CO5: Apply Data Analytics with R and Spark Shell

Text Books

1. Tom White “Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

References

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007.
2. Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press (2013)

3. Tom Plunkett, Mark Hornick, “Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle REnterprise and Oracle R Connector for Hadoop”, McGraw-Hill/Osborne Media (2013), Oracle press.
4. Anand Rajaraman and Jef rey David Ulman, “Mining of Massive Datasets”, Cambridge University Press,2012.

YouTube Resources

edureka! - This channel offers comprehensive tutorials, webinars, and courses on big data technologies, including Hadoop, Spark, and related ecosystems. Viewers can find videos covering various aspects of big data analytics, such as data ingestion, processing, analysis, and visualization**.**

Data School - Data School provides tutorials and practical tips on data science and big data analytics topics. The channel covers a wide range of subjects, including data preprocessing, machine learning, and data visualization, with a focus on practical applications and real-world examples.

Big Data University - Big Data University offers tutorials and courses on big data technologies and analytics. The channel covers topics like Hadoop, Spark, NoSQL databases, and cloud-based big data solutions, catering to both beginners and experienced professionals in the field.

Google Cloud Platform - The Google Cloud Platform (GCP) channel features videos and tutorials on big data solutions offered by Google Cloud, such as BigQuery, Dataflow, and Dataproc. Viewers can learn about data analytics best practices, architectural patterns, and case studies on GCP.

Databricks - Databricks' channel provides tutorials, webinars, and demonstrations on Apache Spark and Delta Lake, offering insights into big data analytics and machine learning workflows. Viewers can find content on Spark optimization, data engineering, and advanced analytics techniques**.**

Cloudera - Cloudera's channel offers videos and presentations on big data technologies like Hadoop, Spark, and Impala. Viewers can access tutorials, case studies, and expert discussions on topics related to big data analytics, data engineering, and machine learning.

Total:75 Periods

Semester VI

Course Code		L	T	P	C
AM2601	**Parallel Programming through Python**	**2**	**0**	**2**	**4**

COURSE OBJECTIVES:

- To understand the basic concepts of python for parallel Computing
- To explore Multithreading and Multiprocessing in python
- To review the distributed computing concepts in python
- To analyze the parallel computing patterns in python
- To experiment the Parallelism in Python without libraries

COURSE DESCRIPTION:
This course is designed to provide students with the knowledge and skills necessary to leverage Python for parallel programming, enabling them to harness the power of multicore processors, clusters, and parallel processing environments effectively.

PREREQUESTIES:

- Proficiency in Python programming language
- Understanding of basic computer science concepts (e.g., data structures, algorithms)
- Familiarity with fundamental concepts of parallel and concurrent programming

Unit -I Python Basics for Parallel Computing **7**

Overview of the Python programming language- Python syntax essentials for high-performance computing- Setting up the Python environment for parallel computing- Introduction to Python's scientific computing stack (NumPy, SciPy)

Unit II Multi-Threading and Multi-Processing in Python **9**

Understanding Python's Global Interpreter Lock (GIL)-Creating and managing threads using the threading Module-Using the multiprocessing module for CPU-bound Tasks-Synchronization primitives, shared memory, and managing state

Unit III Distributed Computing in Python **9**

Introduction to distributed computing with Python- Setting up and managing worker processes with multiprocessing and concurrent futures- Using message passing with Celery for distributed tasks - Introduction to Dask for scalable analytics and parallel computing

Unit IV Parallel Computing Patterns in Python **9**

Common parallel computing patterns: Map Reduce, Scatter-Gather-Implementing parallel map with concurrent futures- Parallel loops, aggregations, and reductions with Dask-Task scheduling and load balancing strategies

Unit IV Implementation of Parallelism in Python without libraries **9**

Python's multiprocessing module- Python's threading module- Python's asyncio module- POSIX threads- extensions in C or Cython to leverage low-level parallelism features - integration of C or Cython into Python code.

Theory: 45 Periods

Practical Exercises

1. Write a Python script that calculates the square of numbers from 1 to 10 using multiprocessing.

2. Extend the script to utilize a multiprocessing pool to parallelize the task.

3.Create a Python program to download multiple images from URLs using multithreading.

4. Explore the Global Interpreter Lock (GIL) limitations and discuss how multithreading may or may not improve performance.

5. Implement parallel versions of common sorting algorithms such as merge sort or quicksort using multiprocessing.

6.Write a Python program to perform matrix multiplication using both serial and parallel approaches. Experiment with different matrix sizes and compare the performance of the parallel version with the serial version.

7.Use a library like Dask or PySpark to perform distributed computing tasks. Design a task such as distributed word counting or distributed matrix operations and execute it on a cluster.

8.Explore GPU parallelization using libraries like PyCUDA or Numba. Implement a computationally intensive task such as image processing or scientific computing using GPU parallelization and compare its performance with CPU-based implementations.

Practical :30Periods

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

OUTCOMES: upon completion of this course, the students will be able to:

CO1: Understand the basic concepts of python for parallel Computing
CO2: Explore Multithreading and Multiprocessing in python
CO3: Analyze the distributed computing concepts in python
CO4: Apply e the parallel computing patterns in python
CO5: Experiment and evaluate the Parallelism in Python without libraries

Text Books:

1. Parallel Programming with Python" by Jan Palach
2. "Python Parallel Programming Cookbook" by Giancarlo Zacco

Reference Books

1. High Performance Python: Practical Performant Programming for Humans" by Micha Gorelick and Ian Ozsvald:
2. Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers" by Barry Wilkinson and Michael Allen:

You Tube Resources

Corey Schafer - Corey Schafer's channel offers comprehensive tutorials on Python programming, including topics related to parallel programming. His videos cover multiprocessing, multithreading, asynchronous programming with asyncio, and practical examples of parallelism in Python.

sentdex - Sentdex provides tutorials on various programming topics, including Python parallel programming. The channel covers multiprocessing, multithreading, and asynchronous programming

concepts, with examples and demonstrations to help viewers understand the implementation of parallelism in Python.

Tech with Tim - Tech with Tim offers tutorials and practical examples on Python programming, including parallel programming techniques. The channel covers multiprocessing, multithreading, and asynchronous programming, with hands-on projects and coding exercises.

Dask Distributed - Dask Distributed's channel provides tutorials and demonstrations on using Dask for parallel computing in Python. Viewers can learn about setting up Dask clusters, parallelizing computations, and scaling up data processing tasks using Dask distributed.

P**yData** - PyData hosts talks, tutorials, and presentations from the PyData community, covering various topics related to data science and analytics, including parallel programming in Python. Viewers can find talks on parallel computing libraries, best practices, and case studies.

TOTAL: 75 PERIODS

Course Code	Generative Artificial Intelligence	L	T	P	C
AM2602		3	0	2	4

COURSE OBJECTIVES:

The main objectives of this course are to:

- Understand the principles and theory behind generative AI.
- Gain practical experience in developing generative AI models.
- Analyze and evaluate the ethical and societal implications of generative AI.
- Apply generative AI techniques to real-world problems and domains.
- Keep up-to-date with the latest developments and trends in the field of generative AI.

Course Description

This course provides an introduction to the theory and practical applications of Generative Artificial Intelligence. Students will learn the fundamental concepts and techniques related to generative models and gain hands-on experience with creating and using generative AI systems.

Prerequisites

- Basic knowledge of machine learning and deep learning.
- Familiarity with a programming language (e.g., Python).

UNIT I Introduction to Generative AI **9**

Overview of Generative AI and its applications – Difference between generative and discriminative models – Historical perspective and key milestones – Ethical and societal implications – Introduction to Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), Long Short-Term Memory Networks (LSTMs), Transformers, and Large Language Models (LLMs).

UNIT II Probability and Statistics for Generative AI **9**

Probability distributions and their role in generative models – Maximum Likelihood Estimation (MLE) – Bayesian Inference and Maximum a Posteriori (MAP) estimation – Generative models as probabilistic models – Application of statistical methods in CNNs, RNNs, and LSTMs.

UNIT III Generative Models **9**

Introduction to Autoencoders – Variational Autoencoders (VAE) – Generative Adversarial Networks (GAN) – Flow-based models – Practical implementation and hands-on exercises (using TensorFlow, PyTorch, Jupyter Notebook, Keras, etc) – Overview of Transformer models and their role in Generative AI – Practical implementation of Transformers and LLMs (e.g., BERT, GPT).

UNIT IV Applications of Generative AI **9**

Image generation and manipulation – Text generation and natural language processing – Anomaly detection and data augmentation – Style transfer and artistic applications – Real-world use cases (Art & Design, Medical Imaging, Content creation, Chatbots, Virtual Assistants, Cybersecurity, etc.) and industry examples – Advanced applications of CNNs in image processing – Applications of RNNs and LSTMs in sequential data – Guest Lectures by Industry Experts and Researchers.

Theory :45 PERIODS

Assignments / Projects (sample):

1. Write a literature review on the historical development and key milestones in generative AI, highlighting the most influential papers and breakthroughs.
2. Solve a set of probability and statistics problems related to generative models and their applications.

3. Implement a simple autoencoder model and train it on a dataset of your choice for image compression or denoising.
4. Implement a Variational Autoencoder to generate new samples in a chosen domain (e.g., images or text).
5. Create a GAN model to generate synthetic images or text data and evaluate its performance.
6. Develop a text generation model that can generate coherent and contextually relevant text paragraphs or poetry.
7. Implement an image style transfer algorithm to transform photographs into various artistic styles.
8. Write an essay analyzing the ethical implications of generative AI in society, focusing on privacy, bias, and security concerns.
9. Choose a specific industry or domain (e.g., healthcare, finance, or art) and propose a generative AI application that could be beneficial in that field. Provide a detailed plan for its implementation.
10. (Final Project) Design and implement a generative AI project of your choice, which can be an image generator, text generator, or any creative application. Present the project and its results in a report or presentation.

Practicals:30 PERIODS

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

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

CO1: Understand the fundamental principles and applications of Generative Artificial Intelligence and distinguish between generative and discriminative models.
CO2: Apply probability and statistics concepts to analyze and model data, with a focus on their role in generative models.
CO3: Implement and evaluate various generative models, including Autoencoders, Variational Autoencoders (VAE), and Generative Adversarial Networks (GANs).
CO4: Apply generative AI techniques to solve real-world problems, including image generation, text generation, and artistic applications.
CO5: Evaluate generative models using appropriate metrics and critically analyze the ethical implications, privacy concerns, and societal impact of generative AI technologies.

TEXT BOOKS:

1. David Foster, "Generative Deep Learning", Second Edition, O'Reilly Media, 2023.
2. Joseph Babcock and Raghav Bali, "Generative AI with Python and TensorFlow 2", Packt Publishing, 2021
3. Jakub Langr and Vladimir Bok, "GANs in Action: Deep learning with Generative Adversarial Networks", Manning, 2019.

REFERENCES:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", The MIT Press, 2016.
2. Hannes Hapke, Cole Howard, Hobson Lane "Natural Language Processing in Action", Manning, 2019.
3. Alberto Chierici, "The Ethics of AI", New Degree Press, 2021.
4. Jacob Emerson, "Ripples of Generative AI", IngramSpark, 2023.
5. Andreas C. Müller, Sarah Guido, "Introduction to Machine Learning with Python", O'Reilly Media, 2017.

6. Eric Matthes, “Python Crash Course”, Third Edition, No Starch Press, 2023.

YouTube Resources:

1. **3Blue1Brown** - While not specific to generative AI, this channel provides fantastic visual explanations of mathematics and concepts that are fundamental to AI and machine learning.
2. **sentdex** - This channel focuses on machine learning and AI using Python. It includes tutorials on various topics, including generative models.
3. **Two Minute Papers** - This channel offers concise summaries of research papers and breakthroughs in computer graphics, machine learning, and AI, including generative AI.
4. **DeepLizard** - This channel provides tutorials on machine learning and deep learning topics, which can be useful for understanding the technical aspects of generative AI.
5. **Andrew Ng's Deeplearning.ai** - The deeplearning.ai courses on Coursera, created by Andrew Ng, are also available on YouTube. These videos cover deep learning and neural networks, which are foundational to generative AI.
6. **Stanford University's Machine Learning** - You can find recordings of Stanford University's machine learning course on YouTube, which includes lectures on relevant topics. (Stanford Online)
7. **PyTorch** - The official PyTorch YouTube channel provides tutorials and resources for learning PyTorch, a popular framework for deep learning and generative AI.
8. **TensorFlow** - The official TensorFlow YouTube channel offers tutorials and resources for learning TensorFlow, another widely used deep learning framework.

TOTAL:75 PERIODS

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Course Code		L	T	P	C
AM2603	**Deep learning for vision**	3	0	2	4

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
- To solve real world computer vision applications using Deep learning.

Prerequisites

- Basic knowledge of Artificial Intelligence and Machine learning
- Familiarity with a programming language (e.g., Python).

UNIT I COMPUTER VISION BASICS 6

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 6

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 6

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 6

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 6

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

Theory :30 PERIODS

PRACTICAL EXERCISES:

1. Implementation of basic Image processing operations including Feature Representation and Feature Extraction
2. Implementation of simple neural network
3. Study of pretrained deep neural network model for Images
4. CNN for Image classification
5. CNN for Image segmentation
6. RNN for video processing
7. Implementation of Deep Generative model for Image editing

PRACTICALS:30 PERIODS

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes, Assignments/ Project, 2IAs, Model, Final Examination

COURSE OUTCOMES:

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 and implement CNN and RNN and Deep generative model
CO 4: Understand the role of deep learning in computer vision applications.
CO 5: Design and implement 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.

TOTAL:60 PERIODS

Semester VII

Course Code		L	T	P	C
HS2701	PROFESSIONAL ETHICS AND UNIVERSAL HUMAN VALUES	3	0	0	3

COURSE OBJECTIVE:

• To enable the students to create an awareness of Engineering Ethics and Human Values, to install Moral and Social Values and Loyalty, and to appreciate the rights of others.

Course Description

This course explores the intersection of ethics and professionalism in various fields, including business, medicine, law, engineering, and beyond. This course delves into the fundamental principles and theories of ethics, focusing on their practical application within professional contexts.

Prerequisites

- Willingness to engage with diverse perspectives and challenge personal biases in ethical reasoning.
- Awareness of contemporary societal issues related to diversity, equity, inclusion, social justice, and sustainability, as these issues often intersect with professional ethics and universal human values.

UNIT I HUMAN VALUES 10

Morals, values, and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as Responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES, AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk-Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES 8

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

Theory: 45 PERIODS

Course Format

Lectures and discussions, Hands-on training, Guest lectures by Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOME:

OUTCOME: upon completion of this course the student will be able to

- to apply ethics in society, discuss the ethical issues related to engineering, and realize societal responsibilities and rights.

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.

2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.

2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.

3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003

4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.

5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd. New Delhi, 2013.

6. World Community Service Centre, 'Value Education', Vethathiri publications, Erode, 2011.

Web sources:

1. www.onlineethics.org

2. www.nspe.org

3. www.globalethics.org

4. www.ethics.org

TOTAL: 45 PERIODS

APPENDIX A: PROFESSIONAL ELECTIVES

COURSES: VERTICALS

Vertical I Full Stack Development	**Vertical II Software Technologies**	**Vertical III Cyber Security**	**Vertical IV Artificial Intelligence and Data Science**	**Vertical V Cloud Computing**	**Vertical VI IoT Systems**	**Vertical VII High-End Computing**
AMPE V12X01 Web Development 5.0	**AMPEV22X01** Software Engineering	**AMPEV32X01** Cryptography & Information Security	**AMPEV42X01** Data Analytics and Visualization	**AMPEV52X01** Cloud Technologies	**AMPEV62X01** Foundations of Embedded IoT Systems	**AMPEV72X01** Parallel Processing
AMPEV12X02 App Development	**AMPEV2X02** Software Testing and Automation	**AMPEV32X02** Security and Privacy in Cloud	**AMPE V42X02** Mathematics for Machine Learning	**AMPEV52X02** Virtualization	**AMPEV62X02** IoT Networks	**AMPEV72X02** High Performance Computing
AMPEV12X03 UI and UX Design	**AMPEV2X03** Agile Methodologies	**AMPEV32X03** Web Application Security	**AMPE2V4X03** Deep Learning	**AMPEV52X03** Cloud Architectures	**AMPEV62X03** Secure Hardware and Embedded Devices	**AMPEV72X03** Pervasive Computing
AMPEV12X04 Cloud Services Management	**AMPEV2X04** Software User Interface Design & Analysis	**AMPEV32X04** Social Network Security	**AMPEV42X04** Natural Language Processing (NLP)	**AMPEV52X04** Cloud Platform Programming	**AMPEV62X04** IoT Processors	**AMPEV72X04** Pico Computing
AMPEV12X05 DevOps	**AMPEV2X05** Software Architecture and Design Patterns	**AMPEV32X05** Digital Forensics and Malware Analysis	**AMPEV42X05** Computer Vision and Image Processing	**AMPEV52X05** Cloud Computing	**AMPEV62X05** Mobile Applications Development	**AMPEV72X05** Nano Computing
AMPEV12X06 Advanced Web Frameworks and Containerization	**AMPEV2X06** Software Quality Management	**AMPEV32X06** Ethical Hacking	**AMPEV42X06** Reinforcement Learning	**AMPEV52X06** Stream Processing	**AMPEV62X06** Industrial IoT & Healthcare Systems	**AMPEV72X06** Fog and Edge Computing
AMPE2107 Middle Tier Technologies	**AMPEV2X07** Software Project Management	**AMPEV32X07** Cryptocurrency & Blockchain Technologies	**AMV4PE2X07** Big Data Analytics	**AMPEV52X07** Fog and Edge Computing	**AMPEV62X07** Smart Cities	**AMPEV72X07** AI and Cloud Computing
AMPEV12X08 Web Application Security	**AMPEV2X08** Human-Computer Interaction	**AMPEV32X08** Security Auditing & Counter Hacking Techniques	**AMPEV42X08** Generative AI	**AMPEV52X08** Blockchain Technologies and Cloud Computing	**AMPEV62X08** Advanced Intelligent Systems	**AMPEV72X08** Quantum Computing

* Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. However, Students are restricted to select from not more than 2 verticals.

Vertical 1: Full Stack Development

Course Code	WEB DEVELOPMENT 5.0	L	T	P	C
AMPEVI2X01		2	0	2	3

COURSE OBJECTIVES:

- To define the evolution of web development from static websites to modern web applications
- To explore the concepts of components, JSX, and state management.
- To define Node.js and Express.js and their roles in server-side development.
- To integrate databases with web applications.
- To understand various deployment strategies for web applications.

Unit 1: Introduction to Modern Web Development **6**

Evolution of Web Development- Historical overview of web development- Introduction to Web Development 5.0 and its characteristics- Modern Web Development Ecosystem- Overview of front-end and back-end technologies- Introduction to popular frameworks and libraries

Unit 2: Front-end Development with React.js **6**

Introduction to React.js- Overview of React.js and its key features- Understanding JSX syntax and component-based architecture- Components and State Management- Creating functional and class components- Managing state and props in React applications

Unit 3: Back-end Development with Node.js and Express.js **6**

Introduction to Node.js and Express.js- Overview of Node.js and its event-driven architecture- Introduction to Express.js as a web application framework- Building RESTful APIs- Understanding RESTful principles- Creating a simple RESTful API with Express.js

Unit 4: Database Integration and Authentication **6**

Database Integration- Overview of database options (MongoDB, MySQL, etc.)- Integrating MongoDB with Express.js- User Authentication and Authorization- Introduction to authentication and authorization- Implementing user authentication using Passport.js

Unit 5: Deployment and Project Work **6**

Deployment Strategies- Traditional Server Hosting-Cloud Hosting-Containerization-Container Orchestration-Serverless Architecture-Continuous Deployment-Blue-Green Deployment-Feature Toggles- Best Practices- Project Work Guidelines- Tips for effective project planning, collaboration, and troubleshooting

Theory: 30 Periods

SAMPLE LIST OF EXPERIMENTS

1. Installation and configuration of development tools.

2. Introduction to version control using Git.

3. Creating a basic HTML5 and CSS3 web page.

4. Introduction to responsive design principles.

5. Building a simple React application.

6. Implementing components and managing state.

7. Practical exercises on creating stateful and stateless components.

8. Implementing interactivity in React applications.

9. Creating a basic web server using Node.js.

10. Implementing asynchronous programming with callbacks and Promises.

11. Integration of MongoDB with Express.js.

Practical:30 Periods

COURSE OUTCOMES:

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

CO1 Understand and Apply Modern Web Development Concepts.

CO2 Create interactive and dynamic user interfaces with React.js.

CO3 Apply design patterns to new projects and re-factor existing code.

CO4 Implement secure user authentication and authorization using Passport.js.

CO5 Understand various deployment strategies and hosting platforms.

TEXTBOOKS:

1. "Learning React" by Alex Banks and Eve Porcello

2."Node.js Design Patterns" by Mario Casciaro

3. "The DevOps Handbook" by Gene Kim, Jez Humble, Patrick Debois, and John Willis.

REFERENCES:

1."Express in Action" by Evan Hahn

2."MongoDB: The Definitive Guide" by Shannon Bradshaw, Eoin Brazil, Kristina Chodorow

Total :60 Periods

Course Code	APP DEVELOPMENT	L	T	P	C
AMPEV12X02		2	0	2	3

COURSE OBJECTIVES:

- To learn the development of native applications with basic GUI Components
- To develop cross-platform applications with event handling
- To develop applications with location and data storage capabilities
- To develop web applications with database access

UNIT I FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT 6

Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, what is Progressive Web App, Responsive Web design

UNIT II NATIVE APP DEVELOPMENT USING JAVA 6

Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Development Frameworks, Java & Kotlin for Android, Swift & Objective-C for iOS, Basics of React Native, Native Components, JSX, State, Props

UNIT III HYBRID APP DEVELOPMENT 6

Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova

UNIT IV CROSS-PLATFORM APP DEVELOPMENT USING REACT-NATIVE 6

What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross-platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX, State, Props

UNIT V NON-FUNCTIONALCHARACTERISTICS OF APP FRAMEWORKS 6

Comparison of different App frame works, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI /UX, Reusability

Theory:30 Periods

SAMPLE LIST OF EXPERIMENTS

1. Using react native, build a cross platform application for a BMI calculator.
2. Build a cross platform application for a simple expense manager which allows entering expenses and income on each day and displays category wise weekly income and expense.
3. Develop a cross platform application to convert units from imperial system to metric system (km to miles, kg to pounds etc.,)
4. 4Design and develop a cross-platform application for day-to-day task (to-do) management.
5. Design an android application using Cordova for a user login screen with username, password, reset button and a submit button. Also, include header image and a label. Use layout managers.
6. Design and develop an android application using Apache Cordova to find and display the current location of the user.
7. Write programs using Java to create Android application having Databases

a. For a simple library application.
b. For displaying books available, books lend, book reservation. Assume that student
c. information is available in a database which has been stored in a database server.

Practical:30 periods

COURSE OUTCOMES:

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

CO1 Develop Native application with GUI Components.

CO2 Develop hybrid applications with basic event handling.

CO3 Implement cross-platformapplicationswithlocationanddatastoragecapabilities.

TEXT BOOKS:

1.Head First Android Development, Dawn Griffiths, O'Reilly, 1st edition

2. Apache Cordovain Action, Raymond K. Camden, Manning. 2015

3.Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, FullStackpublishing

REFERENCES:

1. Android Programming for Beginners, John Horton, Packt Publishing, 2nd Edition

2. Native Mobile Development by Shaun Lewis, Mike Dunn

3. Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach, Pawan Lingras, Matt Triff, Rucha Lingras

4.Apache Cordova 4 Programming, John M Wargo, 2015

5.React Native Cookbook, Daniel Ward, Packt Publishing, 2nd Edition

TOTAL:60 Periods

Course Code	UI AND UX DESIGN	L	T	P	C
AMPEV12X03		2	0	2	3

COURSE OBJECTIVES:

- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- To understand the various Research Methods used in Design
- To explore the various Tools used in UI & UX
- Creating a wireframe and prototype

UNIT I FOUNDATIONS OF DESIGN 6

UI vs. UX Design - Core Stages of Design Thinking- Divergent and Convergent Thinking –Brain storming and Game storming -Observational Empathy

UNIT II FOUNDATIONS OF UI DESIGN 6

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles –Branding-Style Guides

UNIT III FOUNDATIONS OF UX DESIGN 6

Introduction to User Experience - Why You Should Care about User Experience – Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals – Know about Business Goals

UNIT IV WIRE FRAMING, PROTO TYPING AND TESTING 6

Sketching Principles - Sketching Red Routes - Responsive Design – Wire framing – Creating Wire flows-Building a Prototype-Building High-Fidelity Mockups- Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods –Synthesizing Test Findings –Proto type Iteration

UNIT V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE 6

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods – Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams – Flow Mapping-Information Architecture

Theory: 30 periods

SAMPLE LIST OF EXPERIMENTS

1. Designing a Responsive layout for a societal application

2. Exploring various UI Interaction Patterns

3. Developing an interface with proper UI Style Guides

4. Developing Wireflow diagram for application using open source software

5. Exploring various open source collaborative interface Platform

6. Hands on Design Thinking Process for a new product

7. Brainstorming feature for proposed product

8. Defining the Look and Feel of the new Project

9. Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based on UI principles)

10. Identify a customer problem to solve

11. Conduct end-to-end user research - User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping

12. Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements

PRACTICAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1 Build UI for user Applications

CO2 Evaluate UX design of any product or application

CO3 Demonstrate UX Skills in product development

CO4 Implement Sketching principles

CO5 Create Wire frame and Prototype

TEXTBOOKS:

1.JoelMarsh, “UXforBeginners”, O’Reilly,2022

2.JonYablonski, “LawsofUXusingPsychologytoDesignBetterProduct&Services” O’Reilly2021

REFERENCES:

1.JeniferTidwell, CharlesBrewer, AynneValencia, “DesigningInterface”3rdEdition, O’Reilly2020

2.SteveSchoger, AdamWathan “RefactoringUI”,2018

3.Steve Krug, “Don't Make Me Think, Revisited: A Commonsense Approach to Web &Mobile”, Third Edition,2015

4.https://www.nngroup.com/articles/

5.https://www.interaction-design.org/literature.

Total :30 Periods

Course Code	CLOUD SERVICES MANAGEMENT	L	T	P	C
AMPEV12X04		2	0	2	3

COURSE OBJECTIVES:

- Introduce Cloud Service Management terminology, definition & concepts
- Compare and contrast cloud service management with traditional IT service management.
- Identify strategies to reduce risk and eliminate issues associated with the adoption of cloud services.
- Select appropriate structures for designing, deploying, and running cloud-based services in a business environment.
- Illustrate the benefits and drive the adoption of cloud-based services to solve real-world problems

UNIT I CLOUD SERVICE MANAGEMENT FUNDAMENTALS 6

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models.

UNIT II CLOUD SERVICES STRATEGY 6

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture

UNIT III CLOUD SERVICE MANAGEMENT 6

Cloud Service Reference Model, Cloud Service Lifecycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management.

UNIT IV CLOUD SERVICE ECONOMICS 6

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription-based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models.

UNIT V CLOUD SERVICE GOVERNANCE & VALUE 6

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the Value of Cloud Services, Balanced Scorecard, Total Cost of Ownership.

Theory: 30 PERIODS

SAMPLE LIST OF EXPERIMENTS

1. Create a Cloud Organization in AWS/Google Cloud/or any equivalent Open Source cloud softwares like Openstack, Eucalyptus, OpenNebula with Role-based access control
2. Create a Cost-model for a web application using various services and do Cost-benefit analysis
3. Create alerts for usage of Cloud resources
4. Create Billing alerts for your Cloud Organization
5. Compare Cloud cost for a simple web application across AWS, Azure and GCP and suggest the best one.

PRACTICAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1 Exhibit cloud-design skills to build and automate business solutions using cloud technologies.

CO2 Possess Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services.

CO3 Solve the real-world problems using Cloud services and technologies.

TEXTBOOKS:

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque, Enel Publications
2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, Zaigham Mohammad 2013
3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour

REFERENCES:

1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi

TOTAL:60 PERIODS

Course Code	DEVOPS	L	T	P	C
AMPEV12X05		2	0	2	3

COURSE OBJECTIVES:

- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems

UNIT I INTRODUCTION TO DEVOPS 6

Devops Essentials - Introduction to AWS, GCP, Azure - Version control systems: Git and Github.

UNIT II COMPILE AND BUILD USING MAVEN & GRADLE 6

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases (compile build, test, package) Maven Profiles, Maven repositories (local, central, global), Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, understand build using Gradle

UNIT III CONTINUOUS INTEGRATION USING JENKINS 6

Install & Configure Jenkins, Jenkins Architecture Overview, creating a Jenkins Job, configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT IV CONFIGURATION MANAGEMENT USING ANSIBLE 6

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

UNIT V BUILDING DEVOPS PIPELINES USING AZURE 6

Create Github Account, Create Repository, Create Azure Organization, create a new pipeline, build a sample code, Modify azure-pipelines' file

Theory: 30 Periods

SAMPLE LIST OF EXPERIMENTS

1. Create Maven Build pipeline in Azure

2. Run regression tests using Maven Build pipeline in Azure

3. Install Jenkins in Cloud

4. Create CI pipeline using Jenkins

5. Create a CD pipeline in Jenkins and deploy in Cloud

6. Create an Ansible playbook for a simple web application infrastructure

7. Build a simple application using Gradle

8. Install Ansible and configure ansible roles and to write playbooks

PRACTICAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1: Understand different actions performed through Version control tools like Git.

CO2: Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.

CO3: Ability to Perform Automated Continuous Deployment

CO4: Ability to do configuration management using Ansible

CO5: Understand to leverage Cloud-based DevOps tools using Azure DevOps

TEXTBOOKS:

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014

REFERENCES:

1. Hands-On Azure Devops: Cicd Implementation for Mobile, Hybrid, And Web Applications Using Azure Devops and Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni

2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.

3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.

4. MariotTsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019.

5. https://www.jenkins.io/user-handbook.pdf 7. https://maven.apache.org/guides/getting-started/

TOTAL:60 PERIODS

Course Code	ADVANCED WEB FRAMEWORKS AND	L	T	P	C
AMPEV12X06	CONTAINERIZATION	2	0	2	3

Course Objectives:

- To build scalable web applications using Angular
- To import and export functionalities of modules using Angular
- To create reusable Ui components using React
- To manage state of the application more efficiently using React Hook
- To containerize the applications using Docker and Kubernetes

UNIT I– ANGULARV 12 **9**

Introduction to Angular– Typescript (Arrays, Functions, classes) –JS vsTS – Angular CLI Installation– Components – Data Binding – Routing on Angular - Directives

UNIT II– ANGULAR MODULES AND MATERIAL **9**

Angular Modules–HTTP client, Forms Module–Angular Service Files–Dependency Injection– Angular Material – Connecting Angular with Back End

UNIT III – REACT V 18 **9**

Introduction to React– Setting development environment–create app – JSX syntax –properties and states – components – React routing – API request

UNIT IV– REACT HOOKS **9**

React Hooks–useState–useEffect–useCallback–useMemo–useContext–useReducer– Introduction to React Native

UNIT V– CONTAINERIZATION **9**

Introduction to Image and Container–Docker–Containers–DockerImages, Dockerfile, Docker Network – Docker Compose - Kubernetes

Theory: 45 PERIODS

PRACTICAL EXERCISES:

5. Project– Create an angular app with n components and add routing
6. Project–Add functionalities, validation and database with above components
7. Project– Create Login System using React
8. Project–Create Flight Management system

Practical: 30 PERIODS

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by Industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

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

CO1: Build scalable web applications using Angular

CO2: Import and export functionalities of modules using Angular

CO3: Create reusable UI components using React

CO4: Manage state of the application more efficiently using React Hook

CO5: Containerize the applications using Docker and Kubernetes

TEXT BOOKS:

5. NateMurray, FelipeCoury, AriLerner, CarlosTaborda, "TheNgbook—The CompleteBook on Angular"
6. The Road to React, RobinWieruch,2023.
7. The Docker Book: Containerization is the new virtualization, JamesTurnbull,2014.
8. The Kubernetes Book, NigelPoulton,2023.

ONLINERESOURCES:

6. https://angular.io/docs
7. https://react.dev/
8. https://react.dev/reference/react
9. https://docs.docker.com/
10. https://kubernetes.io/docs/home/

TOTAL: 75 PERIODS

Course Code	MIDDLE TIRE TECHNOLOGIES	L	T	P	C
AMPEV12X07		2	0	2	3

COURSE OBJECTIVES:

- To study the set of services that a middleware system constitutes of.
- To understand how middleware facilitates the development of distributed applications in heterogeneous environments
- To study how it helps to incorporate application portability, distributed application component interoperability and integration.
- To learn the object oriented middleware basics through the example of the following CORBA objects.
- To understand the basics of Web services that is the most oft-used middleware technique

UNIT I CLIENT/ SERVER CONCEPTS **6**

Client – Server – File Server, Database server, Group server, Object server, Web server. Middleware – General middleware – Service specific middleware. Client / Server Building blocks – RPC – Messaging – Peer – to- Peer**.**

UNIT II EJB ARCHITECTURE **6**

EJB – EJB Architecture – Overview of EJB software architecture – View of EJB – Conversation – Building and Deploying EJBs – Roles in EJB.

UNIT III EJB APPLICATIONS **6**

EJB Session Beans – EJB entity beans – EJB clients – EJB Deployment – Building an application with EJB.

UNIT IV CORBA **6**

CORBA – Distributed Systems – Purpose – Exploring CORBA alternatives – Architecture overview – CORBA and networking model – CORBA object model – IDL – ORB – Building an application with CORBA.

UNIT V COM **6**

COM – Data types – Interfaces – Proxy and Stub – Marshalling – Implementing Server / Client – Interface Pointers – Object Creation, Invocation, Destruction – Comparison COM and CORBA – Introduction to .NET – Overview of .NET architecture – Marshalling – Remoting.

Theory: 30 Periods

SAMPLE LIST OF EXPERIMENTS

1. Dynamic Mechanical Analysis
2. Tribometer Testing
3. Rheometry
4. Accelerated Aging Tests
5. Recent advances in MTT Laboratory Experiments

PRACTICAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1 Understanding the basic concepts of web application security and the need for it

CO2 Be acquainted with the process for secure development and deployment of web applications

CO3 Acquire the skill to design and develop Secure Web Applications that use Secure APIs

CO4 Be able to get the importance of carrying out vulnerability assessment and penetration testing

CO5 Acquire the skill to think like a hacker and to use hackers tool sets

TEXTBOOKS:

1. Robert Orfali, Dan Harkey and Jeri Edwards, "The Essential Client/Server Survival Guide", Galgotia Publications Pvt. Ltd., 2002. (Unit 1)
2. Tom Valesky," Enterprise Java Beans", Pearson Education, 2002. (Unit 2 & 3)
3. Jason Pritchard,"COM and CORBA side by side", Addison Wesley,2000 (Unit 4 & 5)
4. Jesse Liberty, "Programming C#", 2nd Edition, O'Reilly Press, 2002. (Unit 5)

REFERENCES:

1. Mowbray, "Inside CORBA", Pearson Education, 2002.

2. Jeremy Rosenberger," Teach yourself CORBA in 14 days", Tec media, 2000

TOTAL: 60 PERIODS

Course Code	WEB APPLICATION SECURITY	L	T	P	C
AMPEV12X08		2	0	2	3

COURSE OBJECTIVES:

- To understand the fundamentals of web application security
- To focus on wide aspects of secure development and deployment of web applications
- To learn how to build secure APIs
- To learn the basics of vulnerability assessment and penetration testing
- To get an insight about Hacking techniques and Tools

UNIT I FUNDAMENTALS OF WEB APPLICATION SECURITY 6

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation

UNIT II SECURE DEVELOPMENT AND DEPLOYMENT 6

Web Applications Security - Security Testing, Security Incident Response Planning, The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

UNIT III SECURE API DEVELOPMENT 6

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, securing service-to-service APIs: API Keys, OAuth2, Securing Micro service APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

UNIT IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING 6

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database-based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

UNIT V HACKING TECHNIQUES AND TOOLS 6

Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite, etc.

Theory:30 PERIODS

SAMPLE LIST OF EXPERIMENTS

1. Install Wireshark and explore the various protocols

a. Analyze the difference between HTTP vs HTTPS

b. Analyze the various security mechanisms embedded with different protocols.

2.Identify the vulnerabilities using OWASP ZAP tool

3. Create simple REST API using python for following operation

a. GET

b. PUSH

c. POST

d. DELETE

4. Install Burp Suite to do following vulnerabilities:

   a. cross-site scripting (XSS)

   b.SQL injection

5. Attack the website using Social Engineering method

PRACTICAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1 Understanding the basic concepts of web application security and the need for it

CO2 Be acquainted with the process for secure development and deployment of web applications

CO3 Acquire the skill to design and develop Secure Web Applications that use Secure APIs

CO4 Be able to get the importance of carrying out vulnerability assessment and penetration testing

CO5 Acquire the skill to think like a hacker and to use hackers tool sets

TEXT BOOKS:

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw-Hill Companies.
3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

REFERENCES:

1. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing, Inc.
2. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
3. Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.
4. Malcom McDonald, Web Security for Developers, 2020, No Starch Press, Inc.
5. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies.

Total: 60 PERIODS

Vertical 2: SOFTWARE TECHNOLOGIES

Course Code	SOFTWARE ENGINEERING	L	T	P	C
AMPEV22X01		**2**	**0**	**2**	**3**

COURSE OBJECTIVES:

- To understand Software Engineering Life Cycle Models
- To Perform software requirements analysis
- To gain knowledge of the System Analysis and Design concepts using UML.
- To understand software testing and maintenance approaches
- To work on project management scheduling using DevOps

UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT 6

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility –Agile process - Extreme programming- XP Process-Case Study.

UNIT IIREQUIREMENTS ANALYSIS AND SPECIFICATION 6

Requirement analysis and specification – Requirements gathering and analysis – Functional and Non Functional requirements – Software Requirement Specification – Formal system specification – Finite State Machines – Petrinets – Object modelling using UML – Use case Model–Class diagrams– Interaction diagrams–Activity diagrams–Functional modelling–Dataflow Diagram-CASE TOOLS**.**

UNIT III SOFTWARE DESIGN 6

Software design – Design process – Design concepts – Coupling – Cohesion – Functional independence – Design patterns – Model-view-controller – Publish-subscribe – Adapter –Command – Strategy – Observer – Proxy – Facade – Architectural styles – Layered - Client Server -Tiered-Pipe and Filter-User Interface Design-Case Study.

UNIT IV SOFTWARE TESTING AND MAINTENANCE 6

Testing–Unit testing–Black box testing–White box testing–Integration and System testing– Regression testing–Debugging-Program analysis–Symbolic execution–Model Checking-Case Study – Release Management

UNIT V PROJECT MANAGEMENT 6

Software Project Management-Software Configuration Management-Project Scheduling-DevOps: Motivation-Cloud as a platform - Operations-Deployment pipeline: Overall Architecture Building and Testing-Deployment-Tools-CaseStudy

NUMBEROFTHEORY PERIODS: 30

List of Practical Experiments:

1. Identify a software system that needs to be developed.

2. Document the Software Requirements Specification (SRS) for the identified system.

3. Identify use cases and develop the Use Case model.

4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.

5. Using the identified scenarios, find the interaction between objects and represent them using

UML Sequence and Collaboration Diagrams

6. Draw relevant State Chart and Activity Diagrams for the same system.

7. Implement the system as per the detailed design

8. Test the software system for all the scenarios identified as per the use case diagram

9. Improve the reusability and maintainability of the software system by applying appropriate design patterns.

10. Implement the modified system and test it for various scenarios.

SUGGESTED DOMAINS FOR MINI-PROJECT:

1. Passport automation system.

2. Book bank

3. Exam registration

4. Stock maintenance system.

5. Online course reservation system

6. Airline/Railway reservation system

7. Software personnel management system

8. Credit card processing

9. e-book management system

10. Recruitment system

11. Foreign trading system

12. Conference management system

13. BPO management system

14. Library management system

15. Student information system

NUMBER OF PRACTICAL PERIODS: 30

COURSE OUTCOMES:

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

CO1 Compare Various Software Development Life Cycle Models

CO2 Evaluate project management approaches as well as cost and schedule

CO3 Perform formal analysis on specifications.

CO4 Use UML diagrams for analysis and design.

CO5 Architect and design using architectural styles and design patterns, and test the system

TEXTBOOKS:

1. Bernd Bruegge and Allen H. Dutoit, "Object-Oriented Software Engineering: Using UML, PatternsandJava", Third Edition, Pearson Education,2009.
2. RogerS.Pressman, Object-OrientedSoftwareEngineering: AnAgileUnified Methodology, FirstEdition, McGraw-HillInternationalEdition,2014.

REFERENCES:

1. CarloGhezzi, MehdiJazayeri, DinoMandrioli, FundamentalsofSoftwareEngineering ,2ndedition, PHILearningPvt. Ltd., 2010.
2. CraigLarman, ApplyingUMLandPatterns,3rded, PearsonEducation,2005.
3. Len Bass, Ingo Weber and Liming Zhu, "DevOps: A Software Architect 's Perspective", Pearson Education,2016
4. Rajib Mall, Fundamentals of Software Engineering, 3rd edition, PHI Learning Pvt. Ltd., 2009.
5. Stephen Schach, Object-Oriented and Classical Software Engineering, 8th ed, McGraw- Hill

TOTAL NUMBER OF PERIODS: 60

Course Code	SOFTWARE TESTING AND AUTOMATION	L	T	P	C
AMPEV22X02		2	0	2	3

COURSE OBJECTIVES:

- To understand the basics of software testing
- To learn how to do the testing and planning effectively
- To build test cases and execute them
- To focus on wide aspects of testing and understanding multiple facets of testing
- To get an insight about test automation and the tools used for test automation

UNIT I FOUNDATIONS OF SOFTWARE TESTING 6

Why do we test Software? Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing

UNIT II TEST PLANNING 6

The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.

UNIT III TEST DESIGN AND EXECUTION 6

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle

UNIT IV ADVANCED TESTING CONCEPTS 6

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, testing in the Agile Environment, Testing Web and Mobile Applications**.**

UNIT V TEST AUTOMATION AND TOOLS 6

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

Theory: 30 Periods

SAMPLE LIST OF EXPERIMENTS

1. Develop the test plan for testing an e-commerce web/mobile application (www.amazon.in).

2. Design the test cases for testing the e-commerce application

3. Test the e-commerce application and report the defects in it.

4. Develop the test plan and design the test cases for an inventory control system.

5. Execute the test cases against a client server or desktop application and identify the defects.

6. Test the performance of the e-commerce application.
7. Automate the testing of e-commerce applications using Selenium.
8. Integrate TestNG with the above test automation.
9. Mini Project:

a) Build a data-driven framework using Selenium and TestNG

b) Build Page Object Model using Selenium and TestNG

c) Build BDD framework with Selenium, TestNG and Cucumber

Practical: 30 Periods

COURSE OUTCOMES:

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

CO1 Understand the basic concepts of software testing and the need for software testing

CO2 Understand the basic concepts of software testing and the need for software testing

CO3 Design effective test cases that can uncover critical defects in the application

CO4 Carry out advanced types of testing

CO5 Carry out advanced types of testing

TEXTBOOKS:

1. Yogesh Singh, “Software Testing”, Cambridge University Press, 2012
2. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" - Second Edition 2018

REFERENCES:

1. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition,2012, JohnWiley& Sons, Inc.
2. RonPatton, Software testing, 2ndEdition,2006, Sams Publishing
3. Paul C. Jorgensen, Software Testing: A Craftsman’s Approach, Fourth Edition, 2014, Taylor& Francis Group.
4. Carl Cocchiaro, Selenium Framework Design in Data-Driven Testing, 2018, Packt Publishing.
5. Elfriede Dustin, Thom Garrett, Bernie Gaurf, Implementing Automated Software Testing, 2009, Pearson Education, Inc.
6. Satya Avasarala, Selenium Web Driver Practical Guide, 2014, Packt Publishing.
7. Varun Menon, Test Ng Beginner's Guide ,2013, Pack publishing.

Total:60 Periods

Course Code	AGILE METHODOLOGIES	L	T	P	C
AMPEV22X03		2	0	2	3

COURSE OBJECTIVES:

- To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.
- To provide a good understanding of software design and a set of software technologies and APIs.
- To do a detailed examination and demonstration of Agile development and testing techniques.
- To understand the benefits and pitfalls of working in an Agile team.
- To understand Agile development and testing.

UNIT I AGILE METHODOLOGY **6**

Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations.

UNIT II AGILE PROCESSES **6**

Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

UNIT III AGILITY AND KNOWLEDGE MANAGEMENT **6**

Agile Information Systems – Agile Decision Making - Earls Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment, Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies.

UNIT IV AGILITY AND REQUIREMENTS ENGINEERING **6**

Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modelling and Generation – Concurrency in Agile Requirements Generation.

UNIT V AGILITY AND QUALITY ASSURANCE **6**

Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance - Test Driven Development – Agile Approach in Global Software Development.

Theory:30 PERIODS

SAMPLE LIST OF EXPERIMENTS

1. Understand the background and driving forces for taking an Agile Approach to Software

development.

2. Build out a backlog and user stories.

3. To study automated build tool.

4. To study version control tool.

5. To study Continuous Integration tool.

6. Apply Design principle and Refactoring to achieve agility.

7. Perform Testing activities within an agile project.

Practicals: 30 Periods

COURSE OUTCOMES:

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

CO1 Realize the importance of interacting with business stakeholders in determining the requirements for a software system

CO2 Perform iterative software development processes: how to plan them, how to execute them

CO3 Point out the impact of social aspects on software development success.

CO4 Develop techniques and tools for improving team collaboration and software quality

CO5 Perform Software process improvement as an ongoing task for development teams.

TEXTBOOKS:

1. David J. Anderson and Eli Schragenheim, —Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.
2. Hazza and Dubinsky, —Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.

REFERENCES:

1Craig Larman, —Agile and Iterative Development: A Manager_s Guide, Addison-Wesley, 2004.

2. Kevin C. Desouza, —Agile Information Systems: Conceptualization, Construction, and Management, Butterworth-Heinemann, 2007.

Total: 60 Periods

Course Code	SOFTWARE USER INTERFACE DESIGN & ANALYSIS	L	T	P	C
AMPEV22X04		2	0	2	3

COURSE OBJECTIVES:

- To understand the difference between UI and UX
- To learn user-centered design principles.
- To understand interaction design principles
- To learn to create wireframes and prototypes
- To explore advanced topics like responsive design.

Unit 1: Introduction to UI/UX Fundamentals **6**

Introduction to UI/UX concepts- Definition and differentiation of UI and UX- The Impact of UI/UX on Software Success- Understanding user expectations and behavior- User-Centric Design Principles- Importance of user-centric design- The Impact on User Satisfaction- Understanding user expectations and preferences.

Unit 2: Design Principles and Methodologies **6**

User-centered design principles- Definition and core principles of UCD- Historical context and evolution of UCD in design- Iterative Design Process- Usability heuristics- Definition and significance of usability heuristics -Application of Heuristics in Evaluation-

Unit 3: Interaction and Visual Design **6**

Principles of interaction design- Definition and significance of interaction design principles- Usability and Learn ability- Fundamentals of visual design- Introduction to Visual Design- The psychology of visual elements and their impact on user perception- Color Theory and Application

Unit 4: Prototyping and Usability Testing **6**

Wire framing and prototyping- Definition and significance of wire framing and prototyping- Overview of their roles in the design process - Principles of Effective Wireframing- Usability testing methodologies

Unit 5: Advanced Topics - Responsive Design, Accessibility, and Guidelines **6**

Responsive design principles- Definition and significance of responsive design - Principles of creating layouts with fluid grids - Techniques for making images responsive -Accessibility in UI design- UI guidelines and standards

Theory:30 PERIODS

SAMPLE LIST OF EXPERIMENTS

1. Conduct heuristic evaluations

2. Apply user-centered design to a simple project.

3. Design interactive elements

4. Create visually appealing UI components

5. Conduct a usability test on a prototype

6. Implement responsive design in a project

7. Design an accessible user interface

Practicals: 30 Periods

COURSE OUTCOMES:

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

CO1 Design effective and user-centered interfaces.

CO2 Evaluate and improve user interfaces using usability heuristics.

CO3 Apply visual design principles for aesthetically pleasing interfaces.

CO4 Create prototypes and conduct usability tests.

CO5 Implement responsive design, ensure accessibility, and adhere to UI guidelines.

TEXT BOOKS:

1. " Don't Make Me Think" by Steve Krug
2. "The Design of Everyday Things" by Don Norman
3. "Seductive Interaction Design" by Stephen Anderson

REFERENCES:

1. "Designing Interfaces" by Jenifer Tidwell
2. "About Face: The Essentials of Interaction Design" by Alan Cooper
3. "Universal Principles of Design" by William Lidwell, Kritina Holden, and Jill Butler

Total: 60 Periods

Course Code	SOFTWARE ARCHITECTURE AND DESIGN PATTERNS	L	T	P	C
AMPEV22X05		2	0	2	3

COURSE OBJECTIVES:

- To define software architecture and its role in the development process
- To understand the process of making architectural decisions.
- To learn when and how to apply specific design patterns
- To understand the principles and challenges of micro services architecture
- To explore current trends and emerging paradigms in software architecture

Unit 1: Introduction to Software Architecture **6**

Introduction to Software Architecture- Definition and significance of software architecture- Architectural Styles and Patterns - Overview of different architectural styles- Introduction to common design patterns.

Unit 2: Architectural Decision Making **6**

Architectural Decision Process- Steps involved in making architectural decisions- Role of stakeholders in the decision making process- Trade-offs in Software Design- Evaluating trade- offs in terms of performance, scalability, and maintainability- Analyzing the impact of non-functional requirements on architecture.

Unit 3: Design Patterns in Depth **6**

Creational Design Patterns- Singleton, Factory Method, Abstract Factory patterns- When and how to use creational design patterns- Structural and Behavioral Design Patterns- Composite, Observer, Strategy patterns- Real-world examples illustrating the application of structural and behavioral design patterns.

Unit 4: Advanced Topics in Software Architecture **6**

Micro services Architecture-Principles of micro services Architecture-Case studies on successful Implementations-Event-Driven Architecture-Understanding events and event-driven Systems-Implementing event-driven architectures in software systems.

Unit 5: Emerging Trends and Future Directions **6**

Current Trends in Software Architecture-Overview of current trends, including server less architecture, edge computing, etc.-Case studies on how industry leaders are adapting to new Trends-Continuous Learning and Professional Development-Importance of continuous learning in the field of software Architecture-Resources, communities, and practices for staying updated and relevant.

Theory:30 PERIODS

SAMPLE LIST OF EXPERIMENTS

1. Analyze real-world applications and identify their architectural styles.

2. Discuss the impact of architectural decisions on system properties.

3. Analyze a complex scenario and make architectural decisions as a group

4. Present and defend the chosen architecture.

5. Conduct performance testing on a software system.

6. Hands-on coding session: Applying design patterns to a sample project

7. Identify areas for refactoring in existing code

8. Designing and implementing a micro services-based system

9. Testing and troubleshooting micro services interactions.

Practicals: 30 Periods

COURSE OUTCOMES:

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

CO1 Understand and Apply Software Architecture Concepts.

CO2 Understand the architectural decision-making process.

CO3 Apply design patterns to new projects and re-factor existing code.

CO4 Understand micro services architecture and its advantages and challenges.

CO5 Explore emerging trends in software architecture.

TEXT BOOKS:

1. “Design Patterns: Elements of Reusable Object-Oriented Software" by Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides

2."Clean Architecture: A Craftsman's Guide to Software Structure and Design" by Robert C. Martin

REFERENCES:

1.” Micro services Patterns: With Examples in Java" by Chris Richardson

2."Building Micro services" by Sam Newman

3."Enterprise Integration Patterns: Designing, Building, and Deploying Messaging Solutions" by Gregor Hohpe and Bobby Woolf

Total: 60 Periods

Course Code	SOFTWARE QUALITY MANAGEMENT	L	T	P	C
AMPEV22X06		**2**	**0**	**2**	**3**

COURSE OBJECTIVES:

- To define software quality and its significance in software development.
- To define software testing and its role in the software development life cycle.
- To learn software quality metrics and their significance
- To understand software process improvement (SPI) and its goals.
- To explore current trends and emerging practices in software quality management.

Unit 1: Introduction to Software Quality Management **6**

Overview of Software Quality- Definition and dimensions of software quality- Case studies on the consequences of poor software quality- Quality Management Principles- Evidence-Based Decision Making- Relationship Management- System Approach to Management- Factual Approach to Decision Making- Mutually Beneficial Supplier Relationships- Introduction to quality management frameworks (e.g., ISO 9001)

Unit 2: Software Testing Fundamentals **6**

Basics of Software Testing-Importance of software Testing-Overview of testing levels and Types-Test Planning and Strategy-Objective and Scope-Test Levels and Types-Test Deliverables-Resource Planning-Schedule and Timeline-Risk Assessment and Mitigation-Test Environment-Entry and Exit Criteria-Testing Tools and Techniques-Test Execution Strategy-Best Practices for Test Planning and Strategy

Unit 3: Software Quality Metrics and Measurement **6**

Introduction to Quality Metrics-Defining key quality Metrics-Relationship between metrics and project Objectives-Measurement and Analysis-Principles of effective measurement-analysis in software Quality-Informed Decisions-Drive continuous improvement

Unit 4: Software Process Improvement **6**

Introduction to Process Improvement-Basics of Software Process Improvement-Importance and benefits of SPI-Overview of common SPI models (e.g., CMMI, Six Sigma)-Process Models and Frameworks-Tailoring and Implementing Processes-Adapting Process Models-Best practices for implementing and sustaining process improvements

Unit 5: Emerging Trends in Software Quality Management **6**

Current Trends in Software Quality -Overview of current trends-test automation-AI in testing-importance of staying updated on industry Trends-Continuous Learning and Professional Development-Importance of continuous Learning-Resources, communities, and practices for staying updated and relevant.

Theory:30 PERIODS

SAMPLE LIST OF EXPERIMENTS

1. Creating a basic Software Development Life Cycle (SDLC) model.

2. Building a Quality Assurance Plan for a sample project.

3. Writing and executing basic test cases for a simple application

4. Executing test cases manually on a sample application.

5. Introduction to test automation tools – setting up and running basic automated tests.

6. Simulating the defect life cycle using a bug tracking tool.

7. Root cause analysis and corrective action for identified defects.

8. Conducting performance tests on a web application

9. Exploring basic security testing techniques on a sample system.

Practicals:30 PERIODS

COURSE OUTCOMES:

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

CO1 Define and Apply Software Quality Management Concepts

CO2 Understand and Apply Software Testing Fundamentals.

CO3 Apply Quality Metrics and Measurement.

CO4 Tailor and implement processes using different models and frameworks.

CO5 Develop a plan for continuous learning and professional development.

TEXT BOOKS:

1. "Foundations of Software Testing" by Dorothy Graham and Erik Van Veenendaal
2. "Software Engineering: A Practitioner's Approach" by Roger S. Pressman

REFERENCES:

1. "Quality Software Management: Systems Thinking" by Gerald M. Weinberg
2. "Improving Software Organizations: From Principles to Practice" by Louis Poulin

Total:60 Periods

Course Code	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
AMPEV22X07		2	0	2	3

COURSE OBJECTIVES:

- To understand the Software Project Planning and Evaluation techniques.
- To plan and manage projects at each stage of the software development life cycle (SDLC).
- To learn about the activity planning and risk management principles.
- To manage software projects and control software deliverables.
- To develop skills to manage the various phases involved in project management and people management.

UNIT I PROJECT EVALUATION AND PROJECT PLANNING 6

Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation.

UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 6

Software process and Process Models – Choice of Process models - Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II.

UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 6

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation.

UNIT IV PROJECT MANAGEMENT AND CONTROL 6

Framework for Management and Control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change Control – Software Configuration Management.

UNIT V STAFFING IN SOFTWARE PROJECTS 6

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams.

Theory:30 PERIODS

List of Experiments

Setting up project management tools (e.g., Jira, Trello) and introducing a sample project.

2. Creating a project plan with milestones, tasks, and resource allocation.

3. Conducting a project kickoff meeting and defining project scope.

4. Developing a Work Breakdown Structure (WBS) for a given project.

5. Identifying and analyzing project risks.

6. Developing a quality management plan and implementing quality control measures.

7. Assigning tasks and responsibilities using project management tools.

8. Using collaboration tools for effective communication and document sharing.

9. Implementing Agile methodologies for project management.

Practicals:30 PERIODS

COURSE OUTCOMES:

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

CO1 Understand Project Management principles while developing software.

CO2 Gain extensive knowledge about the basic project management concepts, framework and the process models.

CO3 Obtain adequate knowledge about software process models and software effort estimation techniques.

CO4 Estimate the risks involved in various project activities

CO5 Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles

TEXT BOOKS:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCES:

1. Robert K. Wysocki —Effective Software Project Management – Wiley Publication, 2011.

2. Walker Royce: —Software Project Management- Addison-Wesley, 1998. 3. Gopalaswamy Ramesh, —Managing Global Software Projects – McGraw Hill Education (India), Fourteenth Reprint 2013.

Total:60 PERIODS

Course Code	HUMAN-COMPUTER INTERACTION	L	T	P	C
AMPEV22X08		2	0	2	3

COURSE OBJECTIVES

- To learn the foundations of Human Computer Interaction.
- To become familiar with the design technologies for individuals and persons with disabilities.
- To be aware of mobile HCI.
- To learn the guidelines for user interface.
- Learn to develop meaningful user interface.

UNIT I FOUNDATIONS OF HCI **6**

The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

UNIT II DESIGN & SOFTWARE PROCESS **6**

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules.

UNIT III MODELS AND THEORIES **6**

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements – Communication and collaboration Models-Hypertext, Multimedia and WWW.

UNIT IV MOBILE HCI **6**

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

UNIT V WEB INTERFACE DESIGN **6**

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow.

Theory:30 PERIODS

SAMPLE LIST OF EXPERIMENTS

1. Setting up essential tools and resources for HCI design

2. Understanding the basics of user experience (UX) and user interface (UI) design.

3. Conducting user interviews and creating user personas.

4. Analyzing user behavior through usability testing and heuristic evaluation.

5. Creating paper prototypes for a given scenario.

6. Conducting usability tests on digital prototypes.

7. Analyzing usability testing results and making design refinements.

8. Applying interaction design principles to improve user interfaces.

9. Implementing responsive design for multiple devices. 10. Evaluating and improving access visibility in user interfaces.

Practicals:30 PERIODS

COURSE OUTCOMES:

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

CO1 Design effective dialog for HCI

CO2 Design effective HCI for individuals and persons with disabilities

CO3 Assess the importance of user feedback

CO4 Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.

CO5 Develop meaningful user interface.

TEXT BOOKS:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, —Human Computer Interaction, 3rd Edition, Pearson Education, 2004

2. Brian Fling, —Mobile Design and Development, First Edition, O 'Reilly Media Inc., 2009

3. Bill Scott and Theresa Neil, —Designing Web Interfaces, First Edition, O 'Reilly, 2009.

Total:60 PERIODS

Vertical 3: CYBER SECURITY

Course Code	CRYPTOGRAPHY & INFORMATION SECURITY	L	T	P	C
AMPEV32X01		2	0	2	3

COURSE OBJECTIVES:

- To provide deeper understanding into cryptography, its application to network security, threats/vulnerabilities to networks and countermeasures.
- To explain various approaches to Encryption techniques, strengths of Traffic Confidentiality, Message Authentication Codes
- To familiarize Digital Signature Standard and provide solutions for their issues.
- To familiarize with cryptographic techniques for secure (confidential) communication of two parties over an insecure (public) channel; verification of the authenticity of the source of a message
- To familiarize Authentication service, electronic mail security and web security

UNIT - I INTRODUCTION 6

Security trends, The OSI Security Architecture, Security Attacks, Security Services and Security Mechanisms, A model for Network security. CLASSICAL ENCRYPTION TECHNIQUES: Symmetric Cipher Modes, Substitute Techniques, Transposition Techniques, Rotor Machines, Stenography.

UNIT - II BLOCK CIPHER AND DATA ENCRYPTION STANDARDS 6

Block Cipher Principles, Data Encryption Standards, the Strength of DES, Differential and Linear Crypt Analysis, Block Cipher Design Principles. ADVANCED ENCRYPTION STANDARDS: Evaluation Criteria for AES, the AES Cipher. MORE ON SYMMETRIC CIPHERS: Multiple Encryption, Triple DES, Block Cipher Modes of Operation, Stream Cipher and RC4. INTRODUCTION TO NUMBER THEORY: Prime Numbers, Fermat's and Euler's Theorem, Testing for Primality, The Chinese Remainder Theorem, Discrete logarithms

UNIT - III PUBLIC KEY CRYPTOGRAPHY AND RSA 6

Principles Public key crypto Systems, Diffie Hellman Key Exchange, the RSA algorithm, Key Management, Elliptic Curve Arithmetic, Elliptic Curve Cryptography. MESSAGE AUTHENTICATION AND HASH FUNCTIONS: Authentication Requirement, Authentication Function, Message Authentication Code, Hash Function, Security of Hash Function and MACs. HASH AND MAC ALGORITHM: Secure Hash Algorithm, Whirlpool, HMAC, CMAC. DIGITAL SIGNATURE: Digital Signature, Authentication Protocol, Digital Signature Standard.

UNIT - IV AUTHENTICATION APPLICATION 6

Kerberos, X.509 Authentication Service, Public Key Infrastructure. EMAIL SECURITY: Pretty Good Privacy (PGP) and S/MIME. IP SECURITY: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

UNIT – V WEB SECURITY 6

Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET), Intruders, Viruses and related threats. FIREWALL: Firewall Design principles, Trusted Systems.

Theory:30 PERIODS

SAMPLE LIST OF EXPERIMENTS

1. Symmetric Key Encryption
2. Asymmetric Key Cryptography
3. Secure Communication Protocols
4. Cryptographic Applications
5. Post-quantum Cryptography
6. Cryptographic Attacks and Countermeasures
7. Cryptography in IoT
8. Quantum-Safe Cryptography

Practicals:30 PERIODS

COURSE OUTCOMES:

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

CO1 Identify basic security attacks and services

CO2 Use symmetric and asymmetric key algorithms for cryptography

CO3 Design a security solution for a given application

CO4 Analyze Key Management techniques and importance of number Theory with Message Authentication Codes and Hash Functions work

CO5 Understanding of Authentication functions and Authentication Service and Electronic Mail Security

TEXT BOOKS:

1William Stallings (2006), Cryptography and Network Security: Principles and Practice, 4th edition, Pearson Education, India.

2. William Stallings (2000), Network Security Essentials (Applications and Standards), Pearson Education, India.

REFERENCES:

1. Charlie Kaufman (2002), Network Security: Private Communication in a Public World, 2nd edition, Prentice Hall of India, New Delhi.

2. Atul Kahate (2008), Cryptography and Network Security, 2nd edition, Tata Mc Grawhill, India.

3. Robert Bragg, Mark Rhodes (2004), Network Security: The complete reference, Tata Mc Grawhill, India.

Total:60 PERIODS

Course Code	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
AMPEV32X02		2	0	2	3

COURSE OBJECTIVES:

- To Introduce Cloud Computing terminology, definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity, Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

UNIT I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 6

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Nonrepudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 6

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key

UNIT III ACCESS CONTROL AND IDENTITY MANAGEMENT 6

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention.

UNIT IV CLOUD SECURITY DESIGN PATTERNS 6

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud

UNIT V MONITORING, AUDITING AND MANAGEMENT 6

Proactive activity monitoring - Incident Response, monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management

Theory:30 PERIODS

SAMPLE LIST OF EXPERIMENTS

1. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm not present in Cloud Sim

2. simulate resource management using cloud sim

3. simulate log forensics using cloud sim

4. simulate a secure file sharing using a cloud sim

5. Implement data anonymization techniques over the simple dataset (masking, k-anonymization, etc.)

6. Implement any encryption algorithm to protect the images

7. Implement any image obfuscation mechanism

8. Implement a role-based access control mechanism in a specific scenario

9. implement an attribute-based access control mechanism based on a particular scenario

10. Develop a log monitoring system with incident management in the cloud

Practical:30 PERIODS

COURSE OUTCOMES:

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

CO1 Understand the cloud concepts and fundamentals.

CO2 Explain the security challenges in the cloud.

CO3 Define cloud policy and Identity and Access Management.

CO4 Understand various risks and audit and monitoring mechanisms in the cloud.

CO5 Define the various architectural and design considerations for security in the cloud.

TEXT BOOKS:

1. Raj Kumar Buyya, James Broberg, andrzejGoscinski, "Cloud Computing:", Wiley 2013
2. Dave shackleford, "Virtualization Security", SYBEX a wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, "Cloud Security and Privacy", OREILLY 2011

REFERENCES:

Mark C. Chu-Carroll —Code in the Cloud||, CRC Press, 2011

Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya, Christian Vechhiola, S. ThamaraiSelvi

Total: 60 PERIODS

Course Code	WEB APPLICATION SECURITY	L	T	P	C
AMPEV32X03		2	0	2	3

COURSE OBJECTIVES:

- To understand the fundamentals of web application security
- To focus on wide aspects of secure development and deployment of web applications
- To learn how to build secure APIs
- To learn the basics of vulnerability assessment and penetration testing
- To get an insight about Hacking techniques and Tools

UNIT I FUNDAMENTALS OF WEB APPLICATION SECURITY 6

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation

UNIT II SECURE DEVELOPMENT AND DEPLOYMENT 6

Web Applications Security - Security Testing, Security Incident Response Planning, The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

UNIT III SECURE API DEVELOPMENT 6

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, securing service-to-service APIs: API Keys, OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

UNIT IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING 6

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database-based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

UNIT V HACKING TECHNIQUES AND TOOLS 6

Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite, etc.

Theory:30 PERIODS

SAMPLE LIST OF EXPERIMENTS

Install wireshark and explore the various protocols

a. Analyze the difference between HTTP vs HTTPS
b. Analyze the various security mechanisms embedded with different protocols.

2. Identify the vulnerabilities using OWASP ZAP tool
3. Create simple REST API using python for following operation
    - GET
    - PUSH
    - POST

- DELETE

4. Install Burp Suite to do following vulnerabilities:

- SQL injection
- cross-site scripting (XSS)

5. Attack the website using Social Engineering method

Practical:30 PERIODS

COURSE OUTCOMES:

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

CO1 Understanding the basic concepts of web application security and the need for it

CO2 Be acquainted with the process for secure development and deployment of web applications

CO3 Acquire the skill to design and develop Secure Web Applications that use Secure APIs

CO4 Be able to get the importance of carrying out vulnerability assessment and penetration testing

CO5 Acquire the skill to think like a hacker and to use hackers tool sets

TEXT BOOKS:

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw-Hill Companies.
3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

REFERENCES:

1. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing, Inc.
2. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
3. Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.
4. Malcom McDonald, Web Security for Developers, 2020, No Starch Press, Inc.
5. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies.

Total:60 PERIODS

Course Code	SOCIAL NETWORK SECURITY	L	T	P	C
AMPEV32X04		**2**	**0**	**2**	**3**

COURSE OBJECTIVES:

- To develop semantic web related simple applications
- To explain Privacy and Security issues in Social Networking
- To explain the data extraction and mining of social networks
- To discuss the prediction of human behavior in social communities
- To describe the Access Control, Privacy and Security management of social networks

UNIT I FUNDAMENTALS OF SOCIAL NETWORKING 6

Introduction to Semantic Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis, Historical overview of privacy and security, Major paradigms, for understanding privacy and security, Common security threats in social networks and case studies of notable security incidents.

UNIT II SECURITY ISSUES IN SOCIAL NETWORKS 6

Principles of secure user authentication, Multifactor authentication, Access control mechanisms and user permissions, SSL/TLS protocols for secure data transmission, End-to-end encryption in messaging apps, the evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world.

UNIT III EXTRACTION AND MINING IN SOCIAL NETWORKING DATA 6

Extracting evolution of Web Community from a Series of Web Archive, detecting communities in social networks, Definition of community, evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Big data and Privacy, User education and awareness, regulatory compliance.

UNIT IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES 6

Understanding and predicting human behavior for social communities, User data Management, Inference and Distribution, enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, what is Neo4j, Nodes, Relationships, Properties, Secure third-party integrations.

UNIT V ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT 6

Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning. Emerging trends in social network security.

Theory:30 PERIODS

SAMPLE LIST OF EXPERIMENTS

1. Design own social media application
2. Create a Network model using Neo4j

3. Read and write Data from Graph Database
4. Find “Friend of Friends” using Neo4j
5. Implement secure search in social media
6. Create a simple Security & Privacy detector

Practical: 30 PERIODS

COURSE OUTCOMES:

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

CO1 Develop semantic web related simple applications

CO2 Address Privacy and Security issues in Social Networking

CO3 Explain the data extraction and mining of social networks

CO4 Discuss the prediction of human behavior in social communities

CO5 Describe the applications of social networks

TEXT BOOKS:

1. Peter Mika, “Social Networks and the Semantic Web, First Edition, Springer 2007.
2. BorkoFurht, “Handbook of Social Network Technologies and Application, First Edition, Springer, 2010.
3. Learning Neo4j 3.x “Second Edition by Jérôme Baton, Rik Van Bruggen, Packt publishing

REFERENCES:

1. Easley D. Kleinberg J., “Networks, Crowds, and Markets – Reasoning about a Highly Connected World”, Cambridge University Press, 2010.

2. Jackson, Matthew O., “Social and Economic Networks”, Princeton University Press, 2008.

3. GuandongXu, Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, First Edition, Springer, 2011.

Total:60 PERIODS

Course Code	DIGITAL FORENSICS AND MALWARE ANALYSIS	L	T	P	C
AMPEV32X05		2	0	2	3

COURSE OBJECTIVES:

- Learn preventive measures to safeguard digital systems and information against cyber threats
- Develop policies specific to digital crime and focusing on digital investigation
- Gain a comprehensive understanding of the methodologies, tools, and techniques used in investigating various types of cybercrimes
- Understand scope of the malware borne cyber-attacks, various malware types, and platform-specific variations of malware
- Explain the basic signs of malware infection and signs of intrusion from a security analyst's point of view

UNIT I DIGITAL FORENSIC TECHNIQUE AND TRACES 6

File System Analysis - Network Packet Analysis - Memory Forensics - Digital Evidence Collection - Mobile Device Forensics Techniques - Cloud Forensics - Big Data Analytics in Forensics - Incident Response and Timeline Analysis.

UNIT II INTRODUCTION TO DIGITAL CRIME AND INVESTIGATION 6

Digital Crime Overview - Legal and Ethical Frameworks - Digital Forensic Tools and Techniques - Incident Response Fundamentals - Digital Evidence Collection and Preservation – Cyber security Basics - Digital Investigation Methodologies - Cybercrime Trends and Emerging Threats.

UNIT III INTERNET BASED INVESTIGATIONS 6

Social Media Investigations - Open-Source Intelligence (OSINT) - Email and Communication Tracing - Dark Web Investigations - Online Fraud Investigations - Cyber Threat Intelligence - Digital Copyright and Intellectual Property Investigations - Online Extremism and Radicalization Investigations.

UNIT IV INTRODUCTION TO MALWARE ANALYSIS 6

Malware classification- types- and platform specific issues with malware- Intrusion into IT and operational network (OT) and their signs – Basics of malware detection – Intro to Linux- Networks.

UNIT V BASIC MALWARE ANALYSIS 6

Manual Malware Infection analysis - signature-based malware detection and classification – pros and cons- and need for machine learning based techniques- Advanced Techniques Malware Analysis.

Theory:30 PERIODS

SAMPLE LIST OF EXPERIMENTS

1. Live Case Studies Open Source Forensic Tools
2. Disk Forensics and Data Recovery
3. Steganography
4. Key loggers
5. Network monitors
6. Flowchart management

7. Upload Malware to Virus total - Analyze the file Lab01-02.exe - [Refer Lab 1-2 in Textbook] - Lab01-02.exe

8. This lab uses the file Lab01-04.exe. Analyze the file Lab01-04.exe. [Refer Lab 1-4 in Textbook] - Lab01-04.exe

9. Analyze the malware found in the file Lab05-01.dll using only IDA Pro [Refer Lab 5-1 In Textbook] - Lab05-01.exe

10. Analyze the malware found in the file Lab07-02.exe [Refer Lab 07-02 in Textbook] – Lab 07-02.exe

Practical: 30 PERIODS

COURSE OUTCOMES:

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

CO1: Clarify the foundational principles of digital forensics, un raveling the core concepts essential to the field.

CO2: Evaluate and delineate strategies for managing risks associated with digital forensic investigations.

CO3: Elaborate on the basic tools and techniques utilized in the investigation of various types of cybercrimes.

CO4: Explain and introduce malware analysis efficiently.

CO5: Explain basic malware analysis and demonstrate some basic techniques.

TEXT BOOKS:

1.Andre Arnes, “Digital Forensics”, Wiley, 2018.

2.Chuck Easttom, “An In-depth Guide to Mobile Device Forensics”, First Edition, CRC Press, 2022.

3.Practical Malware Analysis by, Michael Siroski and Andrew Honig - Link

REFERENCES:

1.Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

2.Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet, 3rd Edition Author: Eoghan Casey Publisher: Academic Press ISBN: 9780123742681.

3.Dynamic Malware Analysis in the Modern Era—A State of the Art Survey - Link

On line Reference:

1. https://www.coursera.org/specializations/computerforensics

2. https://www.youtube.com/watch?v=u2zgEFm5RHQ

3. Practical Malware analysis – Youtube

Total:60 PERIODS

Course Code	ETHICAL HACKING	L	T	P	C
AMPEV32X06		2	0	2	3

COURSE OBJECTIVES:

- To understand the basics of computer based vulnerabilities.
- To explore different foot printing, reconnaissance and scanning methods.
- To expose the enumeration and vulnerability analysis methods.
- To understand hacking options available in Web and wireless applications.
- To explore the options for network protection and perform ethical hacking to expose the vulnerabilities.

UNIT I INTRODUCTION 6

Ethical Hacking Overview - Role of Security and Penetration Testers. - Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing. - Network and Computer Attacks - Malware - Protecting Against Malware Attacks. - Intruder Attacks - Addressing Physical Security

UNIT II FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS 6

Foot printing Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering – Foot printing Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

UNIT III ENUMERATION AND VULNERABILITY ANALYSIS 6

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss

UNIT IV SYSTEM HACKING 6

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade.

UNIT V NETWORK PROTECTION SYSTEMS 6

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - NetworkBased and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.

Theory:30 PERIODS

SAMPLE LIST OF EXPERIMENTS

1. Install Kali or Backtrack Linux / Metasploitable/ Windows XP

2. Practice the basics of reconnaissance.

3. Using FOCA / SearchDiggity tools, extract metadata and expanding the target list.

4. Aggregates information from public databases using online free tools like Paterva'sMaltego.

5. Information gathering using tools like Robtex.

6. Scan the target using tools like Nessus.

7. View and capture network traffic using Wireshark.

8. Automate dig for vulnerabilities and match exploits using Armitage

FOCA:http://www.informatica64.com/foca.aspx. 134

Nessus:http://www.tenable.com/products/nessus.

Wireshark:http://www.wireshark.org.

Armitage:http://www.fastandeasyhacking.com/.

Kali or Backtrack Linux, Metasploitable, Windows XP

Practical:30 PERIODS

COURSE OUTCOMES:

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

CO1 To express knowledge on basics of computer based vulnerabilities

CO2 To gain understanding on different foot printing, reconnaissance and scanning methods.

CO3 To demonstrate the enumeration and vulnerability analysis methods

CO4 To gain knowledge on hacking options available in Web and wireless applications

CO5 To acquire knowledge on the options for network protection and perform ethical hacking to expose the vulnerabilities

TEXT BOOKS:

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

REFERENCES:

1. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz, 2014

Total:30 PERIODS

Course Code	CRYPTOCURRENCY & BLOCKCHAIN TECHNOLOGIES	L	T	P	C
AMPEV32X07		2	0	2	3

COURSE OBJECTIVES:

- Understand the basics of Blockchain
- Learn Different protocols and consensus algorithms in Blockchain
- Learn the Blockchain implementation frameworks
- Experiment the Hyperledger Fabric, Ethereum networks
- Understand the Blockchain Applications

UNIT I INTRODUCTION TO BLOCKCHAIN 6

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, TransactionsThe Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash Function-Hash pointer and Merkle tree.

UNIT II BITCOIN AND CRYPTOCURRENCY 6

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay

UNIT III BITCOIN CONSENSUS 6

Bitcoin Consensus, Proof of Work (PoW)- HashcashPoW, Bitcoin PoW, Attacks on PoW, monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases.

UNIT IV HYPERLEDGER FABRIC & ETHEREUM 6

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity. UNIT V BLOCKCHAIN APPLICATIONS 6 Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance - Case Study.

UNIT V BLOCKCHAIN APPLICATIONS 6

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance, etc- Case Study.

Theory:30 Periods

SAMPLE LIST OF EXPERIMENTS

Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.

1. Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.
2. Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rule
3. Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric network.

4. Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards
5. Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain code while storing results and data in the starter plan

Practicals:30 Periods

COURSE OUTCOMES:

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

CO1: Understand emerging abstract models for Blockchain Technology

CO2: Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.

CO3: It provides conceptual understanding of the function of Blockchain as a method of securing distributed ledgers.

CO4: Apply hyperledger Fabric and Ethereum platform to implement the Block Chain Application.

CO5: To design and develop the Block Chain Application.

TEXT BOOKS:

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly, 2014.
3. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

REFERENCES:

1. Daniel Drescher, "Blockchain Basics", First Edition, Apress, 2017.

2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.

3. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015 4. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain", Packt Publishing

Total :60 Periods

Course Code	SECURITY AUDITING & COUNTER HACKING	L	T	P	C
AMPEV32X08	TECHNIQUES	2	0	2	3

COURSE OBJECTIVES:

- Understand fundamentals, tools, and methodologies for security audits
- Learn techniques to identify and mitigate network vulnerabilities
- Explore methods to assess and secure web applications against hacking
- Develop skills for detecting and responding to security incidents, including digital forensics
- Acquire knowledge on advanced counter-hacking techniques and strategies for proactive security

UNIT I FUNDAMENTALS OF SECURITY AUDITING 6

Introduction to Cybersecurity, Principles of Security Auditing, Types of Security Audits, Security Auditing Tools, Methodologies for Security Assessments, Regulatory Compliance Standards, Security Policies and Procedures, Incident Response Planning, Security Documentation and Reporting

UNIT II NETWORK VULNERABILITY ASSESSMENT 6

Network Scanning Techniques, Identification and Classification of Vulnerabilities, Exploitation and Penetration Testing, Risk Assessment Methodologies, Remediation Strategies and Best Practices, Network Security Architecture, Firewalls and Intrusion Detection/Prevention Systems, Wireless Network Security, Security Assessments for IoT Devices

UNIT III WEB APPLICATION SECURITY TESTING 6

Overview of Web Application Architecture. Common Web Vulnerabilities (e.g., SQL Injection, XSS), Testing Methodologies (e.g., OWASP Top 10), Secure Coding Practices, Web Application Firewall (WAF) Usage, Session Management and Authentication, Content Security Policy (CSP) API Security Considerations, Mobile Application Security Testing

UNIT IV INCIDENT RESPONSE AND DIGITAL FORENSICS 6

Incident Detection and Classification, Incident Response Strategies and Frameworks, Basics and Principles of Digital Forensics, Forensic Tools and Analysis Techniques, Chain of Custody and Legal Considerations, Memory Forensics and Disk Analysis, Network Forensics, Malware Analysis and Reverse Engineering, Incident Documentation and Reporting

UNIT V ADVANCED COUNTER-HACKING STRATEGIES 6

Proactive Security Measures and Threat Hunting, Threat Intelligence and Analysis, Offensive Countermeasures and Red Teaming, Security Awareness and Training Programs, Security Automation and Orchestration, Cloud Security Considerations, Blockchain Security, Emerging Trends in Cybersecurity Defense, Ethical and Legal Aspects of Counter-Hacking

Theory: 30 PERIODS

SAMPLE LIST OF EXPERIMENTS

1. Analyze and critique a security audit report, identifying vulnerabilities and suggesting mitigation strategies.
2. Execute a simulated network vulnerability assessment, documenting findings and proposing remediation measures.
3. Conduct a hands-on web application penetration test, addressing identified vulnerabilities and suggesting security enhancements.

4. Develop an incident response plan for a hypothetical security incident, outlining detection, response, and recovery steps.
5. Analyze a digital forensics case study, presenting findings and recommendations for legal proceedings.
6. Research and analyze threat intelligence data, creating a comprehensive report on potential risks and proactive security measures.
7. Participate in a red teaming exercise to simulate advanced cyber threats, gaining insights into offensive counter-hacking strategies.
8. Design a comprehensive security awareness training program, incorporating best practices and tailored content for end-users.
9. Assess the security of a cloud infrastructure, identifying vulnerabilities and proposing strategies for secure cloud adoption.
10. Research and write a whitepaper on blockchain security, addressing potential threats and proposing protective measures.

Practical: 30 PERIODS

COURSE OUTCOMES:

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

CO1 Grasp cybersecurity principles and apply security auditing methodologies effectively.

CO2 Master network scanning, vulnerability identification, and risk assessment techniques.

CO3 Understand web application vulnerabilities, testing methodologies, and secure coding practices

CO4 Execute incident response strategies and perform digital forensics with precision

CO5 Implement proactive security measures, threat intelligence analysis, and offensive counter measures

TEXT BOOKS:

1. "The Web Application Hacker's Handbook" by Dafydd Stuttard and Marcus Pinto (2020, 2nd)
2. "Security Engineering" by Ross J. Anderson (2020, 3rd)
3. "Cybersecurity – Attack and Defense Strategies" by Yuri Diogenes and Erdal Ozkaya (2020, 1st)
4. "Block chain Basics" by Daniel Drescher (2017, 1st)
5. "Network Security Essentials" by William Stallings (2017, 6th)
6. "Incident Response & Computer Forensics" by Jason T. Luttgens, Matthew Pepe, and Kevin Mandia (2014, 3rd)
7. "Threat Modeling: Designing for Security" by Adam Shostack (2014, 1st)

REFERENCES:

Dafydd Stuttard, Marcus Pinto. "The Web Application Hacker's Handbook" (2020, 2nd)

2. Ross J. Anderson. "Security Engineering" (2020, 3rd)

3. Yuri Diogenes, Erdal Ozkaya. "Cybersecurity – Attack and Defense Strategies" (2020, 1st)

4. Daniel Drescher. "Blockchain Basics" (2017, 1st)

5. William Stallings. "Network Security Essentials" (2017, 6th)

Total: 60 PERIODS

Vertical 4: ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Course Code	DATA ANALYTICS AND VISUALIZATION	L	T	P	C
AMPE V42X01		2	0	2	3

COURSE OBJECTIVES:

1. To understand the data science fundamentals and process.
2. To learn to describe the relationship between data.
3. To utilize present and interpret data using Python libraries for Data Wrangling and data visualization.
4. To study the basic inferential statistics, sampling distribution and processes in data analytics
5. To understand the data analytics techniques and apply descriptive data analytics techniques

UNIT I INTRODUCTION 6

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data.

UNIT II DESCRIBING DATA 6

Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data in Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores.

DESCRIBING RELATIONSHIPS: Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations – regression towards the mean

UNIT III PYTHON LIBRARIES FOR DATA WRANGLING 6

Indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

DATA VISUALIZATION: Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three-dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

UNIT IV DESCRIPTIVE ANALYTICS AND INFERENTIAL STATISTICS 6

DESCRIPTIVE ANALYTICS - Frequency distributions – Outliers –interpreting distributions – graphs – averages - describing variability – interquartile range – variability for qualitative and ranked data - Normal distributions – z scores –correlation – scatter plots – regression – regression line – least squares regression line – standard error of estimate – interpretation of r2 – multiple regression equations – regression toward the mean.

INFERENTIAL STATISTICS - populations – samples – random sampling – Sampling distribution-standard error of the mean - Hypothesis testing – z-test – z-test procedure –decision rule – calculations – decisions – interpretations - one-tailed and two-tailed tests – Estimation – point estimate – confidence interval – level of confidence – effect of sample size.

UNIT V ANALYSIS OF VARIANCE AND PREDICTIVE ANALYTICS 6

ANALYSIS OF VARIANCE - T-test for one sample – sampling distribution of t – t-test procedure – t-test for two independent samples – p-value – statistical significance – t-test for two related samples. F-test – ANOVA – Two-factor experiments – three f-tests – two-factor ANOVA –Introduction to chi-square tests.

PREDICTIVE ANALYTICS - Linear least squares – implementation – goodness of fit – testing a linear model – weighted resampling. Regression using Stats Models – multiple regression – nonlinear relationships – logistic regression – estimating parameters – Time series analysis – moving averages – missing values – serial correlation – autocorrelation. Introduction to survival analysis.

Theory:30 PERIODS

SAMPLE LIST OF EXPERIMENTS

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh

2. Working with Numpy arrays

3. Working with Pandas data frames

4. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.

5. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:

a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.

b. Bivariate analysis: Linear and logistic regression modeling

c. Multiple Regression analysis

d. Also compare the results of the above analysis for the two data sets.

6. Apply and explore various plotting functions on UCI data sets.

a. Normal curves

6. Perform Z-test

8. Perform T-test

9. Perform ANOVA

10. Building and validating linear models

11. Building and validating logistic models

12. Time series analysis

NUMBER OF PRACTICAL PERIODS: 30

COURSE OUTCOMES:

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

CO1 Define the data science process Understand different types of data descriptions for data science process

CO2 Gain knowledge on relationships between data and use the Python Libraries for Data Wrangling

CO3 Apply Visualization Libraries in Python to interpret and explore data

CO4 Perform various statistical analyses to make statistical inferences and explain the end-to-end data analytics pipeline

CO5 Build, validate and communicate data analytical models for complex engineering problems

TEXT BOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017. Padeepz App Padeepz App 69
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.

REFERENCES:

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press,2014.
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

Total: 60 PERIODS

Course Code	MATHEMATICS FOR MACHINE LEARNING	L	T	P	C
AMPEV42X02		2	0	2	3

COURSE OBJECTIVES:

- Understand fundamental linear algebra concepts, including vector spaces, matrices, eigenvalues, and eigenvectors.
- Gain proficiency in advanced calculus techniques, including gradient-based optimization, to train and fine-tune learning models effectively for optimal performance.
- Explore the role of probability and statistics in learning and understanding their significance in model training, uncertainty estimation, and probabilistic modeling.
- Apply mathematical models through hands-on projects, implementing machine learning models.
- Give exposure to the deep learning models and analyze their performance using mathematical tools.

UNIT I LINEAR ALGEBRA, MATRIX, AND ANALYTICAL GEOMETRY 6

Introduction and Motivation - Linear Algebra, Systems of Linear Equations, Matrices, Solving Systems of Linear Equations, Vector Spaces, Linear Independence, Basis and Rank, Linear Mappings, Affine Spaces, Analytic Geometry, Norms, Inner Products, Lengths and Distances, Angles and Orthogonality, Orthonormal Basis, Orthogonal Complement, Inner Product of Functions, Orthogonal Projections, Rotations.

UNIT II MATRIX DECOMPOSITION AND VECTOR CALCULUS 6

Matrix Decompositions, Determinant and Trace, Eigenvalues and Eigenvectors, Cholesky Decomposition, Eigen-decomposition and Diagonalization, Singular Value Decomposition, Matrix Approximation, Vector Calculus, Differentiation of Univariate, Partial Differentiation and Gradients, Gradients of Vector-Valued Functions, Gradients of Matrices, Useful Identities for Computing Gradients, Backpropagation and Automatic Differentiation, Higher-Order Derivatives, Linearization, and Multivariate Taylor Series.

UNIT III PROBABILITY DISTRIBUTIONS AND RISK MINIMISATION 6

Probability and Distributions - Construction of a Probability Space-Discrete and Continuous Probabilities, Sum Rule, Product Rule, and Bayes' Theorem, Independence and Gaussian Distribution - Conjugacy and the Exponential Family, Change of Variables/Inverse Transform, Continuous Optimization, Optimization Using Gradient Descent, Constrained Optimization and Lagrange Multipliers, Convex Optimization. Machine Learning Models, Empirical Risk Minimization, Parameter Estimation, Probabilistic Modelling and Inference, Directed Graphical Models, Model Selection.

UNIT IV MACHINE LEARNING MODELS AND APPLICATIONS 6

Linear Regression, Parameter Estimation, Dimensionality Reduction with Principal Component Analysis, Maximum Variance Perspective, PCA in High Dimensions, Latent Variable Perspective, EM Algorithm, Latent-Variable, Classification with Support Vector Machines.

UNIT V DEEP LEARNING MODELS **6**

Tensors from Machine Learning and Data Science, Deep Convolutional Neural Network Architectures for Image Classification, Latent Space and Generative Modelling, Auto encoders and Variation Auto encoders.

THEORY:30 PERIODS

SAMPLE LIST OF EXPERIMENTS

Use python for implementing the following.

1.Systems of Linear Equations Solver: Implement a program to solve systems of linear equations using methods like Gaussian elimination or LU decomposition.

2.Vector Space Visualization: Use a computational tool like MATLAB or Python with libraries such as NumPy and Matplotlib to visualize vector spaces, linear independence, basis, and rank.

3.Matrix Decomposition Analysis: Implement algorithms for matrix decomposition techniques such as eigen-decomposition, singular value decomposition (SVD), and Cholesky decomposition. Analyze their properties and computational complexities.

4.Gradient Computation: Develop code to compute gradients for univariate and multivariate functions using analytical methods and numerical approximation techniques like finite differences.

5.Optimization Algorithms: Implement gradient descent and its variants for unconstrained optimization problems. Study their convergence properties and compare their performance on benchmark functions.

6.Constrained Optimization with Lagrange Multipliers: Solve constrained optimization problems using the Lagrange multiplier method. Explore its applications in machine learning models and analyze trade-offs between constraints and objectives.

7.Probabilistic Modeling and Inference: Develop a probabilistic model for a given dataset and perform inference using methods like maximum likelihood estimation (MLE) or Bayesian inference. Implement algorithms for parameter estimation and compare their performance.

8. Support Vector Machine (SVM) Classifier: Implement a linear SVM classifier from scratch using optimization techniques like gradient descent or quadratic programming. Evaluate its performance on benchmark datasets and compare it with other classification methods.

9.Principal Component Analysis (PCA): Implement PCA for dimensionality reduction on datasets with high dimensions. Visualize the transformed data and analyze the explained variance ratio of principal components.

10.Deep Convolutional Neural Network (CNN) for Image Classification: Implement a CNN architecture using a deep learning framework like TensorFlow or PyTorch. Train the model on image classification tasks and evaluate its performance on standard datasets like CIFAR-10 or MNIST.

PRACTICAL: 30PERIODS

COURSE OUTCOMES:

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

CO1: To understand fundamental linear algebra concepts, including vector spaces, matrices, eigenvalues, and eigenvectors.

CO2: To gain proficiency in advanced calculus techniques, including gradient-based optimization, to train and fine-tune learning models effectively for optimal performance.

CO3: Explore the role of probability and statistics in learning and understanding their significance in model training, uncertainty estimation, and probabilistic modelling.

CO4: To apply mathematical models through hands-on projects, implementing machine learning models.

CO5: To explore implementing deep learning models and analyse their performance using mathematical tools.

TEXT BOOKS:

1. Eugene Charniak, “Introduction to Deep Learning," MIT Press, 2018.
2. Ivan Vasilev, Daniel Slater, Gianmario Spacagna, Peter Roelants, Valentino Zocca, “Python Deep Learning," Packt Publishing Ltd, 2019.

REFERENCES:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, “Deep Learning," MIT Press, 2017.
2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach" O'Reilly Media, 2017.
3. Umberto Michelucci “Applied Deep Learning: A Case-based Approach to Understanding Deep Neural Networks” Apress, 2018.
4. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective" The MIT Press, 2012.
5. EthemAlpaydin,"Introduction to Machine Learning," MIT Press, Prentice Hall of India, Third Edition 2014.
6. Giancarlo Zaccone, Md. Rezaul Karim, Ahmed Menshawy, "Deep Learning with TensorFlow: Explore Neural Networks with Python" Packt Publisher, 2017.
7. Antonio Gulli, Sujit Pal, "Deep Learning with Keras" Packt Publishers, 2017.
8. Francois Chollet, "Deep Learning with Python," Manning Publications, 2017

TOTAL:30 PERIODS

Course Code	DEEP LEARNING	L	T	P	C
AMPEV42X03		2	0	2	3

COURSE OBJECTIVES:

- To understand the basic ideas and principles of neural networks and concepts of deep learning.
- To study Convolutional Neural Networks with image processing facilities like TensorFlow and Keras.
- To study Recurrent Neural Networks with spESh processing models
- To study Deep Reinforcement Learning and the use of real-time applications.
- To understand and implement deep learning architectures.

UNIT I FUNDAMENTALS OF DEEP LEARNING 6

Introduction to Neural Network – Feed Forward Neural Nets – Tensorflow - Deep Learning Fundamentals: Fundamental deep learning concepts, deep learning algorithms, and their types

UNIT II CONVOLUTIONAL NEURAL NETWORK 6

Convolutional Neural Networks – Filters – Strides and Padding – The structure of a convolutional network – Improving the performance of CNNs - Multilevel Convolution – Computer Vision with Convolutional Networks – Advanced Computer Vision

UNIT III RECURRENT NEURAL NETWORK 6

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks - Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders, Contractive Encoders – Language Modelling – Sequence to sequence learning – SpESh Recognition

UNIT IV DEEP REINFORCEMENT LEARNING 6

Reinforcement Learning Theory – Markov Decision process – Monte Carlo methods – Temporal Difference methods – Value functions – Q learning – Deep Q-learning – Policy gradient methods – Model-based methods -Actor-Critic Methods

UNIT V DEEP LEARNING IN AUTONOMOUS VEHICLES 6

Autonomous Vehicles Introduction – Imitation driving policy – Driving policy with ChaufferNet – DL in Cloud

Theory:30 PERIODS

SAMPLE LIST OF EXPERIMENTS

1. Implement a feedforward neural network using TensorFlow to classify handwritten digits from the MNIST dataset.
2. Design a convolutional neural network with appropriate filters and padding to classify images from the CIFAR-10 dataset.
3. Compare the performance of different stride values in convolutional layers on a given image recognition task.
4. Explore the impact of multilevel convolutions on improving the accuracy of a CNN for object detection in computer vision.
5. Build a recurrent neural network model to generate text sequences and analyze its performance in language modeling.

6. Develop a bidirectional RNN architecture for sentiment analysis on movie reviews dataset and compare it with a unidirectional RNN.
7. Implement a deep reinforcement learning agent using Q-learning to solve a simple grid world problem.
8. Evaluate the performance of Deep Q-learning algorithm on the CartPole environment in OpenAI Gym.
9. Design an autonomous driving policy using imitation learning and assess its performance in a simulated environment.
10. Investigate the feasibility of deploying a deep learning model for autonomous driving on cloud infrastructure, considering latency and scalability aspects.

NUMBER OF PRACTICAL PERIODS: 30

COURSE OUTCOMES:

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

CO1: Understanding the basic concepts of deep learning.

CO2: Emphasizing knowledge of Convolutional Neural Networks and applying CNN to its variants for suitable applications.

CO3: Understanding Recurrent Neural Networks to apply autoencoders and generative models for suitable applications.

CO4: Understanding deep reinforcement learning

CO5: Analyzing the key computations underlying deep learning and using them to build and train deep neural networks for various tasks.

TEXT BOOKS:

1. Eugene Charniak, “Introduction to Deep Learning," MIT Press, 2018.
2. Ivan Vasilev, Daniel Slater, Gianmario Spacagna, Peter Roelants, Valentino Zocca, “Python Deep Learning," Packt Publishing Ltd, 2019.

REFERENCES:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, “Deep Learning," MIT Press, 2017.
2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach" O'Reilly Media, 2017.
3. Umberto Michelucci “Applied Deep Learning: A Case-based Approach to Understanding Deep Neural Networks” Apress, 2018.
4. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective" The MIT Press, 2012.
5. EthemAlpaydin,"Introduction to Machine Learning," MIT Press, Prentice Hall of India, Third Edition 2014.
6. Giancarlo Zaccone, Md. Rezaul Karim, Ahmed Menshawy, "Deep Learning with TensorFlow: Explore Neural Networks with Python" Packt Publisher, 2017.
7. Antonio Gulli, Sujit Pal, "Deep Learning with Keras" Packt Publishers, 2017.
8. Francois Chollet, "Deep Learning with Python," Manning Publications, 2017

TOTAL NUMBER OF PERIODS INCLUDING LAB: 60

Course Code	NATURAL LANGUAGE PROCESSING	L	T	P	C
AMPEV42X04		2	0	2	3

COURSE OBJECTIVES:

- To learn the mathematical foundations and basics of Natural Language Processing.
- To understand the text data processing technologies for processing textdata.
- To understand the role of Information Retrieval and Information Extraction in Text Analytics.
- To acquire knowledge of text data analytics using language models.
- To learn about NLP Tools and real-time examples of NLP.

UNIT I INTRODUCTION TO NATURAL LANGUAGE PROCESSING 6

Natural Language Processing – Linguistic Background – Mathematical Foundations – Morphological Analysis – Tokenization – Stemming – Lemmatization – Boundary Determination.

UNIT II TEXT DATA ANALYSIS 6

Reading unstructured data – Representing text data – Part of spESh tagging – Syntactic representation – Text similarity – WordNet-based similarity – Shallow parsing – Semantic representation.

UNIT III INFORMATION RETRIEVAL AND EXTRACTION 6

Information Retrieval: Design features of Information Retrieval Systems-Classical, Nonclassical, Alternative Models of Information Retrieval – Information extraction – Named Entity Recognition – Relation Identification - Template filling.

UNIT IV LANGUAGE MODELLING 6

Language model – Probabilistic Models – n-gram language models- Hidden Markov Model- Topic Modelling - Graph Models -Feature Selection and classifiers -Rule-based Classifiers - Maximum entropy classifier – Clustering-Word and Phrase-based Clustering.

UNIT V NLP TOOLS AND APPLICATIONS 6

Tools: Natural Language Toolkit, Apache OpenNLP. Applications of Text Analytics – Applications in social media - Life science - Legal Text – Visualization - Case studies.

Theory:30 Periods

SAMPLE LIST OF EXPERIMENTS

1. Implement tokenization and compare the effectiveness of stemming versus lemmatization in improving text preprocessing for sentiment analysis.
2. Develop a part-of-spESh tagging system using NLTK and evaluate its accuracy on a corpus of news articles.
3. Explore various text similarity metrics, including WordNet-based similarity, for clustering news headlines into topics.
4. Build an information retrieval system using classical and nonclassical models and compare their performance on a dataset of scientific papers.
5. Implement a named entity recognition model using Apache OpenNLP and assess its accuracy on legal text documents.
6. Investigate different approaches for relation identification in biomedical texts and evaluate their precision and recall.

7. Construct a language model using n-gram models and compare its performance with a hidden Markov model on a corpus of tweets.
8. Apply topic modeling techniques to extract themes from a collection of customer reviews and visualize the results using t-SNE.
9. Develop a rule-based classifier to categorize legal documents into different types and measure its accuracy against a maximum entropy classifier.
10. Utilize word and phrase-based clustering algorithms to identify patterns in social media conversations and analyze their implications for marketing strategies.

COURSE OUTCOMES:

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

CO1: Understand the mathematical foundations and basics of Natural Language Processing.

CO2: Process text data at the syntactic and semantic level.

CO3: Extract key information from text data.

CO4: Analyze text content to provide predictions related to a specific domain using language processing.

CO5: Design an innovative application using NLP components.

TEXT BOOKS:

1. Christopher D. Manning and Hinrich Schutze, “Foundations of Statistical Natural Language Processing," MIT Press, 1999;
2. Steven Struhl, “Practical Text Analytics: Interpreting Text and Unstructured Data
3. for Business Intelligence”, Kogan Page, 2015.
4. Steven Bird, Ewan Klein and Edward Loper, “Natural Language Processing with
5. Python”, 1st Edition, O'Reilly Media, 2009.

REFERENCES:

1. Matthew A. Russell, “Mining the Social Web," O'Reilly Media, 2013;
2. Daniel Jurafsky and James H. Martin “SpESh and Language Processing," 3rd edition, Prentice Hall, 2009.
3. NitinIndurkhya, Fred J. Damerau “Handbook of Natural Language Processing," Second Edition, CRC Press, 2010.

TOTAL NUMBER OF PERIODS INCLUDING LAB: 60

Course Code	COMPUTER VISION AND IMAGE PROCESSING	L	T	P	C
AMPEV42X05		2	0	2	3

Course Objectives:

- Understand the basics of image processing techniques for computer vision.
- Learn the techniques used for image pre-processing.
- Discuss various object detection techniques.
- Understand various object recognition mechanisms.
- Elaborate on video analytics techniques.

UNIT I INTRODUCTION 6

Computer Vision–Image representation and image analysis tasks- Image representations–Digitization –properties–color images– Data structures for Image Analysis –Levels of image data representation - Traditional and Hierarchical image data structures.

UNIT II IMAGE PRE-PROCESSING 6

Local pre-processing- Image smoothing- Edge Detectors-Zero-crossings of the second Derivative-Scale in image processing- Canny edge detection –Parametric edge models – Edges in multi-speralct Images-Local pre-processing in the frequency Domain-Line detection by local pre-processing Operators-Image restoration.

UNIT III OBJECT DETECTION USING MACHINE LEARNING 6

Object detection– Object detection methods – Deep Learning framework for Object detection–bounding box Approach-Inter section over Union(IoU)–Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once (YOLO)-Salient features -Loss Functions-YOLO architectures

UNIT IV FACE RECOGNITION AND GESTURE RECOGNITION 6

Face Recognition- Introduction- Applications of Face Recognition- Process of Face Recognition - Deep Face solution by Face book- Face Net for Face Recognition-Implementation using Face Net - Gesture Recognition.

UNIT VVIDEO ANALYTICS 6

Video Processing –use cases of video analytics – Vanishing Gradient and exploding gradient problem- Rest Net Architecture-Rest Net and skip connections –Inception Network-Google Net Architecture-Improvement in Inception v2- Video analytics –Rest Neta nd Inception v3.

Theory: 30 Periods

SAMPLE LIST OF EXPERIMENTS

1. Computing the T-pyramid of an image
2. Deriving the quadtree representation of an image
3. Developing programs for geometric transforms like rotation, scaling, skewing, affine transform, bilinear transform
4. Implementing Object Detection and Recognition
5. Motion analysis using moving edges
6. Facial Detection and Recognition
7. Event detection in video surveillance systems

Practicals: 30 Periods

Course Outcomes:

CO1: Understand basic image processing techniques and video analysis.

CO2: Explain image pre-processing techniques.

CO3: Develop various object detection techniques.

CO4: Understand various face recognition mechanisms.

CO5: Elaborate on deep learning-based video analytics.

Text books:

1. "Image Processing, Analysis, and Machine Vision" by Milan Sonka, Vaclav Hlavac, Roger Boyle
2. "Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras" by Vaibhav Verdhan

References:

1. "Computer Vision: Algorithms and Applications" by Richard Szeliski
2. "Video Analytics for Business Intelligence" by Caifeng Shan, Fatih Porikli, Tao Xiang, Shaogang Gong
3. "Computer Vision: A Modern Approach" by D.A. Forsyth, J. Ponce
4. "Computer & Machine Vision" by E.R. Davies

TOTAL NUMBER OF PERIODS INCLUDING LAB:60

Course Code	REINFORCEMENT LEARNING	L	T	P	C
AMPEV42X06		2	0	2	3

COURSE OBJECTIVES:

- Explore the historical development and interdisciplinary connections of Reinforcement Learning.
- Gain a deep understanding of Markov Decision Processes (MDPs).
- Focus on iterative policy evaluation and iteration, and understand the convergence properties.
- Understand Monte Carlo methods for model-free prediction and control and their application in reinforcement learning tasks.
- Familiarize with function approximation methods and their applications in reinforcement learning.

UNIT I Introduction 6

Origin and history of Reinforcement Learning research. -Connections with other related fields and different branches of machine learning- Probability Primer: Brush up of Probability concepts - Axioms of probability, random variables, PMF, PDFs, CDFs, Expectation, joint and multiple random variables, distributions, correlation, independence.

Unit 2 Markov Decision Process 6

RL terminology, Markov property, Markov chains, Markov reward process (MRP). - Bellman equations for MRPs, existence of solution. -Introduction to Markov decision process (MDP), state and action value functions. - Bellman expectation equations, optimality of value functions and Policies-Bellman optimality equations.

Unit 3: Prediction and Control by Dynamic Programming 6

Over view of dynamic programming for MDP. Formulation of planning in MDPs, principle of optimality. - Iterative policy evaluation, policy iteration, value iteration. -Proof of convergence of policy evaluation and value iteration algorithms. -DP extensions.

Unit 4: Monte Carlo Methods for Model-Free Prediction and Control 6

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, TD Methods. -TD Control methods: SARSA, Q-Learning and their variants.

Unit 5: Function Approximation Methods 6

Function approximation methods, gradient descent. -Eligibility trace for function approximation, Control with function approximation. -Least squares, Experience replay in deep Q-Networks. -Policy Gradients, Actor-Critic methods.

Theory: 30 Periods

SAMPLE LIST OF EXPERIMENTS:

1. Simulation of a Markov Chain.
2. Bellman Equation Implementation.
3. Policy Evaluation with Dynamic Programming.
4. Monte Carlo Prediction.

5. Q-Learning Implementation.
6. Function Approximation with Linear Regression.
7. Actor-Critic Method Implementation.
8. Gradient Descent in Function Approximation.
9. Experience Replay in Deep Q-Networks.
10. Policy Gradient Method Implementation.

Practicals: 30 Periods

COURSE OUTCOMES:

CO1: Attain comprehensive understanding of RL's historical evolution and interdisciplinary connections, alongside fundamental Probability concepts.

CO2: Achieve deep comprehension of MDPs, emphasizing terminology, properties, and Bellman equations for optimal decision-making.

CO3: Master Dynamic Programming techniques for MDP prediction and control tasks, understanding convergence properties.

CO4: Gain thorough understanding of Monte Carlo methods for model-free RL, proficiently implementing First visit and every visit technique.

CO5: Familiarize with function approximation methods, gradient descent, eligibility traces, experience replay, policy gradient methods, and actor-critic architectures in RL applications.

TEXT BOOKS:

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction", 2nd Edition.
2. Sutton, R. S., & Barto, A. G. (2018). Reinforcement learning: An introduction (2nd ed.). MIT Press.

REFERENCES:

1. Leon-Garcia, A. (2008). Probability, statistics, and random processes for electrical engineering. Prentice Hall.
2. Murphy, K. P. (2012). Machine learning: A probabilistic perspective. MIT Press.

TOTAL NUMBER OF PERIODS INCLUDING LAB: 60

Course Code	BIG DATA ANALYTICS	L	T	P	C
AMPEV42X07		2	0	2	3

COURSE OBJECTIVES:

- To Understand the Big Data Platform and its Use cases
- To Provide the concept of Hadoop framework and HDFS
- To Understand Map-Reduce Jobs and Spark Framework
- To Provide hands on Hadoop Eco System
- To provide Exposure to Data Analytics with R and Spark Shell

COURSE DESCRIPTION:

The course begins with an overview of the fundamental concepts of big data, including the characteristics of big data, challenges associated with its processing and analysis, and the technologies used to manage big data infrastructure. Students will then explore various data processing frameworks, such as Apache Hadoop and Apache Spark, and learn how to leverage them to handle and analyze large-scale datasets efficiently.

PRE- REQUISITES:

- Should have knowledge of one Programming Language (Java preferably)
- Practice of SQL (queries and sub queries), exposure to Linux Environment.

UNIT I INTRODUCTION TO BIG DATA ANALYTICS 6

Data Storage and Analysis: Types of Digital Data, Introduction to Big Data, Evolution, Characteristics of Big Data, Traditional Business Intelligence versus Big Data.

Big Data Analytics: Classification of Analytics, Big Data Analytics important, Typical Analytical Architecture – Requirement for new analytical architecture – Challenges in Big Data Analytics, Top Analytics Tools – Need of big data frameworks. Data Science - Data Scientist - Terminologies used in Big Data Environments.

UNIT II HADOOP FRAMEWORK AND HDFS (Hadoop Distributed File System) 6

Hadoop: History of Hadoop– Requirement of Hadoop Framework - Design principle of Hadoop – Comparison with other system - Hadoop Components – Hadoop 1 vs Hadoop 2 – Hadoop Daemon's – Apache Hadoop, Analysing, Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming.

HDFS: HDFS Concepts, HDFS Commands, Design of HDFS, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

UNIT III MAP REDUCE AND SPARK FRAMEWORK 6

Map Reduce: Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features. Map Reduce Programming: I/O formats, Map side join, Reduce Side Join, Secondary sorting, Pipelining Map Reduce jobs.

Spark Framework

Introduction to GPU Computing, CUDA Programming Model, CUDA API, Simple Matrix, Multiplication in CUDA, CUDA Memory Model, Shared Memory Matrix Multiplication, Additional CUDA API Features.

Unit IV HADOOP ECO SYSTEM 6

Introduction to Hadoop ecosystem technologies: Hadoop Echo System, Hadoop Streaming, Infosphere Big Insights and Big Sheets. Scripting language: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Serialization: AVRO, Co-ordination: Zookeeper. Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, QueryingData and User Defined Functions.HBase: HBasics, Concepts, Clients, Example, Hbase Versus RDBMS.Big SQL: Introduction. Streaming: Flink, Storm.

UNIT V: DATA ANALYTICS 6

Data Analytics with R: Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Regression Model, Clustering, Collaborative Filtering, Associate Rule Making, Decision Tree, Big Data Analytics with BigR.

Data Analysis with Spark Shell: Writing Spark Application - Spark Programming in Scala, Python, R, Java - Application Execution.

Spark SQL and GraphX: SQL Context – Importing and Saving data – Data frames – using SQL – GraphX overview – Creating Graph – Graph Algorithms.

Spark Streaming: Overview – Errors and Recovery – Streaming Source – Streaming live data with spark.

Recent Trends in Big Data Analytics.

Theory: 30Periods

Practical Experiments

1. HDFS Commends Map Reduce Program to show the need of Combiner
2. Map Reduce I/O Formats-Text, key-value Map ReduceI/O Formats –Nline, Multiline
3. Sequence file Input/Output Formats Secondary sorting
4. Distributed Cache & Map Side Join, reduce side Join Building and Running a Spark Application Word count in Hadoop and Spark Manipulating RDD
5. Inverted Indexing in Spark Sequence alignment problem in Spark Implementation of Matrix algorithms in Spark SparkSql programming, Building Spark Streaming application

Practical: 30 Periods

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

OUTCOMES upon completion he students will be able to:

CO1: Identify Big Data and its Business Implications.
CO2: Understand the concept of Hadoop framework and HDFS
CO3: Understand the Map-Reduce Jobs and Spark Framework
CO4: Analyze Info phere Big Insights Big Data Recommendations.

CO5: Apply Data Analytics with R and Spark Shell

Text Books

3. Tom White “Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.
4. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

References

5. Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007.
6. Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press (2013)
7. Tom Plunkett, Mark Hornick, “Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle REnterprise and Oracle R Connector for Hadoop”, McGraw-Hill/Osborne Media (2013), Oracle press.
8. Anand Rajaraman and Jef rey David Ulman, “Mining of Massive Datasets”, Cambridge University Press,2012.

YouTube Resources

edureka! - This channel offers comprehensive tutorials, webinars, and courses on big data technologies, including Hadoop, Spark, and related ecosystems. Viewers can find videos covering various aspects of big data analytics, such as data ingestion, processing, analysis, and visualization**.**

Data School - Data School provides tutorials and practical tips on data science and big data analytics topics. The channel covers a wide range of subjects, including data preprocessing, machine learning, and data visualization, with a focus on practical applications and real-world examples.

Big Data University - Big Data University offers tutorials and courses on big data technologies and analytics. The channel covers topics like Hadoop, Spark, NoSQL databases, and cloud-based big data solutions, catering to both beginners and experienced professionals in the field.

Google Cloud Platform - The Google Cloud Platform (GCP) channel features videos and tutorials on big data solutions offered by Google Cloud, such as BigQuery, Dataflow, and Dataproc. Viewers can learn about data analytics best practices, architectural patterns, and case studies on GCP.

Databricks - Databricks' channel provides tutorials, webinars, and demonstrations on Apache Spark and Delta Lake, offering insights into big data analytics and machine learning workflows. Viewers can find content on Spark optimization, data engineering, and advanced analytics techniques**.**

Cloudera - Cloudera's channel offers videos and presentations on big data technologies like Hadoop, Spark, and Impala. Viewers can access tutorials, case studies, and expert discussions on topics related to big data analytics, data engineering, and machine learning.

Total:60 Periods

Course Code	Generative Artificial Intelligence	L	T	P	C
AMPEV42X08		2	0	2	3

COURSE OBJECTIVES:

The main objectives of this course are to:

- Understand the principles and theory behind generative AI.
- Gain practical experience in developing generative AI models.
- Analyze and evaluate the ethical and societal implications of generative AI.
- Apply generative AI techniques to real-world problems and domains.
- Keep up-to-date with the latest developments and trends in the field of generative AI.

Course Description

This course provides an introduction to the theory and practical applications of Generative Artificial Intelligence. Students will learn the fundamental concepts and techniques related to generative models and gain hands-on experience with creating and using generative AI systems.

Prerequisites

- Basic knowledge of machine learning and deep learning.
- Familiarity with a programming language (e.g., Python).

UNIT I Introduction to Generative AI **6**

Overview of Generative AI and its applications – Difference between generative and discriminative models – Historical perspective and key milestones – Ethical and societal implications.

UNIT II Probability and Statistics for Generative AI **6**

Probability distributions and their role in generative models – Maximum Likelihood Estimation (MLE) – Bayesian Inference and Maximum a Posteriori (MAP) estimation – Generative models as probabilistic models

UNIT III Generative Models **6**

Introduction to Autoencoders – Variational Autoencoders (VAE) – Generative Adversarial Networks (GAN) – Flow-based models – Practical implementation and hands-on exercises (using TensorFlow, PyTorch, Jupyter Notebook, Keras, etc).

UNIT IV Applications of Generative AI **6**

Image generation and manipulation – Text generation and natural language processing – Anomaly detection and data augmentation – Style transfer and artistic applications – Real-world use cases (Art & Design, Medical Imaging, Content creation, Chatbots, Virtual Assistants, Cybersecurity, etc.) and industry examples. Guest Lectures by Industry Experts, and Researchers

UNIT V Evaluation and Ethical Considerations **6**

Metrics for evaluating generative models (e.g., Inception Score, FID) – Ethical concerns in generative AI, including bias and fairness – Privacy and security considerations – Future trends and emerging technologies in Generative AI.

Theory: 30 PERIODS

Assignments / Projects (sample):

1. Write a literature review on the historical development and key milestones in generative AI, highlighting the most influential papers and breakthroughs.
2. Solve a set of probability and statistics problems related to generative models and their applications.
3. Implement a simple autoencoder model and train it on a dataset of your choice for image compression or denoising.
4. Implement a Variational Autoencoder to generate new samples in a chosen domain (e.g., images or text).
5. Create a GAN model to generate synthetic images or text data and evaluate its performance.
6. Develop a text generation model that can generate coherent and contextually relevant text paragraphs or poetry.
7. Implement an image style transfer algorithm to transform photographs into various artistic styles.
8. Write an essay analyzing the ethical implications of generative AI in society, focusing on privacy, bias, and security concerns.
9. Choose a specific industry or domain (e.g., healthcare, finance, or art) and propose a generative AI application that could be beneficial in that field. Provide a detailed plan for its implementation.
10. (Final Project) Design and implement a generative AI project of your choice, which can be an image generator, text generator, or any creative application. Present the project and its results in a report or presentation.

Practicals:30 PERIODS

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

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

CO1: Understand the fundamental principles and applications of Generative Artificial Intelligence and distinguish between generative and discriminative models.
CO2: Apply probability and statistics concepts to analyze and model data, with a focus on their role in generative models.
CO3: Implement and evaluate various generative models, including Autoencoders, Variational Autoencoders (VAE), and Generative Adversarial Networks (GANs).
CO4: Apply generative AI techniques to solve real-world problems, including image generation, text generation, and artistic applications.
CO5: Evaluate generative models using appropriate metrics and critically analyze the ethical implications, privacy concerns, and societal impact of generative AI technologies.

TEXT BOOKS:

4. David Foster, "Generative Deep Learning", Second Edition, O'Reilly Media, 2023.
5. Joseph Babcock and Raghav Bali, "Generative AI with Python and TensorFlow 2", Packt Publishing, 2021
6. Jakub Langr and Vladimir Bok, "GANs in Action: Deep learning with Generative Adversarial Networks", Manning, 2019.

REFERENCES:

7. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, The MIT Press, 2016.
8. Hannes Hapke, Cole Howard, Hobson Lane “Natural Language Processing in Action”, Manning, 2019.
9. Alberto Chierici, “The Ethics of AI”, New Degree Press, 2021.
10. Jacob Emerson, “Ripples of Generative AI”, IngramSpark, 2023.
11. Andreas C. Müller, Sarah Guido, “Introduction to Machine Learning with Python”, O’Reilly Media, 2017.
12. Eric Matthes, “Python Crash Course”, Third Edition, No Starch Press, 2023.

YouTube Resources:

9. **3Blue1Brown** - While not specific to generative AI, this channel provides fantastic visual explanations of mathematics and concepts that are fundamental to AI and machine learning.
10. **sentdex** - This channel focuses on machine learning and AI using Python. It includes tutorials on various topics, including generative models.
11. **Two Minute Papers** - This channel offers concise summaries of research papers and breakthroughs in computer graphics, machine learning, and AI, including generative AI.
12. **DeepLizard** - This channel provides tutorials on machine learning and deep learning topics, which can be useful for understanding the technical aspects of generative AI.
13. **Andrew Ng's Deeplearning.ai** - The deeplearning.ai courses on Coursera, created by Andrew Ng, are also available on YouTube. These videos cover deep learning and neural networks, which are foundational to generative AI.
14. **Stanford University's Machine Learning** - You can find recordings of Stanford University's machine learning course on YouTube, which includes lectures on relevant topics. (Stanford Online)
15. **PyTorch** - The official PyTorch YouTube channel provides tutorials and resources for learning PyTorch, a popular framework for deep learning and generative AI.
16. **TensorFlow** - The official TensorFlow YouTube channel offers tutorials and resources for learning TensorFlow, another widely used deep learning framework.

TOTAL:60 PERIODS

Vertical 5: CLOUD COMPUTING

Course Code	Cloud Technologies	L	T	P	C
AMPEV52X01		2	0	2	3

COURSE OBJECTIVES:

- To understand the principles of cloud architecture, models and infrastructure.
- To understand the concepts of virtualization and virtual machines.
- To gain knowledge about virtualization Infrastructure.
- To explore and experiment with various Cloud deployment environments.
- To learn about the security issues in the cloud environment.

UNIT I CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE 6

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges**.**

UNIT II VIRTUALIZATION BASICS 6

Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.

UNIT III VIRTUALIZATION INFRASTRUCTURE AND DOCKER 6

Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories.

UNIT IV CLOUD DEPLOYMENT ENVIRONMENT 6

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack.

UNIT V CLOUD SECURITY 6

Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyperjacking. Data Security and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice**.**

Theory: 60 Periods

LIST OF EXPERIMENTS

1. Install Virtualbox/VMware/ Equivalent open source cloud Workstation with different flavours of Linux or Windows OS on top of windows 8 and above.
2. Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs
3. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
4. Use the GAE launcher to launch the web applications.

5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Install Hadoop single node cluster and run simple applications like wordcount.
8. Creating and Executing Your First Container Using Docker.
9. Run a Container from Docker Hub

Practical: 30 PERIODS

COURSE OUTCOMES:

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

CO1 Understand the design challenges in the cloud.

CO2 Apply the concept of virtualization and its types.

CO3 Experiment with virtualization of hardware resources and Docker.

CO4 Develop and deploy services on the cloud and set up a cloud environment.

CO5 Explain security challenges in the cloud environment.

TEXT BOOKS:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. James Turnbull, "The Docker Book", O'Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, "Cloud security. A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing, 2010.

REFERENCES:

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", O'Reilly Media, Inc., 2009.

TOTAL NUMBER OF PERIODS INCLUDING LAB: 60

Course Code	VIRTUALIZATION	L	T	P	C
AMPEV52X02		2	0	2	3

COURSE OBJECTIVES:

- To Learn the basics and types of Virtualization
- To understand the Hypervisors and its types
- To Explore the Virtualization Solutions
- To Experiment the virtualization platforms

UNIT I INTRODUCTION TO VIRTUALIZATION 6

Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization - partial virtualization - Paravirtualization-Types of Hypervisors.

UNIT II SERVER AND DESKTOP VIRTUALIZATION 6

Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform-Desktop Virtualization-Types of Desktop Virtualization

UNIT III NETWORK VIRTUALIZATION 6

Introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization-VLAN-WAN Architecture-WAN Virtualization

UNIT IV STORAGE VIRTUALIZATION 6

Memory Virtualization-Types of Storage Virtualization-Block, File-Address Space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID

UNIT V VIRTUALIZATION TOOLS 6

VMWare-Amazon AWS-Microsoft HyperV- Oracle VM Virtual Box - IBM PowerVM- Google Virtualization- Case study.

Theory:30 PERIODS

LIST OF EXPERIMENTS

1. Create type 2 virtualization in VMWARE or any equivalent Open Source Tool. Allocate memory and storage space as per requirement. Install Guest OS on that VMWARE.
2. a. Shrink and extend virtual disk
   b. Create, Manage, Configure and schedule snapshots
   c.Create Spanned, Mirrored and Striped volume
   d.Create RAID 5 volume
3. a. Desktop Virtualization using VNC
   b. Desktop Virtualization using Chrome Remote Desktop
4. Create type 2 virtualization on ESXI 6. server 5. Create a VLAN in CISCO packet tracer
5. Install KVM in Linux

6. Create Nested Virtual Machine (VM under another VM)

Practical: 30 PERIODS

COURSE OUTCOMES:

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

CO1 Analyse the virtualization concepts and Hypervisor

CO2 Apply the Virtualization for real-world applications

CO3 Install &Configure the different VM platforms

CO4 Experiment with the VM with various software

TEXT CUM REFERENCE BOOKS:

1. Cloud computing a practical approach - Anthony T. Velte, Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill, New Delhi – 2010
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
3. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach
4. Chris Wolf, Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", APress, 2005.
5. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
6. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006.

TOTAL NUMBER OF PERIODS INCLUDING LAB: 60

Course Code	CLOUD ARCHITECTURES	L	T	P	C
AMPEV52X03		2	0	2	3

COURSE OBJECTIVES:

- Understand the Fundamentals of Cloud Computing
- Explore Key Concepts in Cloud Architectures
- Evaluate Cloud Service Providers and Deployment Models
- Apply Design Principles for Building Cloud Architectures
- Analyze Architectural Patterns and Networking Strategies in the Cloud

UNIT I FOUNDATIONS OF CLOUD COMPUTING AND ARCHITECTURAL CONCEPTS 6

Introduction to Cloud Computing – Definition and Characteristics, Evolution of Cloud Computing, Cloud Service Models (IaaS, PaaS, SaaS), Deployment Models (Public Cloud, Private Cloud, Hybrid Cloud). Key Concepts in Cloud Architectures – Virtualization, Scalability and Elasticity, Reliability and Availability, Security in the Cloud, Compliance and Governance.

UNIT II CLOUD SERVICE PROVIDERS AND ARCHITECTURAL DESIGN PRINCIPLES 6

Cloud Service Providers – Overview of Major Cloud Providers (AWS, Azure, Google Cloud, etc.), Comparative Analysis of Cloud Providers, Choosing the Right Cloud Service Provider. Design Principles for Cloud Architectures – Microservices Architecture, Serverless Computing, Containerization (Docker, Kubernetes), Decoupling and Asynchronous Communication**.**

UNIT III CLOUD ARCHITECTURE PATTERNS AND NETWORKING 6

Architectural Patterns in the Cloud – Multi-Tier Applications, Event-Driven Architectures, Big Data Architectures, IoT (Internet of Things) Architectures. Cloud Networking and Connectivity - Virtual Private Clouds, Content Delivery Networks (CDN), Hybrid Networking, Network Security in the Cloud.

UNIT IV CLOUD DATA MANAGEMENT AND PERFORMANCE OPTIMIZATION 6

Data Management in the Cloud – Cloud Databases (SQL and NoSQL), Data Storage Services, Data Backup and Recovery, Data Transfer and Migration Strategies. Performance Optimization and Monitoring – Resource Scaling and Auto-Scaling, Performance Monitoring and Logging, Cost Optimization Strategies, Troubleshooting and Debugging in the Cloud**.**

UNIT V REAL-WORLD APPLICATIONS AND FUTURE TRENDS 6

Case Studies and Real-world Implementations – Successful Cloud Migrations, Cloud-Native Applications, Challenges and Lessons Learned. Future Trends in Cloud Architectures - Edge Computing, Quantum Computing and Cloud, Emerging Technologies**.**

Theory :60 PERIODS

LIST OF EXPERIMENTS

1. Deploy a virtual machine on AWS. Install a web server and share the public IP address for verification.
2. Set up auto-scaling for an Azure web app. Show how it responds to a simulated increase in user traffic.
3. Create an AWS VPC with security groups. Launch an EC2 instance with a secure connection. Share access details.

4. Dockerize three microservices (e.g., Node.js, Python, Java). Show how they communicate using Docker Compose.
5. Write an AWS Lambda function in Python. Configure an S3 bucket to trigger the function on object creation.
6. Build an AWS-based big data pipeline using S3, Lambda, and Athena. Show data ingestion and query results.
7. Set up an Azure VNet with front-end and back-end subnets. Implement Azure CDN for a web application.
8. Use Google Cloud Monitoring to track the performance of a Compute Engine instance. Implement auto-scaling based on metrics.
9. Analyze Netflix's cloud architecture. Identify key decisions, challenges, and benefits of their migration to the cloud.

Practical:30 PERIODS

COURSE OUTCOMES:

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

CO1 Master the Core Concepts of Cloud Computing

CO2 Demonstrate Proficiency in Designing Secure and Scalable Cloud Architectures

CO3 Evaluate and Select Appropriate Cloud Service Providers

CO4 Apply Architectural Patterns to Real-world Cloud Solutions

CO5 Implement Efficient Networking and Data Management Strategies in Cloud Environments

CO6 Critically Analyze and Troubleshoot Cloud-based Systems

TEXTBOOKS:

1."Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl, Ricardo Puttini, Zaigham Mahmood

2."Architecting the Cloud: Design Decisions for Cloud Computing Service Models" by Michael J. Kavis

3."Cloud Native Patterns: Designing Change-tolerant Software" by Cornelia Davis

REFERENCES:

1."The Art of Cloud Computing: Building Cloud-Based Applications and Infrastructure" by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi

2."Cloud Computing: From Beginning to End" by Ray J. Rafaels

3."Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" by George Reese

TOTAL NUMBER OF PERIODS INCLUDING LAB: 60

Course Code	CLOUD PLATFORM PROGRAMMING	L	T	P	C
AMPEV52X04		2	0	2	3

COURSE OBJECTIVES:

- Ability to Develop Proficiency in Cloud Service Providers
- Master Cloud Programming Languages and Tools
- Implement Cloud-native Applications
- Ensure Cloud Application Security
- Apply DevOps Practices for Cloud Development

UNIT I INTRODUCTION TO CLOUD COMPUTING AND CLOUD PLATFORMS 6

Overview of Cloud Computing; Evolution of Cloud Computing, Cloud Service Models (IaaS, PaaS, SaaS), Cloud Deployment Models (Public, Private, Hybrid), Major Cloud Service Providers (AWS, Azure, Google Cloud), Setting up Cloud Accounts and Environments, Cloud Platform Services (Compute, Storage, Networking), Identity and Access Management (IAM), Overview of Pricing and Billing in the Cloud.

UNIT II PROGRAMMING LANGUAGES AND TOOLS FOR CLOUD 6

Overview of Programming Languages for Cloud Development, Cloud SDKs and CLIs, Infrastructure as Code (IaC) Concepts and Tools (e.g., Terraform), Containerization and Orchestration (Docker, Kubernetes).

UNIT III CLOUD APPLICATION DEVELOPMENT 6

Serverless Computing and Functions as a Service (FaaS), Microservices Architecture in the Cloud, Cloud-native Development Best Practices, Data Storage and Databases in the Cloud, Testing and Debugging Cloud Applications

UNIT IV CLOUD SECURITY AND COMPLIANCE 6

Security Challenges in the Cloud, Encryption and Key Management, Compliance and Governance in the Cloud, Best Practices for Securing Cloud Applications, Incident Response and Recovery in the Cloud**.**

UNIT V ADVANCED TOPICS IN CLOUD PROGRAMMING 6

DevOps and Continuous Integration/Continuous Deployment (CI/CD), Monitoring and Logging in the Cloud, Advanced Cloud Services (e.g., AI/ML, IoT), Performance Optimization and Scalability.

Theory:30 PERIODS

LIST OF EXPERIMENTS

1. Setting Up a Cloud Account
2. Virtual Machines and Containers
3. Serverless Computing
4. Cloud Storage
5. Database Services
6. Networking and Security
7. Monitoring and Logging

8. Continuous Integration/Continuous Deployment (CI/CD)
9. Scaling and Load Balancing

10. Identity and Access Management (IAM)

Practical: 30 PERIODS

COURSE OUTCOMES:

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

CO1 Able to explain the fundamental concepts of cloud computing, including service models deployment models, and the evolution of cloud technologies.

CO2 Will gain practical experience in setting up and using a cloud platform

CO3 Will acquire proficiency in programming for the cloud, using relevant programming languages, SDKs, and tools.

CO4 Will demonstrate an Understanding of cloud security challenges and solutions, including encryption, identity and access management, compliance.

CO5 Able to design and implement cloud-native applications, incorporating advanced concepts such as serverless computing.

REFERENCES:

1."Cloud Computing: From Beginning to End" by Ray J. Rafaels, Publisher: Apress, Edition: 1st edition (2016)

2."Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" by George Reese, Publisher: O'Reilly Media, Edition: 1st edition (2009)

3."Programming Amazon EC2" by Jurg van Vliet and Flavia Paganelli, Publisher: O'Reilly Media, Edition: 1st edition (2011)

4."Kubernetes: Up and Running" by Kelsey Hightower, Brendan Burns, and Joe Beda, Publisher: O'Reilly Media, Edition: 1st edition (2017)

TOTAL NUMBER OF PERIODS INCLUDING LAB: 60

Course Code	CLOUD COMPUTING	L	T	P	C
AMPEV54X05		2	0	2	3

COURSE OBJECTIVES:

1. To understand the principles of cloud architecture, models and infrastructure.
2. To understand the concepts of virtualization and virtual machines.
3. To gain knowledge about virtualization Infrastructure.
4. To explore and experiment with various Cloud deployment environments.
5. To learn about the security issues in the cloud environment.

UNIT I CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE 6

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges

UNIT II VIRTUALIZATION BASICS 6

Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.

UNIT III VIRTUALIZATION INFRASTRUCTURE AND DOCKER 7

Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories.

UNIT IV CLOUD DEPLOYMENT ENVIRONMENT 6

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack.

UNIT V CLOUD SECURITY 5

Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyperjacking. Data Security and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice.

PRACTICAL EXERCISES: 30 PERIODS

1. Install Virtualbox/VMware/ Equivalent open source cloud Workstation with different flavours of Linux or Windows OS on top of windows 8 and above.
2. Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs
3. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
4. Use the GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Install Hadoop single node cluster and run simple applications like wordcount.
8. Creating and Executing Your First Container Using Docker.
9. Run a Container from Docker Hub

COURSE OUTCOMES:

CO1: Understand the design challenges in the cloud.
CO2: Apply the concept of virtualization and its types.
CO3: Experiment with virtualization of hardware resources and Docker.
CO4: Develop and deploy services on the cloud and set up a cloud environment.
CO5: Explain security challenges in the cloud environment.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, FromParallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. James Turnbull, "The Docker Book", O'Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, "Cloud security. A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing, 2010.

REFERENCES

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: anenterprise perspective on risks and compliance", O'Reilly Media, Inc., 2009.

Course Code	STREAM PROCESSING	L	T	P	C
AMPEV52X06		2	0	2	3

COURSE OBJECTIVES:

- Introduce Data Processing terminology, definition & concepts
- Define different types of Data Processing
- Explain the concepts of Real-time Data processing
- Select appropriate structures for designing and running real-time data services in a business environment
- Illustrate the benefits and drive the adoption of real-time data services to solve real world problems

UNIT I FOUNDATIONS OF DATA SYSTEMS 6

Introduction to Data Processing, Stages of Data processing, Data Analytics, Batch Processing, Stream processing, Data Migration, Transactional Data processing, Data Mining, Data Management Strategy, Storage, Processing, Integration, Analytics, Benefits of Data as a Service, Challenges

UNIT II REAL-TIME DATA PROCESSING 6

Introduction to Big data, Big data infrastructure, Real-time Analytics, near real-time solution, Lambda architecture, Kappa Architecture, Stream Processing, Understanding Data Streams, Message Broker, Stream Processor, Batch & Real-time ETL tools, Streaming Data Storage

UNIT III DATA MODELS AND QUERY LANGUAGES 6

Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Many- to-One and Many-to-Many Relationships, Network data models, Schema Flexibility, Structured Query Language, Data Locality for Queries, Declarative Queries, Graph Data models, Cypher Query Language, Graph Queries in SQL, The Semantic Web, CODASYL, SPARQL

UNIT IV EVENT PROCESSING WITH APACHE KAFKA 6

Apache Kafka, Kafka as Event Streaming platform, Events, Producers, Consumers, Topics, Partitions, Brokers, Kafka APIs, Admin API, Producer API, Consumer API, Kafka Streams API, Kafka Connect API

UNIT V REAL-TIME PROCESSING USING SPARK STREAMING 6

Structured Streaming, Basic Concepts, Handling Event-time and Late Data, Fault-tolerant Semantics, Exactly-once Semantics, Creating Streaming Datasets, Schema Inference, Partitioning of Streaming datasets, Operations on Streaming Data, Selection, Aggregation, Projection, Watermarking, Window operations, Types of Time windows, Join Operations, Deduplication

Theory:30 PERIODS

LIST OF EXPERIMENTS

1. Install MongoDB
2. Design and Implement Simple application using MongoDB
3. Query the designed system using MongoDB
4. Create an Event Stream with Apache Kafka

5. Create a Real-time Stream processing application using Spark Streaming
6. Build a Micro-batch application
7. Real-time Fraud and Anomaly Detection,
8. Real-time personalization, Marketing, Advertising

Practical:30 PERIODS

COURSE OUTCOMES:

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

CO1 Understand the applicability and utility of different streaming algorithms.

CO2 Describe and apply current research trends in data-stream processing.

CO3 Analyze the suitability of stream mining algorithms for data stream systems.

CO4 Program and build stream processing systems, services and applications.

CO5 Solve problems in real-world applications that process data streams.

TEXT BOOKS:

1. Streaming Systems: The What, Where, When and How of Large-Scale Data Processing by Tyler Akidau, Slava Chemyak, Reuven Lax, O'Reilly publication
2. Designing Data-Intensive Applications by Martin Kleppmann, O'Reilly Media
3. Practical Real-time Data Processing and Analytics: Distributed Computing and Event Processing using Apache Spark, Flink, Storm and Kafka, Packt Publishing

REFERENCES:

1. https://spark.apache.org/docs/latest/streaming-programming-guide.html

2. Kafka.apache.org

TOTAL NUMBER OF PERIODS INCLUDING LAB: 60

Course Code	FOG AND EDGE COMPUTING	L	T	P	C
AMPEV52X07		2	0	2	3

COURSE OBJECTIVES:

- To enhance real-time data processing and analytics at the network edge.
- To optimize resource utilization and reduce latency in fog computing environments.
- To improve scalability and flexibility for edge devices and applications.
- To Enhance security and privacy for data processing at the edge.
- To Facilitate seamless integration of fog and edge computing with cloud services.

UNIT I INTRODUCTION TO FOG AND EDGE COMPUTING 6

Definition and Fundamentals: Overview of Fog and Edge Computing, Key concepts and characteristics, Motivations and Advantages: Reasons for adopting Fog and Edge Computing, Comparative advantages over traditional Cloud Computing, Use Cases and Applications: Challenges and Limitations: Security concerns, privacy issues, and compliance, Comparison with Cloud Computing: Contrasting characteristics and use cases, Complementary roles in a hybrid computing environment.

UNIT II ARCHITECTURES AND COMPONENTS 6

Edge Computing Architecture Models: Design principles and characteristics, Hierarchical vs. flat architectures. Fog Nodes and Infrastructure: Role and capabilities of Fog nodes, Infrastructure components supporting Edge Computing. Edge Device Types and Capabilities: Categorization of Edge devices (e.g., gateways, sensors, actuators), Capabilities and limitations of different device types. Edge-to-Cloud Communication Models; Middleware and Software Frameworks: Middleware solutions for Edge Computing.

UNIT III SECURITY AND PRIVACY IN EDGE COMPUTING 6

Security Challenges in Edge Computing: Identifying security threats in Edge Computing, Risks associated with decentralized architectures. Methods for secure access control: Role of authentication in ensuring device integrity, Data Encryption in Edge Environments: Encryption strategies for data at rest and in transit. Privacy Concerns and Regulatory Compliance; Risk Management and Incident Response.

UNIT IV EDGE APPLICATION DEVELOPMENT 6

Programming Models and Frameworks: Overview of programming models for Edge Computing, Exploration of popular frameworks for Edge application development, Integration with IoT Devices: Techniques for integrating Edge Computing with Internet of Things (IoT) devices. Edge Application Deployment Strategies; Edge-to-Cloud Communication Patterns; Optimizing Edge Application Performance: Performance considerations in Edge Computing, Strategies for optimizing resource usage and responsiveness.

UNIT V PERFORMANCE OPTIMIZATION AND FUTURE TRENDS 6

Performance Metrics and Optimization: Metrics for evaluating performance in Edge Computing. Strategies for optimizing Edge applications; Energy-Efficient Edge Architectures: Techniques for optimizing energy consumption, Green computing practices in Edge environments, Real-time Processing and Analytics: Approaches for real-time data processing at the Edge, Analytics

capabilities in decentralized architectures. Scalability and Flexibility in Edge Architectures; Emerging Trends in Fog and Edge Computing.

Theory:30 PERIODS

LIST OF EXPERIMENTS

1. Design and deploy a fog computing architecture for a smart city application.
2. Optimize data processing algorithms for edge devices in a real-time monitoring system.
3. Evaluate resource utilization in a fog computing environment using simulation tools.
4. Implement security protocols for edge devices to protect sensitive data.
5. Develop a scalable edge computing solution for IoT devices in a manufacturing setting.
6. Integrate fog computing with cloud services to enhance overall system efficiency.
7. Perform a hands-on deployment of edge computing nodes in a network infrastructure.
8. Design and implement a fault-tolerant edge computing solution for critical applications.
9. Conduct performance testing to assess the latency reduction achieved through edge computing.
10. Create a comprehensive case study on the successful integration of fog and edge computing in a specific industry.

Practical:30 PERIODS

COURSE OUTCOMES:

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

CO1 Proficiently deploy and manage fog and edge computing solutions in diverse environments.

CO2 Demonstrate expertise in optimizing data processing and analytics at the network edge.

CO3 Evaluate and enhance resource efficiency for fog computing deployments.

CO4 Implement robust security measures for safeguarding edge computing data.

CO5 Successfully integrate fog and edge computing technologies to address real-world challenges.

TEXT& REFERENCE BOOKS

1."Fog and Edge Computing: Principles and Paradigms" by Rajkumar Buyya and Amir Vahid Dastjerdi (Wiley, 1st Edition, 2018),

2."Edge Computing: A Primer" by Shiwen Mao and Ying-Chang Liang (Wiley, 1st Edition, 2019),

3."Fog Computing in the Internet of Things: Intelligence at the Edge" by Yogesh Simmhan, Nalini Venkatasubramanian, and Viktor K. Prasanna (Springer, 1st Edition, 2018),

4."Fog Computing: Concepts, Frameworks and Technologies" by Flavio Bonomi, Rodolfo Milito, Jiang Zhu, and Sateesh Addepalli (Springer, 1st Edition, 2018),

5."Edge Computing – The Dawn of Industry 4.0 Revolution" by Satya Prakash Ghrera (CRC Press, 1st Edition, 2020)

6."Fog Computing: Towards Minimizing Latency and Improving QoE in the Internet of Things" by Mohammad Mehedi Hassan, Saad B. Qaisar, and Abdelgadir Mohammed Ahmed (Springer, 1st Edition, 2018).

TOTAL NUMBER OF PERIODS INCLUDING LAB: 60

Course Code	BLOCKCHAIN TECHNOLOGY AND CLOUD COMPUTING	L	T	P	C
AMPEV52X08		2	0	2	3

COURSE OBJECTIVES:

1. Introduce students to the core principles, mechanisms, and applications of Blockchain Technology and CloudComputing.
2. Foster a solid theoretical foundation in Blockchain mechanisms, cryptographic principles, cloud architectures,and enabling technologies.
3. Provide hands-on experience through lab sessions, experiments, and projects to apply theoretical conceptsinto practical scenarios.
4. Enable students to integrate the principles and practices of Blockchain and Cloud Computing to developinnovative and efficient solutions.
5. Empower students to analyse real-world use cases and explore the potential of utilizing Blockchain and CloudComputing in various applications.

UNIT I INTRODUCTION TO BLOCKCHAIN AND CLOUD COMPUTING 6

Blockchain Technology Mechanisms & Networks: Overview, Blockchain Networks, Decentralization. **Transactions, Blocks, P2P Systems:** Structure of Transactions, Concept of Blocks, Peer-to-Peer (P2P) Systems. **Keys, Digital Signatures, Hashing:** Cryptographic Keys, Digital Signatures in Blockchain Transactions, Hash Functions and Applications. **Cloud Computing - Definition, Evolution, Characteristics**: Introduction to Cloud Computing, Characteristics, Evolution of Cloud. **Principles of Parallel Computing, Elasticity:** Principles of Parallel Computing in Cloud, Elasticity and Scalability in Cloud Environments, Techniques for Parallelism. **On-demand Provisioning:** Understanding On-demand Provisioning in Cloud, Resource Allocation and De-allocation, Implementing Scalable Resources on Demand.

UNIT II CYPTOCURRENCY AND CLOUD ENABLING TECHNOLOGY 6

Bitcoin Overview: Introduction to Bitcoin, Bitcoin Mining Process, Bitcoin Wallets: Types and Functions, Ethereum Virtual Machine (EVM). **Blockchain & Cryptocurrency:** Consensus Mechanisms in Blockchain, Smart Contracts and Applications, Decentralization and its Significance, Impact of Blockchain Technology on Cryptocurrency. **Understanding Cloud Basics:** Service-Oriented Architecture (SOA), Fundamentals of Virtualization, Types and Levels of Virtualization, Cloud Characteristics and Attributes, Elasticity and Scalability in Cloud Computing. **Principles and Implementation**: Cloud Services and Deployment Models, Cloud Virtualization Tools and Mechanisms. CPU, Memory, and I/O Devices Virtualization, Disaster Recovery in Cloud Environments.

UNIT III ETHEREUM & CLOUD ARCHITECTURE 6

Overview of Ethereum: Ethereum Origins and Core Principles, Smart Contracts, Decentralization. **Ethereum Operations & Transactions:** Ethereum Accounts: Types and Functions, Transaction Process in Ethereum Network, Ethereum Smart Contracts: Structure and Execution. **Understanding Hyperledger:** Introduction to Hyperledger Fabric, Hyperledger Composer: Overview and Functions, Consensus Mechanisms in Hyperledger. **Layered Cloud ArchitectureDesign:** Components of Cloud Architecture, Exploring Layers in Cloud Environments, Architectural Design Challenges. **Cloud Services & Service Models:** Overview of Cloud Services (IaaS, PaaS, SaaS), Characteristics and Applications of Each Service Model, Challenges and Solutions in Service Deployment. **Cloud Storage Solutions:** Cloud Storage Basics and Principles, Storage-as-a-Service (STaaS) Concept, Analysis of Cloud Storage Providers (e.g., S3).

UNIT IV SOLIDITY PROGRAMMING AND CLOUD SECURITY **6**

Solidity Programming Language: Syntax, Types, Variables, Functions, Data Structures in Solidity. **Ethereum Wallet & Smart Contracts:** Overview of Ethereum Wallet, Structure & Working of Smart Contracts. **Basics of Solidity & Smart Contract Structure:** Understanding Basic Solidity Concepts, Components and Structure of Smart Contracts. **Resource Provisioning & Cloud Overview:** Cloud Resource Allocation & Management, Cloud Service Models (IaaS, PaaS, SaaS). **Security Overview in Cloud Environment:** Cloud Security Challenges, Security Governance in Cloud. **IAM, Virtual Machine Security, Security Standards:** Identity & Access Management in Cloud, Ensuring Security in Virtual Machines, Compliance with Security Standards in Cloud Environments.

UNIT V BLOCKCHAIN APPLICATIONS AND ADVANCEMENT OF CLOUD TECHNOLGIES 6

IoT Integration with Blockchain: Introduction to IoT (Internet of Things), Blockchain's Role in IoT Security, IoT Data Management using Blockchain. **Blockchain in Medical Record Management:** Healthcare Data Challenges & Security, Blockchain's Impact on Medical Records, Privacy, Integrity, and Accessibility in Medical Records, Applications. **Domain Name Service (DNS) using Blockchain:** DNS Issues in Centralized Systems, Blockchain-Based Decentralized DNS. **Alt Coins and Their Significance:** Introduction to Alt Coins (Alternative Cryptocurrencies), Role and Market Impact of Alt Coins, Differentiating Factors and Advantages, Future Trends and Adoption of Alt Coins. **Future Trends in Blockchain Technology:** Emerging Trends, Impact on Industries and Potential Evolution. **Hadoop and Big Data Processing in Cloud:** Introduction to Hadoop and MapReduce, Cloud-Based Big Data Analytics, Hadoop's Role in Cloud Computing, Use Cases and Industry Applications. **Google App Engine (GAE) for Cloud Development:** Overview of GAE, Building and Deploying Applications on GAE, Scalability and Maintenance Aspects, GAE's Contribution to Cloud Development. **OpenStack and Cloud Federation:** OpenStack in Cloud Environments, Federation in Cloud Computing, Multi-Cloud Management using OpenStack, Benefits and Challenges of Cloud Federation.

TOTAL NUMBER OF PERIODS INCLUDING LAB: 60

SAMPLE LIST OF EXPERIMENTS **NUMBER OF PRACTICAL PERIODS: 30**

1. Simulate a basic blockchain network to understand transactions, blocks, and the structure of peer-to-peer systems, alongside implementing on-demand resource provisioning in cloud computing.
2. Analyze the Bitcoin mining process, types of wallets, and Ethereum Virtual Machine (EVM) while exploring consensus mechanisms and smart contracts' impact on cryptocurrency, and understanding cloud basics such as service-oriented architecture (SOA) and virtualization.
3. Develop smart contracts in Solidity programming language for Ethereum, comprehend Hyperledger Fabric and Hyperledger Composer, and design layered cloud architecture considering cloud services and service models.
4. Implement Solidity programming language features like variables, functions, and data structures, alongside understanding Ethereum wallet and smart contracts structure, and ensuring cloud security through identity & access management (IAM) and compliance with security standards.
5. Explore blockchain applications like IoT integration and medical record management, analyze alternative cryptocurrencies (Alt Coins) and their significance, and investigate advancements in cloud technologies such as Hadoop for big data processing and Google App Engine (GAE) for cloud development.

COURSE OUTCOMES:

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

CO1 Demonstrate a comprehensive understanding of the fundamental principles and mechanisms of BlockchainTechnology and Cloud Computing.

CO2 Apply theoretical knowledge to solve problems related to Blockchain and Cloud Computing through hands-onexperiments and practical sessions.

CO3 Integrate Blockchain Technology and Cloud Computing for the development of innovative solutions,leveraging the combined strengths of both domains.

CO4 Exhibit problem-solving skills by analysing and proposing solutions using Blockchain and Cloud Computingprinciples in diverse scenarios.

CO5 Analyse and evaluate real-world use cases to determine the suitability and potential impact of Blockchain andCloud Computing technologies.

CO6 Develop practical proficiency in executing projects that utilize Blockchain and Cloud Computing for addressingcontemporary challenges.

TEXTBOOKS:

1. Daniel Drescher, "Blockchain Basics: A Non-Technical Introduction in 25 Steps", 1st Edition, 2017
2. Andreas M. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", 2nd Edition, 2017
3. Stephen Grider, "Ethereum Programming", 1st Edition, 2020.
4. Thomas Erl, Ricardo Puttini, and Zaigham Mahmood, "Cloud Computing: Concepts, Technology &Architecture", 2nd edition, 2013.
5. Michael J. Kavis, "Architecting the Cloud: Design Decisions for Cloud Computing Service Models", 1st edition,2014.

REFERENCES:

1. Don Tapscott and Alex Tapscott, "Blockchain Revolution: How the Technology Behind Bitcoin and OtherCryptocurrencies is Changing the World", 2nd edition, 2018.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, "Bitcoin andCryptocurrency Technologies: A Comprehensive Introduction", 1st edition, 2016.
3. Judith Hurwitz, Robin Bloor, Marcia Kaufman, and Fern Halper, "Cloud Computing for Dummies", 1st edition,2009.
4. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspectiveon Risks and Compliance", 1st edition, 2009.

Vertical 6: IOT SYSTEMS

Course Code	FOUNDATIONS OF EMBEDDED IOT SYSTEMS	L	T	P	C
AMPEV62X01		2	0	2	3

COURSE OBJECTIVES:

- To provide students with a good depth of knowledge of Designing Embedded and IOT Systems for various applications.
- Knowledge of the design and analysis of Embedded and IoT Systems for Electronics Engineering students.

UNIT I INTRODUCTION TO EMBEDDED AND IOT SYSTEMS 6

Introduction Embedded and IoT systems, Definition, Examples and components of embedded and IoT Systems, Embedded and IoT Systems Design Process, Various Embedded and IoT cores controllers.

UNIT II HARDWARE/SOFTWARE CO-DESIGN FOR EMBEDDED AND IOT SYSTEMS 6

Microcontrollers for embedded systems, Arduino embedded platform, Peripheral interfacing and programming with Arduino platform, Sensors and Actuator interfacing, Cloud support with Arduino platform.

UNIT III PROTOCOLS FOR EMBEDDED AND IOT SYSTEMS 6

Serial protocols, UART, I2C, and SPI. NFC, Wireless protocols like, RFID, Zig-bee, IEEE 802.15.4e, Thread, 6LoWPAN, Constrained Application Protocol (CoAP), Extensible Messaging Protocol (XMPP), WebSocket, Advanced Message Queueing Protocol (AMQP), Message Queue Telemetry Transport (MQTT), Web Real Time Communications (WebRTC), LoRa, SIGFOX, Z Wave.

UNIT IV IOT BASED EMBEDDED SYSTEMS 6

Open source OS for IoT such as Contiki OS, TinyOS, Basic architecture of an IoT based Embedded Systems., Embedded Hardware for IoT applications, like Raspberry Pi, Arduino, and Raspberry Pi based development board, IoT Cloud Platform and IoT client applications on mobile phones.

UNIT V CASE STUDIES OF EMBEDDED AND IOT SYSTEMS 6

Embedded application development through Arduino and Raspberry Pi based development boards, Development of Mini-Project on new version of Operating systems and development board. That project should also address to the current societal needs.

Theory :30 Periods

LIST OF EXPERIMENTS

1. Study of Open source operating system used in Embedded Design.
2. Introduction to Arduino based Embedded System Programming.
3. LED Interfacing program for Arduino based Embedded System
4. Interfacing Push Button Switch interfacing with Arduino based Embedded System
5. External Peripheral Interfacing with Arduino based Embedded System.
6. On Chip peripheral programming with Arduino/Raspberry Pi based Embedded System
7. Serial Communication Protocol programming with Arduino/Raspberry Pi based Embedded
8. Systems.

9. Wireless communications with Arduino/Raspberry Pi Embedded IOT Platform.
10. Bluetooth communication interfacing with Arduino/Raspberry PiEmbedded IOT Board.
11. WiFi module interfacing with Arduino/Raspberry Pi Embedded IOT Board.
12. Embedded Systems design with IOT capability.
13. IOT based Temperature monitoring embedded system with open source cloud tools.
14. Introduction to RTOS
15. RTOS based task performances

Practical: 30 Periods

COURSE OUTCOMES:

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

CO1 Knowledge of theory and practice related to Embedded and IOT System.

CO2 Ability to identify, formulate and solve engineering problems by using Embedded Systems with IoT.

CO3 Ability to implement real field problem by gained knowledge of Embedded Systems with IoT capability.

TEXT CUM REFERENCE BOOKS:

1. Muhammad Ali MazidiShujen Chen, Sepehr Naimi Sarmad Naimi "Embedded Programming
2. Using C Language", 1st Edition, Freescale ARM Cortex-M.
3. Steve Ferbur, "ARM System on Chip".
4. Rajkamal, "Embedded System: Architecture, Programming and Design", TMH3.
5. Dr. OvidiuVermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies for
6. Smart Environments and Integrated Ecosystems", River Publisher

TOTAL NUMBER OF PERIODS INCLUDING LAB: 60

Course Code	IOT NETWORKS	L	T	P	C
AMPEV62X02		2	0	2	3

COURSE OBJECTIVES:

1. To give an understanding about the choice and application of IoT & M2M communication protocols.
2. To describe Cloud computing and design principles of IoT.
3. To relate to MQTT clients, MQTT server and its programming.
4. To describe the architectures and communication protocols of WSNs.
5. To identify the uplink and downlink communication protocols associated with specific application of IOT /WSNs.

UNIT I OVERVIEW OF INTERNET OF THINGS 6

IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT, M2M communication, Examples of IoT. Modified OSI Model for the IoT/M2M Systems, data enrichment, data consolidation and device management at IoT/M2M Gateway, web communication protocols used by connected IoT/M2M devices, Message communication protocols (CoAP-SMS, CoAP-MQ, MQTT, XMPP) for IoT/M2M devices. -Refer Chapter 1,2 and 3 of Text 1.

UNIT IIARCHITECTURE AND DESIGN PRINCIPLES FOR IOT 6

Internet connectivity, Internet¬ based communication, IPv4, IPv6,6LoWPAN protocol, IP Addressing in the IoT, Application layer protocols: HTTP, HTTPS, FTP, TELNET and ports.

UNIT III PROTOTYPING AND DESIGNING SOFTWARE FOR IOT APPLICATIONS 6

Introduction, Prototyping Embedded device software, Programming Embedded Device Arduino Platform using IDE, Reading data from sensors and devices, Devices, Gateways, Internet and Web/Cloud services software development. Programming MQTT clients and MQTT server. Introduction to IoT privacy and security. Vulnerabilities, security requirements and threat analysis, IoT Security Tomography and layered attacker model. -Refer Chapter 9 and 10 of Text 1.

UNIT IV OVERVIEW OF WIRELESS SENSOR NETWORKS 6

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks. Architectures: Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture-Sensor Network Scenarios, Optimization Goals and Figures of Merit, Design principles for WSNs, Service interfaces of WSNs Gateway Concepts. -Refer Chapter 1,2, 3 of Text 2.

UNIT V COMMUNICATION PROTOCOLS 6

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wrreless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Contention based protocols (CSMA, PAMAS), Schedule based protocols (LEACH, SMACS, TRAMA) Address and Name Management in WSNs, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing, Hierarchical networks by clustering. Refer Chapter 4, 5, 7 and 11 of Text 2. Lt, L2, L3

Theory :30 Periods

LIST OF EXPERIMENTS

1.Implement an IoT conceptual framework and analyze M2M communication using CoAP-SMS and CoAP-MQ protocols, focusing on data enrichment and consolidation at the IoT/M2M gateway.

2.Design a prototype for Internet connectivity in IoT, exploring IPv4, IPv6, and 6LoWPAN protocol, alongside understanding application layer protocols like HTTP, HTTPS, and FTP.

3.Develop embedded device software using Arduino IDE, read data from sensors, and program MQTT clients and servers while addressing IoT privacy and security concerns through threat analysis and IoT Security Tomography.

4.Explore enabling technologies and architectures for wireless sensor networks (WSNs), understand single-node architecture components, and optimize energy consumption using operating systems and execution environments.

5.Analyze physical layer and transceiver design considerations for WSNs, implement MAC protocols like S-MAC and contention-based protocols like CSMA, and design energy-efficient routing protocols for hierarchical networks by clustering.

Practical: 30 Periods

COURSE OUTCOMES:

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

CO1 Understand choice and application of IoT & M2M communication protocols.

CO2 Describe Cloud computing and design principles of IoT.

CO3 Relate to MQTT clients, MQTT server and its programming.

CO4 Describe the architectures and communication protocols of WSNs.

CO5 Identify the uplink and downlink communication protocols associ¬ated with specific application of IOT /WSNs.

TEXTBOOKS:

1. Raj Kamal, "Internet of Things-Architecture and Design Principles", McGraw Hill Education.

2 Holger Karl & Andreas Willig, " Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.

REFERENCES:

1. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 007.

2 Kazem Sohraby, Daniel Minoli, &TaiebZnati, '' Wireless Sensor Networks- Technology, Protocols and Applications", John Wiley, 2007.

3. Anna Hac, 'Wireless Sensor Network Designs", John Wiley, 2003.

TOTAL NUMBER OF PERIODS INCLUDING LAB: 60

Course Code	SECURE HARDWARE AND EMBEDDED DEVICES	L	T	P	C
AMPEV62X03		2	0	2	3

COURSE OBJECTIVES:

- To Understand the Concepts of Computer and Network Security
- To Study and Understand Encryption Techniques.
- To Explore the different aspects of Embedded System Security.
- To Understand the role of Security Aspects during Data Transfer and Communication.
- To apply the Security Algorithms for Real-time Applications.

UNIT I: BACKGROUND AND INTRODUCTION **6**

Computer and Network Security Concepts- The OSI Security Architecture-Security Attacks and Services -Security Mechanisms-Fundamentals of Security Design Principles -Introduction to Number Theory

UNIT II: SYMMETRIC CIPHERS **6**

Classical Encryption Techniques -Symmetric Cipher Model -Substitution and Transposition Techniques -Block Ciphers and Data Encryption Standard (DES) -Advanced Encryption Standard (AES)

UNIT III: EMBEDDED SYSTEMS SECURITY **6**

Embedded Security Trends -Security Policies and Threats-System Software -onsiderations Access Control and Hypervisors-Integrity Assurance of the Trusted Computing Base (TCB)

UNIT IV: EMBEDDED CRYPTOGRAPHY AND DATA PROTECTION PROTOCOLS **6**

One-time Pad and Cryptographic Modes -Public Key Cryptography and Key Management Elliptic Curve Cryptography and Hash Functions -Cryptographic Certifications Data Protection Protocols for Embedded Systems

UNIT V: PRACTICAL EMBEDDED SYSTEM SECURITY **6**

Network Communications Protocols and Built-in Security -Security Protocols and Algorithms-Secured Socket Layer (SSL)-Embedded Security in Wireless Systems Application-Layer Protocols and Cryptographic Algorithms

Theory :30 Periods

LIST OF EXPERIMENTS

1. Analysis of OSI Security Architecture
2. Implementation of classical encryption techniques
3. Implementation and strength analysis of Data Encryption Standard (DES)
4. Exploration and implementation of Advanced Encryption Standard (AES)
5. Investigation of embedded security trends, policies, and threats
6. Examination of system software considerations for embedded systems
7. Implementation of cryptographic primitives
8. Implementation of public key cryptography in embedded systems
9. Comparison of data protection protocols for embedded systems
10. Implementation of a secure communication protocol for resource-constrained embedded systems

Practical: 30 Periods

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

CO1: Understand the significance of Security.
CO2: Understand major concepts and techniques related to Cryptography.
CO3: Demonstrate thorough knowledge about aspects of Embedded System Security.
CO4: Understand the role of Security Aspects during Data Transfer and Communication.
CO5: Applying the Security Algorithms for Real-time Applications.

TEXT CUM REFERENCE BOOKS:

1. "Cryptography and Network Security Principles and Practice", 7th Edition - Global Edition, William Stallings, Pearson Education Limited, 2017.
2. "Embedded Systems Security - Practical Methods for Safe and Secure Software and Systems Development", David Kleidermacher and Mike Kleidermacher, Newnes (an imprint of Elsevier), 2012.
3. "Practical Embedded Security - Building Secure Resource-Constrained Systems", Timothy Stapko, Newnes (an imprint of Elsevier), 2008.

TOTAL NUMBER OF PERIODS INCLUDING LAB: 60

Course Code	**IOT PROCESSORS**	**L**	**T**	**P**	**C**
AMPEV62X04		2	0	2	3

COURSE OBJECTIVES:

1. Learn the architecture and features of ARM.
2. Study the exception handling and interrupts in CORTEX M3
3. Program the CORTEX M3
4. Learn the architecture of STM 32L15XXX ARM CORTEX M3/M4 microcontroller.
5. Understand the concepts of System – On – Chip (SoC)

UNIT I OVERVIEW OF ARM AND CORTEX-M3 **6**

ARM Architecture – Versions, Instruction Set Development, Thumb 2 and Instruction Set Architecture, Cortex M3 Basics: Registers, Stack Pointer, Link Register, Program Counter, Special Registers, Operation Mode, Exceptions and Interrupts, Vector Tables, Stack Memory Operations, Reset Sequence, CORTEX M3 Instruction Sets: Assembly Basics, Instruction List, Instruction Descriptions, CORTEX M3 – Implementation Overview: Pipeline, Block Diagram. Bus Interfaces, I – Code Bus, D – Code Bus, System Bus- External PPB and DAP Bus.

UNIT II CORTEX EXCEPTION HANDLING AND INTERRUPTS **6**

Exception Types, Priority, Vector Tables, Interrupt Inputs and Pending behaviour, Fault Exceptions, Supervisor Call and Pendable Service Call, NVIC: Nested Vector Interrupt Controller, Overview, Basic Interrupts, SYSTICK Time, Interrupt Behaviourm Interrupt/Exception Sequences, Exception Exits, Nested Interrupts, Tail – Chaining Interrupts, Late Arrivals and Interrupt Latency.

UNIT III CORTEX M3/M4 PROGRAMMING **6**

Cortex M3/M4 Programming: Overview, Typical Development Flow, Using C, CMSIS UsingAssembly, Excepiton Programming Using Interrupts, Exception/Interrupt Handlers, Software Interrupts, Vector Table Relocation, Memory Protection Unit and other CORTEX M3 Features, MPU Registers, Setting up the MPU, Power Management, Multiprocessor Configuration.

UNIT IV STM32L15XXX ARMCORTEX M3/M4 MICROCONTROLLER AND DEBUGGING TOOLS **6**

STM32L15XXX ARM CORTEX M3/M4 Microcontroller: Memory and Bus Architecture, Power Control, Reset and Clock Control, STM32L15XXX Peripherals: GPIOs, System Configuration Controller, NVIC, ADC, Comparators, GP Timers, USART Development and Debugging Tools: Software and Hardware tools like Cross Assembler Compiler, Debugger, Simulator, In – Circuit Emulator (ICE), Logic Analyser.

UNIT V INTRODUCTION TO SYSTEM – ON – CHIP **6**

System Architecture: An Overview, Components of the System Processors, Memories and Interconnects, Processor Architectures, Memory and Addressing, System Level Interconnection –An Approach for SOC Design – Chip basics – Cycle Time – Die Area – Power and Cost – Area, Power and Time Trade – Offs in Processor Design – Reliability and Configurability – SOC Design Approach – Application Studies – AES, 3D Graphics Processor. Image Compression and Video Compression**.**

Theory :30 Periods

LIST OF EXPERIMENTS

ARM Assembly Programming

1. Write a program to add two 32-bit numbers stored in r0 and r1 registers and write the result to r2. The result is stored to a memory location. a) Run the program with breakpoint and verify the result b) Run the program with stepping and verify the content of registers at each stage.

2. Write ARM assembly to perform the function of division. Registers r1 and r2 contain the dividend and divisor, r3 contains the quotient, and r5 contains the remainder.

Embedded C Programming on ARM Cortex M3/M4 Microcontroller

1. Write a program to turn on green LED (Port B.6) and Blue LED (Port B.7) on STM32L-Discovery by configuring GPIO.

2. Transmit a string “Programming with ARM Cortex” to PC by configuring the registers of USART2. Use polling method.

ARM Cortex M3/M4 Programming with CMSIS

1. Write a program to toggle the LEDs at the rate of 1 sec using standard peripheral library. Use Timer3 for Delay.

2. Transmit a string “Programming with ARM Cortex” to PC by using standard peripheral library with the help of USART3. Use polling method.

Practical: 30 Periods

COURSE OUTCOMES:

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

CO1 Explain the architecture and features of ARM.

CO2 List the concepts of exception handling.

CO3 Write a program using ARM CORTEX M3/M4.

CO4 Learn the architecture of STM32L15XXX ARM CORTEX M3/M4.

CO5 Design an SoC for any application**.**

TEXT CUM REFERENCE BOOKS

1. Joseph Yiu, The Definitive Guide to the ARM CORTEX M3/M4, Second Edition, Elsevier, 2010. (Unit – I, II)

2. Andrew N Sloss, Dominic Symes, Chris Wright, ARM System Developers Guide Designing and Optimising System Software, Elsevier, 2006 (Unit – III, IV)

3. Michael J Flynn and Wayne Luk, Computer System Design, System On Chip, Wiley India 2011. (Unit – V)

TOTAL NUMBER OF PERIODS INCLUDING LAB: 60

Course Code	MOBILE APPLICATION DEVELOPMENT	L	T	P	C
AMPEV62X05		2	0	2	3

COURSE OBJECTIVES:

- To facilitate students to understand android SDK
- To help students to gain basic understanding of Android application development
- To understand how to work with various mobile application development frameworks
- To inculcate working knowledge of Android Studio development tool
- To learn the basic and important design concepts and issues of development of mobile applications

UNIT I MOBILE PLATFORM AND APPLICATIONS 6

Mobile Device Operating Systems — Special Constraints & Requirements — Commercial Mobile Operating Systems — Software Development Kit: iOS, Android, BlackBerry, Windows Phone — MCommerce — Structure — Pros & Cons — Mobile Payment System — Security Issues

UNIT II INTRODUCTION TO ANDROID 6

Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, building your First Android application, Understanding Anatomy of Android Application, Android Manifest file.

UNIT III ANDROID APPLICATION DESIGN ESSENTIALS 6

Anatomy of Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

UNIT IV ANDROID USER INTERFACE DESIGN & MULTIMEDIA 6

User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation. Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures

UNIT V ANDROID APIs 6

Using Android Data and Storage APIs, managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

Theory :30 Periods

LIST OF EXPERIMENTS

1. Develop an application that uses GUI components, Font, Layout Managers and event listeners.
2. Develop an application that makes use of databases
3. Develop a native application that uses GPS location information
4. Implement an application that creates an alert upon receiving a message
5. Develop an application that makes use of RSS Feed.
6. Create an application using Sensor Manager
7. Create an android application that converts the user input text to voice.
8. Develop a Mobile application for simple and day to day needs (Mini Project)

Practical: 30 Periods

COURSE OUTCOMES:

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

CO1 Identify various concepts of mobile programming that make it unique from programming for other platforms.

CO2 Create, test and debug Android application by setting up Android development.

CO3 Demonstrate methods in storing, sharing and retrieving data in Android applications

CO4 Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces

CO5 Create interactive applications in android using databases with multiple activities including audio, video and notifications and deploy them in marketplace

TEXT CUM REFERENCE BOOKS:

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)
2. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017.
3. Prasanth Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt.Ltd, New Delhi-2012
4. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd, 2010
5. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd, 2009
6. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O'Reilly SPD Publishers, 2015. ISBN-13: 978-9352131341
7. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014. ISBN-13: 978-8126547197.
8. Bill Phillips, Chris Stewart and Kristin Marsicano, "Android Programming: The Big Nerd Ranch Guide", 4th Edition, Big Nerd Ranch Guides, 2019. ISBN-13: 978-0134706054

TOTAL NUMBER OF PERIODS INCLUDING LAB: 60

Course Code	**INDUSTRIAL IOT & HEALTHCARE SYSTEMS**	**L**	**T**	**P**	**C**
AMPEV62X06		2	0	2	3

COURSE OBJECTIVES:

- To teach key skills employed in the IIoT & IoRT space building applications.
- To give knowledge on Design suitable network architecture and use appropriate learning algorithm.
- To Comprehend IOT protocols
- To implement digital Twin
- To implement IOT systems for robotics

UNIT I INTRODUCTION TO INDUSTRIAL IOT **6**

Technical requirements, IoT Background-History and definition, IoT enabling factors, IoT applications, IoT key technologies, I-IoT, IoT and I-IoT – similarities and differences, Industry environments and scenarios covered by I-IoT.

UNIT II UNDERSTANDING THE INDUSTRIAL PROCESS AND DEVICES TECHNICAL REQUIREMENTS **6**

The industrial Process-Automation in the industrial process, Control and measurement systems, Types of industrial processes**.**

UNIT III INDUSTRIAL DATA FLOW AND DEVICES **6**

Technical requirements, The I-IoT data flow in the factory, Measurements and the actuator chain Sensors, The converters - Digital to analogical, Analog to digital, Actuators, Controllers - Microcontrollers, Embedded microcontrollers, Microcontrollers with external memory, DSP's. Industrial protocols -Automation networks, the fieldbus, Developing Industrial IoT and Architecture Introduction to the I-IoT platform and architectures, OSGi, micro service, containers, and server less computing, The standard IoT flow.

UNIT IV INTRODUCTION TO IOT BASED HEALTH CARE **6**

Introduction to IoT applications in smart healthcare& their distinctive advantages - Patient Health Monitoring System (PHMS), Tele-Health, Tele-medicine, Tele-Monitoring, Mobile Health Things (m-health).

UNIT V IOT SMART SENSING HEATH CARE AND POWER CHALLENGE **6**

Concept of Generic Biomedical sensors, Smart Sensors: Monitor health parameters, Wearable ECG sensors, IoT Data Acquisition System, Energy harvesting, Battery based systems, Power management.

Theory :30 Periods

LIST OF EXPERIMENTS

1. Analyze the technical requirements and key technologies of Industrial IoT (I-IoT), comparing its similarities and differences with traditional IoT, while exploring its applications and enabling factors.
2. Explore automation, control, and measurement systems in industrial processes, categorizing different types of industrial processes.
3. Investigate the industrial data flow in factories, focusing on sensors, converters, actuators, controllers, and industrial protocols, and introduce I-IoT platform architectures like OSGi and microservices.
4. Examine IoT applications in healthcare, including Patient Health Monitoring System (PHMS), Tele-Health, Tele-medicine, and Mobile Health Things (m-health), highlighting their advantages.
5. Implement smart sensing healthcare solutions using generic biomedical sensors, wearable ECG sensors, and IoT Data Acquisition Systems, while addressing power challenges through energy harvesting, battery-based systems, and power management techniques.

Practical: 30 Periods

COURSE OUTCOMES:

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

CO1 Understand key skills employed in the IIoT & IoRT space building applications.

CO2 Design suitable network architecture and use appropriate learning algorithm.

CO3 Comprehend IOT protocols

CO4 Implement Digital Twin

CO5 Implement IOT systems for robotics

TEXT CUM REFERENCE BOOKS:

1. "Industry 4.0: The Industrial Internet of Things", Alasdair Gilchrist, Apress,2016

2. "Introduction to Industrial Internet of Things and Industry 4.0", Sudip Misra, Chandana Roy, Anadarup Mukherjee, CRC Press,2021

3. "Hands on Industrial Internet of Things", Giacomo Veneri, Antonio Capasso, Packt Press, 2018

4. "Emerging Technologies for Health and Medicine: Virtual Reality, Augmented Reality, Artificial Intelligence, Internet of Things, Robotics, Industry 4.0", Dac- Nhuong Le Wiley, 2019

5. "Introduction to IoT". S. Misra, A. Mukherjee, and A. Roy Cambridge University Press, 2017

6. "The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and Beagle Bone Black", Donald Norris, 2014.

TOTAL NUMBER OF PERIODS INCLUDING LAB: 60

Course Code	SMART CITIES	L	T	P	C
AMPEV62X07		2	0	2	3

COURSE OBJECTIVES:

1. To understand the concept of a smart city and associated challenges.
2. To understand the latest technologies used in intelligent building.
3. To understand the process of planning and drafting a plan for a smart city.
4. To understand the importance of different smart systems.
5. To understand technologies, infrastructure, and the concept of planning and the latest methodology.

UNIT I INTRODUCTION TO SMART CITIES **6**

Introduction to city planning: Concept, Principle stakeholders, key trends in smart cities developments.

UNIT II SMART CITIES PLANNING AND DEVELOPMENT **6**

Understanding smart cities, Dimension of smart cities, Global Standards and performance benchmarks, Practice codes, Smart city planning and development, Financing smart cities development, Governance of smart cities.

UNIT III PROJECT MANAGEMENT IN SMART CITIES **6**

Phases, Stages of project and work break down Structure, Project organization structure, Planning, Scheduling and CPM, Project cost analysis, resource allocation & levelling, Line of balancing technique, Project monitoring and control, Project risk management.

UNIT IV GREEN BUILDING IN SMART CITIES **6**

Introduction to green buildings, Rating system, Energy saving system

UNIT V CASE STUDY **6**

Smart environment, smart streetlight and smart water & waste management, Smart Road & Traffic (Live & Connected roads), Smart Parking (Connected Parking)

Theory :30 Periods

LIST OF EXPERIMENTS

Prepare a comprehensive project report by analysing the following aspects of a smart city.

1. Analyze key stakeholders and trends in smart city development.
2. Investigate global standards and benchmarks in smart city planning.
3. Implement project management phases and work breakdown structures for smart city projects.
4. Explore green building concepts and energy-saving systems in smart cities.
5. Conduct a case study on smart environment initiatives in urban areas.
6. Evaluate the implementation of smart streetlight and water/waste management systems.
7. Study live and connected road systems for smart traffic management.
8. Implement smart parking solutions using connected technologies.
9. Analyze the financing and governance structures of smart city projects.
10. Develop a comprehensive smart city plan integrating various aspects of planning, development, and management.

Practical: 30 Periods

COURSE OUTCOMES:

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

CO1 Understand the concept of a smart city and associated challenges.

CO2 Understand the latest technologies used in intelligent building.

CO3 Understand the process of planning and drafting a plan for a smart city.

CO4 Understand the importance of different smart systems.

CO5 Understand technologies, infrastructure, and the concept of planning and the latest methodology.

TEXTBOOKS:

1. "Designing, Developing, and Facilitating Smart Cities Urban Design to IoT Solutions", Vangelis Angelakis Springer, 2019
2. "Introduction to IoT", S. Misra, A. Mukherjee, and A. Roy, Cambridge University Press, 2018

REFERENCES:

1. Jo Beall (1997); "A city for all: valuing differences and working with diversity"; Zed books limited, London (ISBN: 1-85649-477-2)
2. UN-Habitat; "Inclusive and sustainable urban planning: a guide for municipalities"; Volume3: Urban Development Planning (2007); United Nations Human Settlements Programme (ISBN: 978- 92-1-132024-4)
3. Arup Mitra; "Insights into inclusive growth, employment and wellbeing in India"; Springer (2013), New Delhi (ISBN: 978-81-322-0655-2)
4. William J. V. Neill (2004); "Urban Planning and cultural identity"; Routledge, London (ISBN:0- 415-19747-3)
5. John S. Pipkin, Mark E. La Gory, Judith R. Balu (Editors); "Remaking the city: Social science perspective on urban design"; State University of New York Press, Albany (ISBN:0-87395-678-8)
6. Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers (2007). "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science
7. "Draft Concept Note on Smart City Scheme". Government of India - Ministry of Urban Development

TOTAL NUMBER OF PERIODS INCLUDING LAB: 60

Course Code	ADVANCED INTELLIGENT SYSTEM	L	T	P	C
AMPEV62X08		2	0	2	3

COURSE OBJECTIVES:

- Introduce students to the concepts of machine learning and deep learning and their significance in developing intelligent systems.
- Provide hands-on experience with Python programming for implementing machine learning algorithms such as linear regression, polynomial regression, clustering, and classification.
- Explore emerging trends in hardware architectures for deep learning, including quantization, precision reduction, and hardware-software co-design.
- Enable students to develop Python applications specifically for deep learning tasks, focusing on CNN and YOLO algorithms.
- Engage students in case studies to apply their knowledge and skills in developing intelligent systems for various domains, including power systems, smart energy, motor control, and Industry 4.0 and Industry 5.0 applications.

UNIT I: INTELLIGENT SYSTEMS AND PYTHON PROGRAMMING 6

Introduction to Machine Learning and Deep Learning -Performance Improvement with Machine Learning -Building Intelligent Systems -Introduction to Python-Python Programming

UNIT II: PYTHON FOR ML 6

Python Application of Linear Regression and Polynomial Regression using SciPy -Interpolation, Overfitting, and Under fitting concepts & examples using SciPy -Clustering and Classification using Python

UNIT III: EMERGING TRENDS IN HARDWARE ARCHITECTURES FOR DEEP LEARNING 6

Quantization and Precision Reduction Techniques -Hardware-aware Neural Architecture
Hardware-software Co-design for Deep Learning Systems -Memory Hierarchy and Cache Optimization for Deep Learning -Parallelization and Distributed Training of Deep Learning Models - Energy-efficient Deep Learning Hardware Architectures - Hardware Acceleration for Specific Deep Learning Applications (e.g., Natural Language Processing, Computer Vision)

UNIT IV: PYTHON FOR DL 6

Python Applications for Deep Learning -Python for CNN and YOLO

UNIT V: CASE STUDIES 6

Development of Intelligent System for Power System Protection -Smart Energy-IOE Internet of Everything)-Motor Control -BMS (Building Management Systems) - Intelligent Systems for Industry 4.0 and Industry 5.0

Theory: 30 Periods

LIST OF EXPERIMENTS

1. Implement linear regression and polynomial regression in Python using SciPy, analyze concepts like interpolation, overfitting, and underfitting, then explore clustering and classification algorithms.
2. Investigate quantization and precision reduction techniques in hardware architectures for deep learning, focusing on hardware-software co-design and memory hierarchy optimization.

3. Develop Python applications for deep learning, specifically for Convolutional Neural Networks (CNN) and You Only Look Once (YOLO) algorithms.
4. Create intelligent systems for various applications such as power system protection, smart energy management, motor control, and building management systems (BMS), exploring Industry 4.0 and Industry 5.0 scenarios.

Practical: 30 Periods

COURSE OUTCOMES:

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

CO1: Gain proficiency in the Python programming language and learn how to apply it in the context of intelligent systems.

CO2: Learn Python libraries such as NumPy, Pandas, and scikit-learn to preprocess data, build and train Machine Learning models, and evaluate their performance.

CO3: Learn Deep Learning libraries such as TensorFlow or PyTorch to build, train, and evaluate Deep Learning models for tasks such as image classification, natural language processing, and computer vision.

CO4: Learn hardware components, such as processors, memory, and accelerators, and how they are integrated.

CO5: Learn intelligent systems implementations, examine their design choices, evaluate their performance, and understand the challenges**.**

TEXT CUM REFERENCE BOOKS:

1. "Intelligent Systems: Principles, Paradigms, and Pragmatics" by Rajendra P. Srivastava (Published in 2013)
2. "Intelligent Systems: A Modern Approach" by Thomas Bäck, David B. Fogel, and Zbigniew Michalewicz (Published in 2000)
3. "Intelligent Systems: Modeling, Optimization, and Control" by Grzegorz Bocewicz and Konrad Jackowski (Published in 2016)
4. "Intelligent Systems: Architecture, Design, and Control" by Janos Sztipanovits and Gabor Karsai (Published in 2018)
5. "Intelligent Systems: Concepts and Applications" by Veera M. Boddu (Published in 2017)

TOTAL NUMBER OF PERIODS INCLUDING LAB: 60

Vertical 7: HIGH END COMPUTING

Course Code	PARALLEL PROCESSING	L	T	P	C

AMPEV72X01		3	0	0	3

COURSE OBJECTIVES:

1. To study the scalability and clustering issues and the technology necessary for them.
2. To understand the technologies enabling parallel computing.
3. To study the different types of interconnection networks.
4. To study the different parallel programming models.
5. To study the software support needed for shared memory programming.

UNIT I: INTRODUCTION **9**

Introduction to Parallel Processing - Shared Memory Multiprocessing -Distributed Shared Memory - Message Passing Parallel Computers

UNIT II: PROCESSES & SHARED MEMORY PROGRAMMING **9**

Processes -Shared Memory Programming -General Model of Shared Memory Programming

Process Model Under UNIX

UNIT III: BASIC PARALLEL PROGRAMMING TECHNIQUES **9**

Loop Splitting - Ideal Speedup -Spin-Locks, Contention, and Self-Scheduling -Loop Scheduling

UNIT IV: THREAD-BASED IMPLEMENTATION **9**

Thread Management -The POSIX Thread Application Programmer Interface -Synchronization Primitives in POSIX -Example with Threads

UNIT V: ALGORITHMS FOR PARALLEL MACHINES **9**

Models of Computation -Analysis of Parallel Algorithms-Prefix Computation-Histogram Computation

THEORY PERIODS: 45

COURSE OUTCOMES:

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

CO1 Understand the basic concepts of Parallel Processing.

CO2 Apply the concepts of processes and shared memory programming.

CO3 Use basic parallel programming techniques.

CO4 Implement thread-based methods.

CO5 Understand parallel algorithms for tightly coupled and loosely coupled parallel systems for various applications.

TEXTBOOKS:

1. "Introduction to Parallel Programming" by Steven Brawer.
2. "Introduction to Parallel Computing" by Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, Pearson Publication.
3. "Introduction to Parallel Processing" by M. Sasikumar, Dinesh Shikhare, and P. Ravi Prakash.

4. "Introduction to Parallel processing" by M. Sasikumar, D. Shikhare, and P. Ravi Prakash, PHI, 2006.

REFERENCES:

1. Hwang, K, "Advanced Computer Architecture: Parallelism, Scalability, Programmability", Tata McGrawHill, 3rd Edition, 1993.
2. Tanenbaum A.S, "Distributed Operating Systems", Pearson Education Asia, 2002.
3. Dezso Sima, Terence Fountain, Peter Kacsuk, "Advanced Computer Architectures", Pearson Education, 2007.
4. V. Rajaraman and C. Siva Ram Murthy, "Parallel Computers Architecture and Programming", PHI, 2000.
5. Quinn, M.J., "Designing Efficient Algorithms for Parallel Computers", McGraw–Hill, 2003.
6. Culler, D.E., "Parallel Computer Architecture: A Hardware – Software approach", Morgan Kaufmann Publisher, 1998.

TOTAL PERIODS: 45

AMPEV72X02		3	0	0	3

COURSE OBJECTIVES:

- To study various computing technology architectures.
- To know emerging trends in computing technology.
- To highlight the advantage of deploying computing technology.

UNIT I: Cluster Computing and its Architecture **9**

Ease of Computing -Scalable Parallel Computer Architecture-Towards Low-Cost Parallel Computing & Motivation-Windows Opportunity -A Cluster Computer and Its Architecture Cluster Classification -Commodity Components for Clusters -Network Services/Communication SW -Cluster Middleware and Single Systems Image -Resource Management & Scheduling (RMS)

UNIT II: Cluster Setup and Administration **9**

Introduction to Cluster Setup and Administration -Setting up the cluster -Security- System Monitoring -System Tuning-Introduction to Grid and its Evolution -Beginning of the Grid-Building blocks of Grid-Grid Application and Grid Middleware-Evolution of the Grid: First, Second & Third Generation

UNIT III: Cloud Definition and Management **9**

Introduction to Cloud Computing -Defining Clouds -Cloud Providers -Consuming Cloud Services -Cloud Models: IaaS, PaaS, SaaS -Inside the cloud -Administering cloud services, technical interface, and Cloud resources

UNIT IV: Nature of Cloud **9**

Traditional Data Center-Cost of Cloud Data Center-Scaling Computer Systems-Cloud Workload-Managing data on Clouds-Public, private, and hybrid clouds

UNIT V: Cloud Elements **9**

Infrastructure as a service -Platform as a service -Software as a service

THEORY PERIODS: 45

COURSE OUTCOMES:

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

1. Have basic knowledge of computing technology.
2. Understand the architecture of computing technology.
3. Know cloud computing service models.
4. Know about emerging trends in computing technology.
5. Understand big data and Hadoop architecture**.**

TEXT CUM REFERENCE BOOKS:

1. Ronald Krutz, "Cloud Security," Wiley India.
2. CloudComputing, APracticalApproach, AnthonyVelte, TobyVelte, RobertElsenpeter, McGrawHill**.**

TOTAL PERIODS: 45

Course Code	PERVASIVE COMPUTING	L	T	P	C

AMPEV72X03		3	0	0	3

COURSE OBJECTIVES:

- To understand the characteristics and principles of Pervasive computing and the solutions that are in use.
- To realize the role of wireless protocols in shaping the future Internet.
- To design and implement pervasive applications.
- To give an introduction to the enabling technologies of pervasive computing.

UNIT I: INTRODUCTION **9**

Pervasive Computing Principles and Characteristics -Architecture for Pervasive Computing Context Communication and Access Services

UNIT II: PROTOCOLS **9**

Open Protocols - Service Discovery Technologies - Data Synchronization -Context-Aware Security

UNIT III: TECHNOLOGIES **9**

Device Technology - Device Connectivity -Web Application Concepts -Voice Technologies

UNIT IV: ARCHITECTURE **9**

Server-Side Programming in Java - Pervasive Web Application Architecture - Example Applications

UNIT V: EXAMPLES **9**

Smart Tokens - Heating, Ventilation, and Air Conditioning Systems - Set-Top Boxes -Appliances and Home Networking -Residential Gateway -Automotive Computing - Entertainment Systems

COURSE OUTCOMES:

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

CO1: Outline the basic problems, performance requirements of pervasive computing applications, and the trends of pervasive computing and its impacts on future computing applications and society.

CO2: Analyze and compare the performance of different data dissemination techniques and algorithms for mobile real-time applications.

CO3: Analyze the performance of different sensor data management and routing algorithms for sensor networks.

CO4: Develop an attitude to propose solutions with comparisons for problems related to pervasive computing systems through investigation.

REFERENCES:

1. Seng Loke, "Context-Aware Computing Pervasive Systems", Auerbach Pub., New York, 2007.
2. Uwe Hansmann et al., "Pervasive Computing", Springer, New York, 2001.
3. Jochen Burkhardt, Stefan Hepper, Klaus Rindtorff, Thomas Schaeck, "Pervasive Computing - Technology and Architecture of Mobile Internet Application", Pearson Education, sixth Edition, 2009

TOTAL PERIODS: 45

Course Code	PICO COMPUTING	L	T	P	C

AMPEV72X04		3	0	0	3

COURSE OBJECTIVES:

- Understanding PICO Computing Principles
- Exploring PICO Architecture
- Mastering PICO Programming Skills
- Examining PICO Operating Systems
- Investigating Advanced Topics in PICO Computing

UNIT I: INTRODUCTION TO PICO COMPUTING 9

Overview of PICO Computing - Historical perspective and evolution -Importance and applications in modern computing -Characteristics of PICO Computing systems.

UNIT II: PICO ARCHITECTURE 9

Basic principles of PICO architecture - Components and building blocks-PICO processors and memory -Parallelism and concurrency in PICO Computing

UNIT III: PROGRAMMING FOR PICO COMPUTING 9

PICO programming languages - PICO-specific programming paradigms Code optimization techniques for PICO systems -Case studies and examples

UNIT IV: PICO OPERATING SYSTEMS 9

Role of operating systems in PICO Computing - PICO OS design principles -Kernel architecture for PICO systems - Resource management and scheduling in PICO OS.

UNIT V: ADVANCED TOPICS IN PICO COMPUTING 9

Emerging trends in PICO Computing - Quantum aspects of PICO systems - PICO Computing in specific domains - Ethical considerations and challenges in PICO Computing.

NUMBER OF THEORY PERIODS: 45

COURSE OUTCOMES:

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

CO1: Demonstrate Comprehensive PICO Computing Knowledge

CO2: Apply PICO Architecture Concepts

CO3: Develop Proficient PICO Programming Skills

CO4: Design and Analyze PICO Operating Systems

CO5: Critically Evaluate Advanced PICO Computing Concepts

TEXTBOOKS:

1. "Parallel Computer Architecture: A Hardware/Software Approach" by David Culler, Jaswinder Pal Singh, and Anoop Gupta
2. "Quantum Computing: A Gentle Introduction" by Eleanor G. Rieffel and Wolfgang H. Polak
3. "Computer Organization and Design: The Hardware/Software Interface" by David A. Patterson and John L. Hennessy
4. "Programming Massively Parallel Processors: A Hands-on Approach" by David B. Kirk and Wen-mei W. Hwu

Course Code	NANOCOMPUTING	L	T	P	C
AMPEV72X05		3	0	0	3

COURSE OBJECTIVES:

- To understand the fundamental principles of Dielectrics and Electronic Structures.
- To know the construction and working of Logic Devices.
- To know the construction and working of mass storage devices.
- To study sensor arrays and Imaging systems.
- To know about various types of Displays.

UNIT I: INTRODUCTION **9**

Dielectrics-Ferroelectrics-Electronic Properties and Quantum Effects-Magneto electronics Magnetism and Magneto transport in Layered Structures-Organic Molecules-Neurons-Circuit and System Design

UNIT II: LOGIC DEVICES **9**

Silicon MOSFETs-Novel Materials and Alternative Concepts-Ferroelectric Field Effect -Transistors-Quantum Transport Devices Based on Resonant Tunnelling-Single-Electron Devices for Logic Applications-Superconductor Digital Electronics-Quantum Computing Using Superconductors-Carbon Nanotubes for Data Processing-High-Permittivity Materials for DRAMs-Ferroelectric Random Access Memories-Magneto resistive RAM

UNIT III: MASS STORAGE DEVICES **9**

Hard Disk Drives -Magneto-Optical Discs -Rewriteable DVDs Based on Phase Change Materials -Holographic Data Storage -AFM-Based Mass Storage-Transmission on Chip and Board Level -Photonic Networks-Microwave Communication Systems -Neuroelectronic Interfacing: Semiconductor Chips with Ion Channels, Nerve Cells, and Brain

UNIT IV: SENSOR ARRAYS AND IMAGING SYSTEMS **9**

Optical 3-D Time-of-Flight Imaging System - Pyroelectric Detector Arrays for IR Imaging Electronic Noses - 2-D Tactile Sensors and Tactile Sensor Arrays.

UNIT V: DISPLAYS **9**

Liquid Crystal Displays - Organic Light Emitting Devices - Field-Emission and Plasma Displays - Electronic Paper.

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

CO1: To design the basic components in Nano Computing.

CO2: To construct the Logic Devices.

CO3: To design the storage devices.

CO4: To analyze different types of imaging systems.

CO5: To analyze the principles of Various Displays LCD, LED, and Plasma Displays.

REFERENCES:

1. Rainer Waser, "Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices", Wiley-VCH, April 2003.

2. "Nanocomputing: Computational Physics for Nanoscience and Nanotechnology", Jang-Yu Hsu, CRC Press, 2009.

3. "Nanocomputing: The Future of Computing", Vishal Sahni, Tata McGraw Hill, 2008.

4. "Nano, Quantum and Molecular Computing: Implications to High-level design and validation", Shukla, Sandeep Kumar, 2004, Springer.

5. "Bio Inspired Nanoscale Integrated computing", Mary Mehrnoosh Eshaghian-Wilner, 2009, John Wiley publications.

6. N.K. JhaandD.Chen, Editors, Nanoelectronic Circuit Design, Springer,2011.

TOTAL PERIODS: 45

Course Code	FOG AND EDGE COMPUTING	L	T	P	C
AMPEV72X06		3	0	0	3

COURSE OBJECTIVES:

- To enhance real-time data processing and analytics at the network edge.
- To optimize resource utilization and reduce latency in fog computing environments.
- To improve scalability and flexibility for edge devices and applications.
- To enhance security and privacy for data processing at the edge.
- To facilitate seamless integration of fog and edge computing with cloud services.

UNIT 1: INTRODUCTION TO FOG AND EDGE COMPUTING 9

Definition and Fundamentals - Motivations and Advantages -Use Cases and Applications-Challenges and Limitations -Comparison with Cloud Computing.

UNIT 2: ARCHITECTURES AND COMPONENTS 9

Edge Computing Architecture Models - Fog Nodes and Infrastructure -Edge Device Types and Capabilities -Edge-to-Cloud Communication Models -Middleware and Software Frameworks

UNIT 3: SECURITY AND PRIVACY IN EDGE COMPUTING 9

Need for automata theory - Introduction to formal proof -Finite Automata (FA) -Deterministic Finite Automata (DFA)-Non-Deterministic Finite Automata (NFA)-Edge-to-Cloud Communication Patterns

UNIT 4: EDGE APPLICATION DEVELOPMENT 9

Programming Models and Frameworks - Integration with IoT Devices - Edge Application - Deployment Strategies - Optimizing Edge Application Performance

UNIT 5: PERFORMANCE OPTIMIZATION AND FUTURE TRENDS 9

Performance Metrics and Optimization - Energy-Efficient Edge Architectures - Real-time Processing and Analytics - Scalability and Flexibility in Edge Architectures -Emerging Trends in Fog and Edge Computing

NUMBER OF THEORY PERIODS: 45

SAMPLE LIST OF EXPERIMENTS:

1. Design and deploy a fog computing architecture for a smart city application.
2. Optimize data processing algorithms for edge devices in a real-time monitoring system.
3. Evaluate resource utilization in a fog computing environment using simulation tools.
4. Implement security protocols for edge devices to protect sensitive data.
5. Develop a scalable edge computing solution for IoT devices in a manufacturing setting.
6. Integrate fog computing with cloud services to enhance overall system efficiency.
7. Perform a hands-on deployment of edge computing nodes in a network infrastructure.
8. Design and implement a fault-tolerant edge computing solution for critical applications.
9. Conduct performance testing to assess the latency reduction achieved through edge computing.
10. Create a comprehensive case study on the successful integration of fog and edge computing in a specific industry.

COURSE OUTCOMES:

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

CO1: Proficiently deploy and manage fog and edge computing solutions in diverse environments.

CO2: Demonstrate expertise in optimizing data processing and analytics at the network edge.

CO3: Evaluate and enhance resource efficiency for fog computing deployments.

CO4: Implement robust security measures for safeguarding edge computing data.

CO5: Successfully integrate fog and edge computing technologies to address real-world challenges.

REFERENCES:

1. "Fog and Edge Computing: Principles and Paradigms" by Rajkumar Buyya and Amir Vahid Dastjerdi (Wiley, 1st Edition, 2018).
2. "Edge Computing: A Primer" by Shiwen Mao and Ying-Chang Liang (Wiley, 1st Edition, 2019).
3. "Fog Computing in the Internet of Things: Intelligence at the Edge" by Yogesh Simmhan, Nalini Venkatasubramanian, and Viktor K. Prasanna (Springer, 1st Edition, 2018).
4. "Fog Computing: Concepts, Frameworks and Technologies" by Flavio Bonomi, Rodolfo Milito, Jiang Zhu, and Sateesh Addepalli (Springer, 1st Edition, 2018).
5. "Edge Computing – The Dawn of Industry 4.0 Revolution" by Satya Prakash Ghrera (CRC Press, 1st Edition, 2020).
6. "Fog Computing: Towards Minimizing Latency and Improving QoE in the Internet of Things" by Mohammad Mehedi Hassan, Saad B. Qaisar, and Abdelgadir Mohammed Ahmed (Springer, 1st Edition, 2018).

TOTAL PERIODS: 45

Course Code	AI AND CLOUD COMPUTING	L	T	P	C
AMPEV72X07		3	0	0	3

COURSE OBJECTIVES:

1. Understand the fundamentals of basic AI approaches.
2. Learn techniques to identify problem-solving agents.
3. Understand the concept of cloud computing.
4. To appreciate the evolution of the cloud from the existing technologies.
5. To have knowledge of the various issues in cloud computing.

UNIT I: INTELLIGENT AGENTS **9**

Introduction to AI-Agents and Environments-Concept of Rationality-Nature of Environments-Structure of Agents -Problem Solving Agents-Search Algorithms-Uninformed Search Strategies-Constraint satisfaction problems

UNIT II: PROBLEM SOLVING & LOGICAL REASONING **9**

Heuristic search strategies - Heuristic functions -Knowledge-based Agents-Propositional Logic-Propositional Theorem Proving-Agents based on propositional Logic-First-order Logic-Syntax and -semantics -Inferences in first-order logic -Forward chaining -Backward Chaining-Resolution.

UNIT III: CLOUD COMPUTING INTRODUCTION **9**

Introduction to Cloud Computing - Definition of Cloud -Evolution of Cloud Computing - Underlying Principles of Parallel and Distributed Computing -Cloud Characteristics -Elasticity in Cloud -On-demand Provisioning

UNIT IV: CLOUD ENABLING TECHNOLOGIES **9**

Service Oriented Architecture - REST and Systems of Systems -Web Services-Publish-Subscribe - Model Basics of Virtualization-Types of Virtualization-Implementation Levels of Virtualization Structures-Tools and Mechanisms-Virtualization of CPU, Memory, I/O Devices-Virtualization Support and Disaster Recovery.

UNIT V: CLOUD ARCHITECTURE, SERVICES AND STORAGE **9**

Layered Cloud Architecture Design - NIST Cloud Computing Reference Architecture-Public, Private and Hybrid Clouds -IaaS, PaaS, SaaS-Architectural Design Challenges-Cloud Storage-Storage-as-a-Service-Advantages of Cloud Storage-Cloud Storage Providers-S3.

NUMBER OF THEORY PERIODS: 45

COURSE OUTCOMES:

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

CO1: Learn the intelligent agent frameworks.

CO2: Apply problem-solving techniques and CSP techniques.

CO3: Articulate the main concepts, key technologies, strengths, and limitations of cloud computing.

CO4: Learn the key and enabling technologies that help in the development of the cloud.

CO5: Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.

TEXTBOOKS:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 2021.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. Rittinghouse, John W., and James F. Ransome, “Cloud Computing: Implementation, Management and Security”, CRC Press, 2017.

REFERENCES:

1. Dan W. Patterson, “Introduction to AI and ES”, Pearson Education, 2007.
2. Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2008.
3. Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006.
4. Deepak Khemani, “Artificial Intelligence”, Tata McGraw Hill Education, 2013.
5. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, “Mastering Cloud Computing”, Tata Mcgraw Hill, 2013.
6. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach", Tata Mcgraw Hill, 2009.
7. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", O'Reilly, 2009.

TOTAL PERIODS: 45

Course Code	QUANTUM COMPUTING	L	T	P	C
AMPEV72X08		3	0	0	3

COURSE OBJECTIVES:

1. To introduce the building blocks of Quantum computers and highlight the paradigm change between conventional computing and quantum computing.
2. To understand the Quantum state transformations and the algorithms.
3. To understand entangled quantum subsystems and properties of entangled states.
4. To explore the applications of quantum computing.

UNIT I: QUANTUM BUILDING BLOCKS **9**

The Quantum Mechanics of Photon Polarization-Single-Qubit Quantum Systems-Quantum State Spaces-Entangled States-Multiple-Qubit Systems-Measurement of Multiple-Qubit States-EPR Paradox and Bell's Theorem-Bloch sphere.

UNIT II: QUANTUM STATE TRANSFORMATIONS **9**

Unitary Transformations-Quantum Gates-Unitary Transformations as Quantum Circuits-Reversible Classical Computations to Quantum Computations-Language for Quantum Implementations

UNIT III: QUANTUM ALGORITHMS **9**

Computing with Superpositions-Quantum Subroutines-Quantum Fourier Transformations-Shor's Algorithm and Generalizations-Grover's Algorithm and Generalizations.

UNIT IV: ENTANGLED SUBSYSTEMS AND ROBUST QUANTUM COMPUTATION **9**

Quantum Subsystems-Properties of Entangled States-Quantum Error Correction-Graph states and codes-CSS Codes-Stabilizer Codes-Fault Tolerance and Robust Quantum Computing.

UNIT V: QUANTUM INFORMATION PROCESSING **9**

Limitations of Quantum Computing-Alternatives to the Circuit Model of Quantum Computation-Quantum Protocols-Building Quantum Computers-Simulating Quantum Systems-Bell States-Quantum Teleportation-Quantum Cryptography-No-cloning theorem.

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

CO1: Understand the basic principles of quantum computing.
CO2: Gain knowledge of the fundamental differences between conventional computing and quantum computing.

CO3: Understand several basic quantum computing algorithms.

CO4: Understand the classes of problems that can be expected to be solved well by quantum computers.
CO5: Simulate and analyze the characteristics of Quantum Computing Systems.

TEXTBOOKS:

Parag K Lala, Mc Graw Hill Education, "Quantum Computing: A Beginner's Introduction", First edition (1 November 2020).

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

Chris Bernhardt, "Quantum Computing for Everyone", The MIT Press; Reprint edition (8 September 2020).

REFERENCES:

John Gribbin, "Computing with Quantum Cats: From Colossus to Qubits", 2021.

William (Chuck) Easttom, "Quantum Computing Fundamentals", 2021.

Parag Lala, "Quantum Computing", 2019.

Eleanor Rieffel and Wolfgang Polak, "Quantum Computing: A Gentle Introduction", 2011.

Nielsen M. A., "Quantum Computation and Quantum Information", Cambridge University Press, 2002.

Benenti G., Casati G. and Strini G., "Principles of Quantum Computation and Information", Vol. I: Basic Concepts, Vol. II: Basic Tools and Special Topics, World Scientific, 2004.

Pittenger A. O., "An Introduction to Quantum Computing Algorithms", 2000.

TOTAL PERIODS: 45

APPENDIX B: OPEN ELECTIVES

Open Electives – I

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			CREDITS
				L	T	P	
1.	MEOE2601	Lean Concepts, Tools and Practices	OEC	3	0	0	3
2.	MEOE2609	Machine Learning for Smart Manufacturing	OEC	3	0	0	3
3.	CEOE2602	Life cycle Assessment	OEC	3	0	0	3
4.	CEOE2605	Environmental Impact Assessment	OEC	3	0	0	3
5.	CSOE2605	Emotional Intelligence	OEC	3	0	0	3

Open Electives – II

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			CREDITS
				L	T	P	
1.	MEOE2701	Technical Writing	OEC	3	0	0	3
2.	EEOE2704	Drinking Water Supply and Treatment	OEC	3	0	0	3
3.	CEOE2704	Geographic Information System	OEC	3	0	0	3
4.	MEOE2705	Renewable Energy Technologies	OEC	3	0	0	3
5.	CSOE2703	Green Computing	OEC	3	0	0	3

Open Electives – I

Course Code	LEAN CONCEPTS, TOOLS AND PRACTICES	L	T	P	C
MEOE2601		3	0	0	3

COURSE OBJECTIVES:

- To impart knowledge about the basics of lean principles, tools and techniques, and implementation in the construction industry.

UNIT I Introduction 9

Introduction and overview of the construction project management - Review of Project Management & Productivity Measurement Systems - Productivity in Construction - Daily Progress Report-The state of the industry with respect to its management practices - construction project phases - The problems with current construction management techniques.

UNIT IILean Management 9

Introduction to lean management - Toyota's management principle-Evolution of lean in construction industry - Production theories in construction –Lean construction value - Value in construction - Target value design - Lean project delivery system- Forms of waste in construction industry - Waste Elimination.

UNIT III Core Concepts in Lean 9

Concepts in lean thinking – Principles of lean construction – Variability and its impact – Traditional construction and lean construction – Traditional project delivery - Lean construction and workflow reliability – Work structuring – Production control.

UNIT IV Lean Tools and Techniques 9

Value Stream Mapping – Work sampling – Last planner system – Flow and pull based production – Last Planner System – Look ahead schedule – constraint analysis – weekly planning meeting- Daily Huddles – Root cause analysis – Continuous improvement – Just in time.

UNIT VLean Implementation in Construction Industry 9

Lean construction implementation- Enabling lean through information technology - Lean in design - Design Structure - BIM (Building Information Modelling) - IPD (Integrated Project Delivery) – Sustainability through lean construction approach.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Explains the contemporary management techniques and the issues in present scenario.
CO2: Apply the basics of lean management principles and their evolution from manufacturing industry to construction industry.
CO3: Develops a better understanding of core concepts of lean construction tools and techniques and their importance in achieving better productivity.
CO4: Apply lean techniques to achieve sustainability in construction projects.
CO5: Apply lean construction techniques in design and modeling.

REFERENCES:

1. Corfe, C. and Clip, B., Implementing lean in construction: Lean and the sustainability agenda, CIRIA, 2013.

2. Shang Gao and Sui Pheng Low, Lean Construction Management: The Toyota Way, Springer, 2014.

3. Dave, B., Koskela, L., Kiviniemi, A., Owen, R., andTzortzopoulos, P., Implementing lean in construction: Lean construction and BIM, CIRIA, 2013.

4. Ballard, G., Tommelein, I., Koskela, L. and Howell, G., Lean construction tools and techniques, 2002.

5. Salem, O., Solomon, J., Genaidy, A. and Luegring, M., Site implementation and Assessment of Lean Construction Techniques, Lean Construction Journal, 2005.

Course Code	MACHINE LEARNING FOR SMART MANUFACTURING	L	T	P	C
MEOE2609		3	0	0	3

COURSE OBJECTIVES:
Impart knowledge of smart manufacturing for industry 4.0 for making student innovative.

UNIT I Industry 4.0 **9**
Concept, Globalization and emerging issues, The Fourth Revolution, LEAN manufacturing, Smart and connected business perspectives, Smart factories.

UNIT II Automation **9**
Programable Logic Controller (PLC) and its Programming software, Communication of different devices with PLC, Sensor, Smart Sensor, HMI design, Cyber Physical System – key components, ISA-95 architecture, CPS-5C architecture, Concept of Digit Twin.

UNIT III Communication **9**
Protocols – MQTT, OPC UA, EtherNet/IP, Profinet, EtherCAT, etc; MQTT – History, MQTT broker, Message types, Quality of Service (QoS), Application; OPC UA – History, Specification, Client, Server, Programming with – Free and open-source software, Propriety software; Augmented Reality.

UNIT IV IoT Platform **9**
Data Modelling, IoT platforms – Thing, basic functionalities, Abstract definition of Thing, Networks, etc; IoT Gateway, Machine interfaces – Cloud-based Mosquitto brokers, Programming with – Free and open-source software, Propriety software.

UNIT V Machine Learning Foundation **9**
Learning algorithms – Supervised, Unsupervised, Self learning, Feature learning, etc. Models – Artificial Neural Networks, Decision trees, Regression analysis, Genetic algorithms, etc.; Programming with – Free and open-source software, Propriety software.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
- Introduce concept of Industry 4.0 for Smart Manufacturing.
- Understand use various hardware used in Smart Manufacturing.
- Understand need of various communication protocols. hardware and software, IoT Layers and their relative importance.
- Understand could-computing IoT platform for Smart Manufacturing.
- Understand machine learning to make smart factories.
- Understand application of hardware, communication protocol, IOT platform, machine learning etc. to implement IoT for smart manufacturing for the need of Industry 4.0.

REFERENCES:
1. Christoph Jan Bartodziej, "The Concept Industry 4.0 – An Empirical Analysis of Technologies and Application in Production Logistics", Spinger Gabler, 2015 2.
2. Alasdair Gilchrist, "Industry 4.0 – The Industrial Internet of Thigs", Springer Link, 2016 3.
3. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications. 4.
4. Michahelles, "Architecting the Internet of Things", ISBN 978-3- 642-19156-5 e-ISBN 978- 3-642-19157-2, Springer. 5.

5. Hakima Chaouchi, “The Internet of Things Connecting Objects to the Web” ISBN : 978-1-84821-140-7, Willy Publications. 6.
6. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things: Key Applications and Protocols”, ISBN: 978-1-119-99435-0, 2nd Edition, Willy Publications 7.
7. W. Botton, “Programmable Logic Controllers”, Fourth Edition, Elsevier, 2006
8. P. Juahs, K. Molnar, “Key Components of the Architecture of Cyber-physical manufacturing systems”, International Scientific Journal “Industry 4.0”, 2017, issue 5, 205- 207
9. Jen-Ruey Jiang, “An improved cyber-physical systems architecture for Industry 4.0 smart factories”, Advances in Mechanical Engineering, 2018, Vol. 10(6) 1-15

Course Code	Life cycle assessment	L	T	P	C
CEOE2602		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are to:

- To impart knowledge and skills on the concept and methodology of Life Cycle Assessment as per international standards and its potential applications
- To develop sustainable products and promote sustainable consumption.
- Understanding of the principles, methodologies, and techniques involved in Life Cycle Assessment (LCA).
- Develop the ability to identify, quantify, and assess the environmental impacts associated with various stages of a product or system's life cycle.
- Learn how to interpret LCA results and communicate findings effectively, including understanding the significance of different impact categories.

Course Description

This course provides an in-depth exploration of the principles, methodologies, and applications of LCA, equipping students with the knowledge and skills necessary to conduct comprehensive environmental assessments and make informed decisions to promote sustainability.

Prerequisites

- Familiarity with the concept of life cycle thinking and systems theory.
- Understanding of fundamental environmental science concepts such as ecology, environmental impacts, and sustainability principles provides a foundational knowledge base for studying LCA.

UNIT I Life Cycle Thinking and Life Cycle Management 9

Introduction to Life Cycle Thinking – Industrial ecology – Life cycle management (LCM) and Stakeholder Expectations - LCM drivers and issues - materials flow analysis - Life cycle of Products and services- International organizations and networks - History and definition of LCA - analytical tools for product and service systems –––Value creation along the life cycle– technical characteristics – applications – limitations

UNIT II LCA Goal, Scope and Inventory 9

ISO 14040 framework for LCA - Life cycle goal and scope definition - function, functional unit and reference flow System boundaries, data categories, inputs and outputs, data quality, critical review and other procedural aspects - Inventory Analysis: Raw Material Extraction and Processing , Manufacturing and Production , Product Use and Consumption , End-of-life Management, Transportation and Distribution - Dealing with Allocation Issues - Solutions to the multi functionality problem - Flow diagram - Format and data categories - Attributional versus consequential LCI – LCA software and database - Data quality - Data collection and relating data to unit processes – Data validation - Cut-off and data estimation .

UNIT III Life Cycle Impact Analysis and Interpretation 9

Characterization factors and principle of characterization - Selection of impact categories, category indicators and characterization models – Classification -Characterization - Optional elements - normalization , grouping, weighting ,data quality analysis - Characterization models – Impact assessment Case studies -Simplified/streamlined Life Cycle Assessments – procedural

approaches, numerical approaches - Examples of numerical approaches - contribution analysis, perturbation analysis, uncertainty - analysis, comparative analysis, key issue analysis – Treatment of uncertainties - Elements in uncertainty handling - Sensitivity of LCA results – Sustainability analysis - Extending LCA - economic dimension, social dimension - Life cycle costing – Eco efficiency - Combining LCA and LCC – Case studies

UNIT IV Design for Environment and Ecolabelling 9

Sustainable consumption – Eco-efficiency - green consumerism - product stewardship and green engineering - Extended producer responsibility – Design For Environment Strategies, Practices, Guidelines, Methods, And Tools .Eco design strategies –Design for Disassembly - Dematerialization, re materialization, trans materialization – Green procurement and green distribution - Analysis framework for reuse and recycling – Typical constraints on reuse and recycling - Communication of Life Cycle Information - Indian eco mark scheme – Environmental product declarations – Environmental marketing

UNIT V LCA Softwares and Case Studies 9

LCA Softwares - LCA Software Demo: SimaPro, GREET, BEES, CMU EIO,GABI - Advances in LCA: Hybrid LCA, Thermodynamic LCA - LCA case studies on Product Design, Product Improvement, Product Comparison and Policy development.

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by industry Experts, Group discussions and presentations, online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

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

CO1: Explain the various functional elements of Life Cycle Analysis and Design for Environment

CO2: Apply the knowledge of science and engineering fundamentals to characterize the environmental interactions of products and services

CO3: Design of engineering systems taking into account the material flow and pollutant interactions between engineering decisions and the environment

CO4: Select appropriate LCA tools to support product/process design and decision making, taking into account the impact of the solutions in a sustainability context

CO5: Evaluate generative models using appropriate metrics and critically analyse the ethical implications, privacy concerns, and societal impact of generative AI technologies.

TEXT BOOKS:

1. Ralph Horne, Tim Grant, Karli Verghese, Life Cycle Assessment: Principles, Practice and Prospects, Csiro Publishing, 2009.

REFERENCES:

1. ISO 14040-2016-Environmental management - Life cycle assessment - Principles and framework, International Organization for Standardization, 2016.

2. ISO/TR 14047:2003, Environmental management - Life cycle impact assessment - Examples of application of ISO 14042, International Organization for Standardization, 2007.
3. International Organization for Standardization: ISO TR 14062 Environmental management Integrating environmental aspects into product design and development, 2002.
4. European Commission - Joint Research Centre - Institute for Environment and Sustainability: International Reference Life Cycle Data System (ILCD) Handbook – General guide for Life Cycle Assessment - Detailed guidance. Luxembourg. European Union; 2010.
5. Catherine Benoit, UQAM/CIRAIG, and Bernard Mazijn, Guidelines for Social Life Cycle Assessment of Products, United Nations Environment Programme,2009

TOTAL: 45 PERIODS

YouTube Resources:

1. **Sustainable Minds -** Sustainable Minds is a provider of cloud-based software and services for sustainable product development.
2. **Life Cycle Assessment – SimaPro** - SimaPro is one of the leading software tools for conducting Life Cycle Assessments.
3. **European Commission – JRC** - The Joint Research Centre (JRC) of the European Commission produces research and technical reports on a wide range of topics, including environmental sustainability and Life Cycle Assessment.
4. **Life Cycle Initiative** - The Life Cycle Initiative, hosted by the United Nations Environment Programme (UNEP), promotes the use of life cycle approaches for sustainable development.
5. **LCA Learning** - This channel offers various educational videos on Life Cycle Assessment, including tutorials, case studies, and discussions on LCA methodology and applications:

Course Code	Environmental Impact Assessment	L	T	P	C
CEOE2605		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are to:

- To expose the students to the need, methodology, documentation and usefulness of environmental impact assessment and to develop the skill to prepare environmental management plan.
- To participate in the performance of an environmental assessment process (EIA or SEA), given the disciplinary knowledge and skills in natural sciences and engineering the student have achieved in other courses.

Course Description

This course provides an introduction to the theory and practical applications of environmental impact. Students will learn the fundamental concepts and techniques related to environmental impact and gain hands-on experience with creating and using environmental impact assessment.

Prerequisites

- Basic knowledge of environmental impact assessment.
- Familiarity with an environmental issues

UNIT I Introduction **9**

Historical development of Environmental Impact Assessment (EIA). Environmental Clearance- EIA in project cycle. legal and regulatory aspects in India – types and limitations of EIA –EIA process screening – scoping - terms of reference in EIA- setting – analysis – mitigation. Cross sectoral issues –public hearing in EIA- EIA consultant accreditation.

UNIT II Impact Identification And Prediction **9**

Matrices – networks – checklists – cost benefit analysis – analysis of alternatives – expert systems in EIA. Prediction tools for EIA – mathematical modelling for impact prediction – assessment of impacts – air – water – soil – noise – biological –– cumulative impact assessment

UNIT III Socio-Economic Impact Assessment **9**

Socio-economic impact assessment - relationship between social impacts and change in community and institutional arrangements. factors and methodologies- individual and family level impacts. communities in transition-rehabilitation

UNIT IV EIA Documentation And Environmental Management Plan **9**

Environmental management plan - preparation, implementation and review – mitigation and rehabilitation plans – policy and guidelines for planning and monitoring programmes – post project audit – documentation of EIA findings – ethical and quality aspects of environmental impact assessment

UNIT V Case Studies **9**

Mining, power plants, cement plants, highways, petroleum refining industry, storage & handling of hazardous chemicals, common hazardous waste facilities, CETPs, CMSWMF, building and construction projects.

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

OUTCOMES: Upon completion of the course, the students are expected to be able to:

CO1: Carry out scoping and screening of developmental projects for environmental and social Assessments
CO2: Explain different methodologies for environmental impact prediction and assessment.
CO3: Assessing socio-economic investigation of the environment as a project.
CO4: Plan environmental impact assessments and environmental management plans.
CO5: Knowledge to prepare environmental impact assessment reports for various projects.

TEXT BOOKS:

1. Canter, L.W., "Environmental Impact Assessment", McGraw Hill, New York. 1996.
2. Lawrence, D.P., "Environmental Impact Assessment – Practical solutions to recurrent problems",Wiley-Interscience, New Jersey. 2003 .

REFERENCES:

1. World Bank –Source book on EIA
2. Cutter, S.L., "Environmental Risk and Hazards", Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
3. Kolluru Rao, Bartell Steven, Pitblado R and Stricoff "Risk Assessment and Management Handbook", McGraw Hill Inc., New York,1996.
4. K.V.Raghavan and A A. Khan, "Methodologies in Hazard Identification and Risk Assessment",Manual by CLRI, 1990.

TOTAL :45 PERIODS

YouTube Resources:

1. **IIT Roorkee**- EIA is basically a tool used to assess the positive and negative environmental, economic and social impacts of a project.
2. **Science Sauce** - Explaining tricky Science concepts in as little time as possible. All content created by Alex Nixon..
3. **Border Archaeology** - They are mandated by The Town and Planning Regulations 2011 for projects falling under Schedule 1 and may also be sought by a local planning authority for Schedule 2-type projects following project screening and scoping..
4. **Sustainable Technology Solutions** - The relevance of EIA lies in its ability to ensure that projects are designed and implemented in a way that minimizes environmental harm and promotes sustainable development.
5. **Sigma Earth** - Climate change refers to long-term shifts in temperatures and weather patterns. Human activities have been the main driver of climate change, primarily due to the burning of fossil fuels like coal, oil and gas..

Course Code	EMOTIONAL INTELLIGENCE	L	T	P	C
CSOE2606		3	0	0	3

COURSE OBJECTIVES:

1. To know the theoretical background of cognition.
2. To understand the link between cognition and computational intelligence.
3. To explore probabilistic programming language.
4. To study the computational inference models of cognition.
5. To study the computational learning models of cognition.

UNIT I INTRODUCTION TO EMOTIONAL INTELLIGENCE **9**

Meaning of Emotions, Emotional Intelligence- Importance- Models of Emotional Intelligence- Social Intelligence- IQ and EQ- Self Awareness- Social Skills – Relationship Management- EI and Motivation.

UNIT II UNDERSTANDING EMOTIONS **9**

The Brain and Emotion - The Relationship of Mood and Emotion - The Role of Emotion in Organizational Health and the Bottom Line - Types of Emotions- Control of Emotions
Gender Differences in Emotion - Impulse Control- Marshmallow Experiment- Negative and Positive Emotions – Emotion and Health

UNIT III MANAGING EMOTIONS **9**

Learning EI – Emotional Self Awareness – EI Assessment Tools - Emotional Intelligence and Psychological Adjustment - Issues in Anxiety, Stress, Depression, Anger, Self Esteem and Self Management Empathy

UNIT IV EI PRACTICE IN ORGANIZATIONS **9**

Emotional Intelligence and Decision Making - EI and Personality- Work Frustrations- EI and Work Performance- EI and Leadership - EI and Job Stress – EI and Information Processing - EI and Communication – Goal Conflict – EI and Conflict Resolution – EI and Work Place Diversity – Group EI – Star Performers

UNIT V EMOTIONAL COMPETENCE **9**

Developing EI in Organization – Transformation and Change – Training, Transfer, Maintenance and Evaluating Change - Emotional Quality Management.

NUMBER OF THEORY PERIODS: 45

COURSE OUTCOMES:

On completion 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.

TEXTB CUM REFERENCE BOOKS:

1. Ciarruchi, J., Forgas, J. and Mayer, John. (2001) Emotional Intelligence in Everyday

Life: A Scientific Inquiry. Psychology Press: Philadelphia, PA.

2. Daliph Singh (2001) Emotional Intelligence At Work: A Professional Guide. Response Books: New Delhi

3. Daniel Goleman, (1996) Emotonal Intelligence: Why It can Matter More Than IQ.

Bantam Books: NewYork.

4. Doty, G. (2001). Fostering Emotional Intelligence in K-8 Students. Corwin Press:

Thousand Oaks, CA.

5. Oatley, K and Jenkins, J (2000) Understanding Emotions. Malden MA: Blackwell

Course Code	TECHNICAL WRITING	L	T	P	C
MEOE2701		3	0	0	3

COURSE OBJECTIVES:

- To understand the present complex information in a clear and easily understandable way to the target audience, which involves breaking down intricate concepts into simpler terms and providing clear explanations.

UNIT I Introduction to Technical Writing 9

Characteristics of Technical Writing - Rhetorical awareness - Ethics - Steps in the technical writing process- Prewriting for technical documents-Understanding audience and purpose, Primary and secondary research - Surveys and interviews - Research methods

UNIT IIComponents of Technical Documents 9

Introductions – Abstracts – Definitions – Titles and headings - Effective visual design – Summaries – Technical descriptions – conclusions

UNIT III Types of Technical Report 9

Formal Technical Reports - Progress and research reports - Incidence reports - Feasibility reports - Evaluation reports – Analytical and informational reports - Executive summaries.

UNIT IV Language 9

Style – Accuracy – Brevity – Clarity – Tone – Vocabulary – Formal and impersonal language – Structure of the report - Plagiarism.

UNIT VWriting Proposals 9

Nature and significance –Types of proposals - Persuasive elements - Request for proposals – Structure and parts of a proposal

TOTAL: 45 PERIODS

COURSE OUTCOMES: On successful completion of this course, the student will be able to

CO1: Acquire a working knowledge of writing strategies, formats and templates of professional writing.

CO2: Analyse communication-related problems of technical documents from number of genres.

CO3: Use visuals to communicate a large amount of information quickly and efficiently

CO4: Enhance writing skills to produce effective reports confidently

TEXT BOOKS:

1. Daniel G. Riordan, Steven E. Pauley, Biztantra: Technical Report Writing Today, 8th Edition (2004).
2. Rizvi M Ashraf, (2005). Effective Technical Communication. McGraw Hill Education (India) Pvt. Ltd. New Delhi.
3. Alred, G. (2011). Handbook of Technical Writing (10th ed.). New York: St Martin's. (OPTIONAL)

REFERENCES:

1. M. Frank. Writing as thinking: A guided process approach, Englewood Cliffs, Prentice Hall Reagents.

2. R. Quirk, S. Greenbaum, G. Leech and J. Svartik: A comprehensive grammar of the English language, Longman, London.

3. Daniel G. Riordan & Steven A. Panley: "Technical Report Writing Today" - Biztaantra.

Course Code	Drinking water supply and treatment	L	T	P	C
EEOE2704		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are to:

- To equip the students with the principles and design of water treatment units and distribution system.
- To understand the sources of water and their characteristics.
- To gain knowledge of conveyance systems, including pipes, conduits, and pumps.
- To understand the principles and processes of water treatment, including coagulation, filtration, and disinfection.
- To explore advanced water treatment technologies such as desalination, membrane systems, and ion exchange.

Course Description

This course provides students with an in-depth understanding of water supply systems, including the planning, design, and operation of water sources, conveyance systems, treatment plants, and distribution networks. Students will learn about the characteristics of different water sources, the design of intake structures and transmission mains, principles and processes of water treatment, advanced water treatment technologies, and the design and operation of water distribution systems.

Prerequisites

- Basic knowledge of fluid mechanics and hydraulics.
- Understanding of environmental science and water quality parameters.
- Familiarity with engineering design principles.

UNIT I Sources of Water **9**

Public water supply system – Planning, Objectives, Design period, Population forecasting; Water demand – Sources of water and their characteristics, Surface and Groundwater – Impounding Reservoir – Development and selection of source – Source Water quality – Characterization – Significance – Drinking Water quality standards.

UNIT II Conveyance from the Source **9**

Water supply–in take structures–Functions; Pipes and conduits for water –Pipe materials – Hydraulics of flow in pipes –Transmission main design – Laying, jointing and testing of pipes – appurtenances – Types and capacity of pumps – Selection of pumps and pipe materials.

UNIT III Water Treatment **9**

Objectives–Unitoperationsandprocesses–Principles,functions,anddesignofwater treatmentplantunits,aeratorsofflashmixers,Coagulationandflocculation––sandfilters-Disinfection–Construction,OperationandMaintenance aspects.

UNIT IV Advanced Water Treatment **9**

Water softening – Desalination- R.O. Plant – demineralization –Adsorption – Ion exchange– Membrane Systems – Iron and Manganese removal – Defluoridation – Construction and Operation and Maintenance aspects

UNIT V Water Distribution and Supply **9**

Requirements of water distribution – Components – Selection of pipe material – Service reservoirs – Functions – Network design – Economics – Computer applications – Appurtenances–Leak detection Principles of design of water supply in buildings – House service connection–Fixtures and fittings ,systems of plumbing and types of plumbing

Course Format

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by industry Experts, Group discussions and presentations, Online resources and tutorials

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

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

CO1 An understanding of water quality criteria and standards, and their relation to public health
CO2 The ability to design the water conveyance system
CO3 The knowledge in various uni tope rations and processes in water treatment
CO4 An ability to understand the various systems for advanced water treatment

TEXT BOOKS:

1. Garg. S.K., "Water Supply Engineering", Khanna Publishers, Delhi, September 2008.
2. Punmia B.C,ArunK.Jain,Ashok K.Jain, " Water supply Engineering" Lakshmi publication private limited, New Delhi, 2016.
3.. Rangwala"WaterSupplyandSanitaryEngineering",February2022
4. Birdie.G.S., "Water Supply and Sanitary Engineering", Dhanpat Rai and sons, 2018.

REFERENCES:

1. Fair.G.M.,Geyer.J.C.,"WaterSupplyandWastewaterDisposal",JohnWileyand Sons, 1954.
2. Babbit.H.E,andDonald.J.J,"WaterSupplyEngineering",McGrawHillbookCo, 1984.
3. Steel. E.W.et al., "Water Supply Engineering" , Mc Graw Hill International book Co, 1984.
4. Duggal.K.N.,"ElememtsofpublicHealthEngineering",S.ChandandCompanyLtd,NewDelhi,1998.

YouTube Resources:

1. https://youtu.be/yZwfcMSDBHs?si=h-va7awNWu862fMB
2. https://youtu.be/ZQKpu-obzlU?si=0DUbNWO0rw7RPq_q
3. https://youtu.be/u4k2XY-fJJY?si=5EQUC2t6NuJlFhEx
4. https://youtu.be/Ki8LmnPt6qE?si=5X2oJ-3vltWlT35I
5. https://youtu.be/iyVdiQonEA0?si=9OoaiwtiHGKablZj

TOTAL: 45 PERIODS

Course Code	Geographic Information System	L	T	P	C
CEOE2704		3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are to:

- Introduce concepts of Cartography and GIS
- Expose the process of map making and production
- Introduce GIS data structures, data input and data presentation Apply principles of sustainability and resilience to civil infrastructure projects.

Course Description

This course provides an introduction on concepts and principles of mapping the surface components, geographical terrain projection, Data inputs and Topology.

Prerequisites

- Basic knowledge in Engineering and Geographic surveys.
- Familiarity with computer software for engineering analysis and design, such as AutoCAD, QGIS (Geographic Information Systems).

UNIT I Elements Of Cartography **9**

Definition of Cartography – Maps – Functions – Uses and Types of Maps – Map Scales and Contents – Map Projections – Shape, Distance, Area and Direction Properties – Perspective and mathematical Projections – Indian Maps and Projections – Map Co-ordinate System – UTM and UPS References.

UNIT II Map Design and Production **9**

Elements of a Map – Map Layout Principles – Map Design Fundamentals – Symbols and Conventional Signs – Graded and Ungraded Symbols – Color Theory – Colours and Patterns in Symbolization – Map Lettering – Map Production – Map Printing – Colours and Visualization – Map Reproduction – Map Generalization – Geometric Transformations – Bilinear and Affine Transformations.

UNIT III Fundamentals Of GIS **9**

Introduction to GIS – Definitions – History of GIS – Components of a GIS – Hardware, Software, Data, People, Methods – Introduction to data quality – Types of data – Spatial, Attribute data – types of attributes – scales/levels of measurements – spatial data models – Raster Data Structures – Raster Data Compression – Vector Data Structures – Raster Vs Vector Models – TIN and GRID data models.

UNIT IV Data Input And Topology **9**

Image Scanner – Raster Data Input – Raster Data File Formats – Georeferencing – Vector Data Input – Digitizer– Datum Projection and Reprojection – Coordinate Transformation – Topology - Adjacency, Connectivity and containment – Topological Consistency – Non topological file formats – Attribute Data Linking – Linking External Databases – GPS Data Integration – Raster to Vector and Vector to Raster Conversion.

UNIT V Data Quality And Output **9**

Assessment of Data Quality – Basic Aspects – Completeness, Logical Consistency, Positional Accuracy, Temporal Accuracy, Thematic Accuracy and Lineage – Metadata – GIS Standards – Interoperability – OGC – Spatial Data Infrastructure – Data Output – Map Compilation – Chart / Graphs.

Course Format

Lectures and discussions, Hands-on projects, Guest lectures by industry Experts, Group discussions and presentations, Online resources and tutorials.

Assessments & Grading

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

COURSE OUTCOMES:

OUTCOMES: Upon completion of the course, the student is expected to:

CO1: Be familiar with appropriate map projection and co-ordinate system for production of Maps and shall able to compile and design maps for their required purpose.
CO2: Be familiar with co-ordinate and Datum transformations
CO3: Understand the basic concepts and components of GIS, the techniques used for storage of spatial data and data compression
CO4: Understand the concepts of spatial data quality and data standard
CO5: Understand the concept of spatial data inputs

TEXT BOOKS:

1. Arthur H. Robinson et al, “Elements of Cartography”, 7th Edition, Wiley, 2002.
2. Kang – Tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill Publishing, Fourth Edition, 2017.
3. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, “An Introduction to Geographical Information Systems, Pearson Education, Fourth Edition, 2011.

REFERENCES:

1. John Campbell, "Introductory Cartography", Wm. C.BrownPublishers,3rd Edition,2004
2. Chor Pang LO, Albert K. W. Yeung, “Concepts and Techniques of Geographic Information Systems”, Pearson Education, 2nd Edition, November 2016. ISBN: 9789332581883

TOTAL:45 PERIODS

YouTube Resources:

1. **Esri** – Esri is a leading provider of GIS software and solutions. Their YouTube channel features tutorials, webinars, case studies, and product demonstrations related to ArcGIS, one of the most widely used GIS platforms globally.
2. **GIS Tutorial** - This channel offers tutorials and guides for learning GIS concepts, software usage (especially ArcGIS), and practical applications in various fields such as urban planning, environmental science, and engineering.
3. **GeoSpatial Training** - GeoSpatial Training provides video tutorials and webinars covering a wide range of GIS topics, including software tutorials, data analysis techniques, and industry-specific applications.
4. **QGIS Tutorials and Tips** - QGIS is an open-source GIS software alternative to ArcGIS. This channel offers tutorials, tips, and tricks for using QGIS effectively, covering topics from basic to advanced functionalities.
5. **MapScaping** - MapScaping produces informative videos on GIS, cartography, remote sensing, and geospatial technologies. Their content includes tutorials, interviews with GIS professionals, and discussions on emerging trends in the field.

Course Code	RENEWABLE ENERGY TECHNOLOGIES	L	T	P	C
MEOE2705		3	0	0	3

COURSE OBJECTIVES:

- To know the Indian and global energy scenario
- To learn the various solar energy technologies and its applications.
- To educate the various wind energy technologies.
- To explore the various bio-energy technologies.
- To study the ocean and geothermal technologies.

UNIT I Energy Scenario **9**

ndian energy scenario in various sectors – domestic, industrial, commercial, agriculture, transportation and others – Present conventional energy status – Present renewable energy status.Potential of various renewable energy sources-Global energy status-Per capita energy consumption - Future energy plans.

UNIT II Solar Energy **9**

Solar radiation – Measurements of solar radiation and sunshine – Solar spectrum - Solar thermal collectors – Flat plate and concentrating collectors – Solar thermal applications – Solar thermal energy storage – Fundamentals of solar photo voltaic conversion – Solar cells – Solar PV Systems – Solar PV applications

UNIT III Wind Energy **9**

Wind data and energy estimation – Betz limit - Site selection for windfarms – characteristics - Wind resource assessment - Horizontal axis wind turbine – components - Vertical axis wind turbine – Wind turbine generators and its performance – Hybrid systems – Environmental issues – Applications.

UNIT IV Bio-Energy **9**

io resources – Biomass direct combustion – thermochemical conversion - biochemical conversionmechanical conversion - Biomass gasifier - Types of biomass gasifiers - Cogeneration –- Carbonisation – Pyrolysis - Biogas plants – Digesters –Biodiesel production – Ethanol production – Applications

UNIT V Ocean and geothermal energy **9**

Small hydro - Tidal energy – Wave energy – Open and closed OTEC Cycles – Limitations – Geothermal energy – Geothermal energy sources - Types of geothermal power plants – Applications - Environmental impact **TOTAL: 45 PERIODS**

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Discuss the Indian and global energy scenario.
CO2: Describe the various solar energy technologies and its applications.
CO3: Explain the various wind energy technologies.
CO4: Explore the various bio-energy technologies.
CO5: Discuss the ocean and geothermal technologies.

TEXT BOOKS:

1. Fundamentals and Applications of Renewable Energy | Indian Edition, by Mehmet Kanoglu, Yunus A. Cengel, John M. Cimbala, cGraw Hill; First edition (10 December 2020), ISBN-10 : 9390385636

2. Renewable Energy Sources and Emerging Technologies, by Kothari, Prentice Hall India Learning Private Limited; 2nd edition (1 January 2011), ISBN-10 : 812034470

REFERENCES:

1. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 2012.
2. Rai.G.D., "Non-Conventional Energy Sources", Khanna Publishers, New Delhi, 2014.
3. Sukhatme.S.P., "Solar Energy: Principles of Thermal Collection and Storage", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2009.
4. Tiwari G.N., "Solar Energy – Fundamentals Design, Modelling and applications", Alpha Science Intl Ltd, 2015.
5. Twidell, J.W. & Weir A., "Renewable Energy Resources", EFNSpon Ltd., UK, 2015

Course Code	GREEN COMPUTING	L	T	P	C
CSOE2703		3	0	0	3

COURSE OBJECTIVES:

1. Understand the fundamentals, significance, and regulations shaping the field of green computing.
2. Implement techniques to enhance energy efficiency in computing systems and embrace sustainable practices.
3. Develop eco-friendly software solutions, incorporating energy-efficient coding practices and sustainable software design.
4. Design and manage data centers with a focus on energy efficiency and environmentally responsible practices.
5. Equip students with knowledge to manage electronic waste responsibly, emphasizing reuse, recycling, and regulatory compliance.

UNIT I FOUNDATIONS OF GREEN COMPUTING **9**

Introduction to Green Computing, Significance and Global Relevance, Environmental Challenges in Computing, Energy Consumption in Computing, Electronic Waste and Resource Depletion, Green Policies and Regulations, Compliance with Environmental Standards, Case Studies in Sustainable Computing.

UNIT II OPTIMIZING ENERGY CONSUMPTION **9**

Techniques for Reducing Energy Consumption, Power Management Strategies, Energy-efficient Hardware Design, Sustainable Software Development, Virtualization and Server Consolidation, Energy-aware Algorithms, Renewable Energy Integration, Best Practices in Energy Optimization.

UNIT III GREEN SOFTWARE PRACTICES **9**

Principles of Green Software, Code Optimization for Energy Efficiency, Sustainable Software Design Patterns, Energy-efficient Algorithms, Software Development Lifecycle and Green Computing, Case Studies in Green Software Development, Hands-on Coding Exercise, Collaboration Between Developers and Environmental Experts

UNIT IV BUILDING ECO-FRIENDLY DATA CENTERS **9**

Green Data Center Concepts, Cooling and Climate Control Innovations, Server Virtualization and Consolidation, Sustainable Server and Storage Solutions, Energy-efficient Hardware Selection, Monitoring and Optimization Tools, Data Center Certification Standards, Group Workshop: Designing a Green Data Center.

UNIT V RESPONSIBLE E-WASTE PRACTICES **9**

Understanding Electronic Waste (E-waste), E-waste Collection and Recycling Programs, Reuse and Upcycling of Computing Equipment, Eco-friendly Disposal Practices, Regulatory Compliance in E-waste Management, Community Engagement for E-waste Awareness, Student-led E-waste Collection Drive, Final Project Presentations and Reflections.

NUMBER OF THEORY PERIODS : 45

COURSE OUTCOMES:

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

CO1 Understand environmental impact, regulations, and ethical considerations influencing sustainable computing practices globally.

CO2 Apply strategies for energy efficiency and renewable energy integration in computing systems effectively.

CO3 Develop eco-friendly software, employing energy-efficient coding, sustainable design patterns, and lifecycle assessment principles.

CO4 Design and manage data centers with a focus on energy efficiency, eco-friendly hardware, and certifications.

CO5 Lead e-waste initiatives, ensuring ethical disposal, regulatory compliance, and community engagement for sustainability.

TEXTBOOKS:

1. "Green IT for Dummies" by Carol Baroudi (2022)
2. "Energy Efficient Servers: Blueprints for Data Center Optimization" by Corey Gough (2021)
3. "Sustainable Software Development: An Agile Perspective" by Kevin Carlson (2023)
4. "Designing Green Data Centers" by Bill Kleyman (2022)
5. "E-Waste in Transition: From Pollution to Resource" by Flor Avelino (2021)

REFERENCES:

1. "Green Computing: Tools and Techniques for Saving Energy, Money, and Resources" by Bud E. Smith (2023)
2. "Energy-Efficient Distributed Computing Systems" by Albert Y. Zomaya (2022)
3. "Sustainable Software Architecture: A Framework for Modern Enterprise Applications" by Carola Lilienthal (2023)
4. "Data Center Handbook" by Hwaiyu Geng (2021)
5. "Electronic Waste Management and Treatment Technology" by Majeti Narasimha Vara Prasad (2022)

APPENDIX C: MANDATORY COURSES

Mandatory Course – I (MC)

S. No.	Course Title	Semester	L	T	P	C
1.	Well Being with Traditional Practices Yoga Ayurveda and Sidda	II	2	0	0	0
2.	Elements of Literature	II	2	0	0	0
3.	Film Appreciation	II	2	0	0	0
4.	Disaster Risk Reduction and Management	II	2	0	0	0
5.	Environmental Sciences and Sustainability	II	2	0	0	0
Total Credits			**0**			

Mandatory Course – II (MC)

S. No.	Course Title	Semester	L	T	P	C
1.	Introduction to Women and Gender Studies	III	2	0	0	0
2.	History of Science and Technology in India	III	2	0	0	0
3.	Political and Economic Thought for a Human Society	III	2	0	0	0
4.	State, Nation Building and Politics in India	III	2	0	0	0
5.	Industrial Safety	III	2	0	0	0
Total Credits			**0**			

MANDATORY COURSE I

Course Code	WELL-BEING WITH TRADITIONAL PRACTICES, AYURVEDA AND SIDDHA	L	T	P	C
MC2301		3	0	0	0

COURSE OBJECTIVES:

1. To enjoy life happily with fun-filled new style activities that help to maintain health also
2. To adapt a few lifestyle changes that will prevent many health disorders
3. To be cool and handbill every emotion very smoothly in every walk of life
4. To learn to eat cost-effective but healthy foods that are rich in essential nutrients
5. To develop immunity naturally that will improve resistance against many health disorders

UNIT I HEALTH AND ITS IMPORTANCE 2+4

Health: Definition - Importance of maintaining health - More importance on prevention than treatment Ten types of health one has to maintain - Physical health - Mental health - Social health - Financial health - Emotional health - Spiritual health - Intellectual health - Relationship health - Environmental health - Occupational/Professional health.

Present health status - The life expectancy-present status - mortality rate - dreadful diseases - Non-communicable diseases (NCDs) the leading cause of death - 60% - heart disease – cancer – diabetes - chronic pulmonary diseases - risk factors – tobacco – alcohol - unhealthy diet - lack of physical activities.

Types of diseases and disorders - Lifestyle disorders – Obesity – Diabetes - cardiovascular diseases – Cancer – Strokes – COPD - Arthritis - Mental health issues.

Causes of the above diseases/disorders - Importance of prevention of illness - Takes care of health - Improves quality of life - Reduces absenteeism - Increases satisfaction - Saves time.

Simple lifestyle modifications to maintain health - Healthy Eating habits (Balanced diet according to age) Physical Activities (Stretching exercise, aerobics, resisting exercise) - Maintaining importance and actions to be taken

UNIT II DIET 9

Role of diet in maintaining health - energy one needs to keep active throughout the day - nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, such as some cancers - keeps active and - helps one to maintain a healthy weight - helps to reduce risk of developing lifestyle disorders like diabetes – arthritis – hypertension – PCOD – infertility – ADHD – sleeplessness -helps to reduce the risk of heart diseases - keeps the teeth and bones strong.

Balanced Diet and its 7 Components - Carbohydrates – Proteins – Fats – Vitamins – Minerals - Fibre and Water.

Food additives and their merits & demerits - Effects of food additives - Types of food additives - Food additives and processed foods - Food additives and their reactions

Definition of BMI and maintaining it with diet Importance - Consequences of not maintaining BMI - different steps to maintain optimal BM

Common cooking mistakes Different cooking methods, merits and demerits of each method.

UNIT III ROLE OF AYURVEDA & SIDDHA SYSTEMS IN MAINTAINING HEALTH 4+4

AYUSH systems and their role in maintaining health - preventive aspect of AYUSH - AYUSH as a soft therapy.

Secrets of traditional healthy living - Traditional Diet and Nutrition - Regimen of Personal and Social Hygiene - Daily routine (Dinacharya) - Seasonal regimens (Ritucharya) - basic sanitation and healthy living environment - Sadvritta (good conduct) - for conducive social life.

Principles of Siddha & Ayurveda systems - Macrocosm and Microcosm theory - Pancheekarana Theory / (Five Element Theory) 96 fundamental Principles - Uyir Thathukkal (Tri-Dosha Theory) - Udal Thathukkal

Prevention of illness with our traditional system of medicine Primary Prevention - To decrease the number of new cases of a disorder or illness - Health promotion/education, and - Specific protective measures - Secondary Prevention - To lower the rate of established cases of a disorder or illness in the population (prevalence) - Tertiary Prevention - To decrease the amount of disability associated with an existing disorder.

UNIT IV MENTAL WELLNESS 3+4

Emotional health - Definition and types - Three key elements: the subjective experience - the physiological response - the behavioural response - Importance of maintaining emotional health - Role of emotions in daily life – Short term and long-term effects of emotional disturbances - Leading a healthy life with emotions - Practices for emotional health - Recognize how thoughts influence emotions - Cultivate positive thoughts - Practice self-compassion - Expressing a full range of emotions.

Stress management - Stress definition - Stress in daily life - How stress affects one's life - Identifying the cause of stress - Symptoms of stress - Managing stress (habits, tools, training, professional help) - Complications of stress mismanagement.

Sleep - Sleep and its importance for mental wellness - Sleep and digestion.

Immunity - Types and importance - Ways to develop immunity

UNIT V YOGA 9

Definition and importance of yoga - Types of yoga - How to Choose the Right Kind for Individuals according to their age - The Eight Limbs of Yoga - Simple yogasan as for cure and prevention of health disorders - What yoga can bring to our life.

TOTAL NUMBER OF PERIODS: **45**

COURSE OUTCOMES:

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

CO1 Learn the importance of different components of health

CO2 Gain confidence to lead a healthy life

CO3 Learn new techniques to prevent lifestyle health disorders

CO4 Understand the importance of diet and workouts in maintaining health

TEXTBOOKS:

1. Nutrition and Dietetics - Ashley Martin, Published by White Word Publications, New York, NY 10001, USA

2. Yoga for Beginners_ 35 Simple Yoga Poses to Calm Your Mind and Strengthen Your Body, by Cory Martin, Copyright © 2015 by Althea Press, Berkeley, California

REFERENCES:

1. WHAT WE KNOW ABOUT EMOTIONAL INTELLIGENCE How It Affects Learning, Work, Relationships, and Our Mental Health, by Moshe Zeidner, Gerald Matthews, and Richard D. Roberts

2. A Bradford Book, The MIT Press, Cambridge, Massachusetts, London, England The Mindful Self-Compassion Workbook, Kristin Neff, Ph. D Christopher Germer, Ph. D, Published by The Guilford Press A Division of Guilford Publications, Inc.370 Seventh Avenue, Suite 1200, New York, NY 10001.

Web Reference:

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4799645/

2. Simple lifestyle modifications to maintain health

https://www.niddk.nih.gov/health-information/diet-nutrition/changing-habits-better-health#:~:text=Make%20your%20new%20healthy%20habit,t%20have%20time%20to%20cook.

3. Read more: https://www.legit.ng/1163909-classes-food-examples-functions.html

4. https://www.yaclass.in/p/science-state-board/class-9/nutrition-and-health-5926

5. Benefits of healthy eating https://www.cdc.gov/nutrition/resources-publications/benefits-ofhealthy-eating.html

6. Food additives

https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/foodadditives

7. BMI https://www.hsph.harvard.edu/nutritionsource/healthy-weight/

   https://www.who.int/europe/news-room/fact-sheets/item/a-healthy-lifestyle---whorecommendations

8. Yoga https://www.healthifyme.com/blog/types-of-yoga/

   https://yogamedicine.com/guide-types-yoga-styles/

   Ayurveda : https://vikaspedia.in/health/ayush/ayurveda-1/concept-of-healthy-living-in-ayurveda

9. Siddha : http://www.tkdl.res.in/tkdl/langdefault/Siddha/Sid_Siddha_Concepts.asp

10. CAM : https://www.hindawi.com/journals/ecam/2013/376327/

11. Preventive herbs : https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3847409

Course Code	ELEMENTS OF LITERATURE	L	T	P	C
MC2302		3	0	0	0

COURSE OBJECTIVES:

1. To make the students aware about the finer sensibilities of human existence through an art form. The students will learn to appreciate different forms of literature as suitable modes of expressing human experience.

UNIT I INTRODUCTION TO ELEMENTS OF LITERATURE 9

Relevance of literature a) Enhances Reading, thinking, discussing and writing skills. b) Develops finer sensibility for better human relationship. c) Increases understanding of the problem of humanity without bias. d) Providing space to reconcile and get a cathartic effect.

UNIT II ELEMENTS OF FICTION 9

a) Fiction, fact and literary truth.

b) Fictional modes and patterns.

c) Plot character and perspective.

UNIT III ELEMENTS OF POETRY 9

a) Emotions and imaginations. b) Figurative language. c) (Simile, metaphor, conceit, symbol, pun and irony). d) Personification and animation. e) Rhetoric and trend.

UNIT IV ELEMENTS OF DRAMA 9

a) Drama as representational art. b) Content mode and elements. c) Theatrical performance. d) Drama as narration, mediation and persuasion. e) Features of tragedy, comedy and satire.

UNIT V OTHER SESSION 9

Tutorials:

Laboratory:

Project: The students will write a term paper to show their understanding of a particular piece of literature

ASSESSMENT:

HA:

Quizzes-HA:

Periodical Examination: one

Project/Lab: one (under the guidance of the teachers the students will take a volume of poetry, fiction or drama and write a term paper to show their understanding of it in a given context; sociological, psychological, historical, autobiographical etc.

Final Exam:

TOTAL NUMBER OF PERIODS: 45

COURSE OUTCOMES:

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

CO1 Students will be able to understand the relevance of literature in human life and appreciate

its aspects in developing finer sensibilities.

READINGS

1. An Introduction to the Study of English Literature, W.H. Hudson, Atlantic, 2007.
2. An Introduction to Literary Studies, Mario Klarer, Routledge, 2013.
3. The Experience of Poetry, Graham Mode, Open college of Arts with Open Unv Press,1991.
4. The Elements of Fiction: A Survey, Ulf Wolf (ed), Wolfstuff, 2114.
5. The Elements of Drama, J.L.Styan, Literary Licensing, 2011.

REFERENCES:

1. To be decided by the teacher and student, on the basis of individual student so as to enable him or her to write the term paper**.**

Course Code	FILM APPRECIATION	L	T	P	C
MC2303		3	0	0	0

COURSE OBJECTIVES:

1. In this course on film appreciation, the students will be introduced broadly to the development of film as an art and entertainment form. It will also discuss the language of cinema as it evolved over a century. The students will be taught as to how to read a film and appreciate the various nuances of a film as a text. The students will be guided to study film joyfully

UNIT I THEME - A: THE COMPONENT OF FILMS 9

A-1: The material and equipment A-2: The story, screenplay and script A-3: The actors, crew members, and the director A-4: The process of film making… structure of a film

UNIT II THEME - B: EVOLUTION OF FILM LANGUAGE 9

B-1: Film language, form, movement etc. B-2: Early cinema… silent film (Particularly French) B-3: The emergence of feature films: Birth of a Nation B-4: Talkies

UNIT III THEME - C: FILM THEORIES AND CRITICISM/APPRECIATION 9

C-1: Realist theory; Auteurists C-2: Psychoanalytic, Ideological, Feminists C-3: How to read films? C-4: Film Criticism / Appreciation

UNIT IV THEME – D: DEVELOPMENT OF FILMS 9

D-1: Representative Soviet films, D-2: Representative Japanese films, D-3: Representative Italian films, D-4: Representative Hollywood film and the studio system

UNIT VTHEME - E: INDIAN FILMS 9

E-1: The early era, E-2: The important films made by the directors, E-3: The regional films, E-4: The documentaries in India

TOTAL NUMBER OF PERIODS: 45

READINGS

1. A Reader containing important articles on films will be prepared and given to the students. The students must read them and present in the class and have discussion on these.

Course Code	DISASTER RISK REDUCTION AND MANAGEMENT	L	T	P	C
MC2304		3	0	0	0

COURSE OBJECTIVES:

1. To impart knowledge on concepts related to disaster, disaster risk reduction, disaster management
2. To acquaint with the skills for planning and organizing disaster response.

UNIT I HAZRADS, VULNERABILITY AND DISASTER RISKS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural, Human induced, Climate change induced –Earthquake, Landslide, Flood, Drought, Fire etc – Technological disasters- Structural collapse, Industrial accidents, oil spills -Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc.- Disaster vulnerability profile of India and Tamil Nadu - Global trends in disasters: urban disasters, pandemics, Complex emergencies, - Inter relations between Disasters and Sustainable development Goals

UNIT II DISASTER RISK REDUCTION (DRR) 9

Sendai Framework for Disaster Risk Reduction, Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community Based DRR, Structural- non-structural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Early Warning System – Advisories from Appropriate Agencies. - Relevance of indigenous Knowledge, appropriate technology and Local resources.

UNIT III DISASTER MANAGEMENT 9

Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction- Disaster Risk Management and post disaster management – Compensation and Insurance- Disaster Management Act (2005) and Policy - Other related policies, plans, programmers and legislation - Institutional Processes and Framework at State and Central Level- (NDMA –SDMA-DDMA-NRDF- Civic Volunteers)

UNIT IV TOOLS AND TECHNOLOGY FOR DISASTER MANAGEMENT 9

Early warning systems -Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment. - Elements of Climate Resilient Development –Standard operation Procedure for disaster response – Financial planning for disaster Management

UNIT V DISASTER MANAGEMENT: CASE STUDIES 9

Discussion on selected case studies to analyse the potential impacts and actions in the contest of disasters-Landslide Hazard Zonation: Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.- Field work-Mock drill -

TOTAL NUMBER OF PERIODS: 45

COURSE OUTCOME:

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

CO1: To impart knowledge on the concepts of Disaster, Vulnerability and Disaster Risk reduction (DRR)
CO2: To enhance understanding on Hazards, Vulnerability and Disaster Risk Assessment prevention and risk reduction
CO3: To develop disaster response skills by adopting relevant tools and technology
CO4: Enhance awareness of institutional processes for Disaster response in the country and
CO5: Develop rudimentary ability to respond to their surroundings with potential Disaster response in areas where they live, with due sensitivity

TEXT BOOKS

1. Taimpo (2016), Disaster Management and Preparedness, CRC Publications
2. Singh R (2017), Disaster Management Guidelines for earthquakes, Landslides, Avalanches and tsunami, Horizon Press Publications
3. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
4. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India
5. Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]

REFERENCE BOOKS

1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.
2. Government of India, National Disaster Management Policy, 2009.
3. Shaw R (2016), Community based Disaster risk reduction, Oxford University Press

Course Code	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	L	T	P	C
MC2305		3	0	0	0

COURSE OBJECTIVES:

1. To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
2. To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
3. To facilitate the understanding of global and Indian scenario of renewable and non-renewable resources, causes of their degradation and measures to preserve them.
4. To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyse climate changes, concept of carbon credit and the challenges of environmental management.
5. To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyze the role of sustainable urbanization.

UNIT I ENVIRONMENT AND BIODIVERSITY 6

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.

UNIT II ENVIRONMENTAL POLLUTION 6

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts .

UNIT III RENEWABLE SOURCES OF ENERGY 6

Energy management and energy conservation, New Energy Sources: Need of new energy sources. Different types of new energy sources. Applications of–Hydrogen energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT IV SUSTAINABILITY AND MANAGEMENT 6

Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT V SUSTAINABILITY PRACTICES 6

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles- carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio- economical and technological change.

TOTAL NUMBER OF PERIODS: 30

COURSE OUTCOMES:

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

CO1 To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.

CO2 To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.

CO3 To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.

CO4 To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.

CO5 To demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

TEXTBOOKS:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.

2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.

3. Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.

5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.

6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.

7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERENCES:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38, edition 2010.

2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.

3. Dharmendra S. Sengar, 'Environmental law', Prentice Hall of India PVT. LTD, New Delhi, 2007.

4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.

5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

MANDATORY COURSES II

Course Code	INTRODUCTION TO WOMEN AND GENDER STUDIES	L	T	P	C
MC2401		3	0	0	0

UNIT I CONCEPTS 2+4

Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private, essentialism, binaryism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour.

UNIT II FEMINIST THEORY 9

Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, ecofeminist.

UNIT III WOMEN'S MOVEMENTS: GLOBAL, NATIONAL AND LOCAL 4+4

Rise of Feminism in Europe and America. Women's Movement in India.

UNIT IV GENDER AND LANGUAGE 3+4

Linguistic Forms and Gender. Gender and narratives.

UNIT V GENDER AND REPRESENTATION 9

Advertising and popular visual media. Gender and Representation in Alternative Media. Gender and social media.

TOTAL NUMBER OF PERIODS:45

Course Code	HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA	L	T	P	C
MC2402		3	0	0	0

UNIT I CONCEPTS AND PERSPECTIVES **9**

Meaning of History Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation verses evidence, the concept of historical inevitability, and Historical Positivism. Science and Technology-Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India

UNIT II HISTORIOGRAPHY OF SCIENCE AND TECHNOLOGY IN INDI **9**

Introduction to the works of D.D. Kosambi, Dharmpal, Debiprasad Chattopadhyay, Rehman, S. Irfan Habib, Deepak Kumar, Dhruv Raina, and others.

UNIT III SCIENCE AND TECHNOLOGY IN ANCIENT INDIA **9**

Technology in pre-historic period Beginning of agriculture and its impact on technology Science and Technology during Vedic and Later Vedic times Science and technology from 1st century AD to C-1200

UNIT IV SCIENCE AND TECHNOLOGY IN MEDIEVAL INDIA **9**

Science and the Empire Indian response to Western Science Growth of techno-scientific institutions

UNIT V SCIENCE AND TECHNOLOGY IN A POST-INDEPENDENT INDIA **9**

Science, Technology and Development discourse Shaping of the Science and Technology Policy Developments in the field of Science and Technology Science and technology in globalizing India Social implications of new technologies like the Information Technology and Biotechnology.

TOTAL NUMBER OF PERIODS:45

REFERENCES:

1. Acharya , P. K ., Dictionary o f Hindu Architecture. London, 1927.
2 Bose , D. M ., Sen , S. N., and Subba rayappa , B. V. (Eds.), A Concise History o f Science in India. Indian National Science Academy, New Delhi, 1971.
3.. Chatterji, Sunm Kumar (E d.), The Cultural Heritage o f India. Vol. V. The Ramakrishna Mission Institute of Culture, Calcutta, 1978.
4. Chattopadhyaya , Debiprasad (Ed.), Studies in the History o f Science in India (2 Vols.). Editorial Enterprises, New Delhi, 1982.
5. Dampier, W. C., History of Science and its Relations with Philosophy and Religion. 4th Edn. Cam bridge, 1961.
6. Forbes , George , History o f Astronomy. Watts & Co., London, 1909.
7. Forbes , R . J ., Metallurgy in Antiquity. Leyden, 1950.

8. Haldane , J . B. S., Science and Indian Culture. New Age Publishers Pvt. L td., Calcutta, 1965.
9. Frawley, D., Planets in the Vedic literature, Indian Journal of History of Science. 29.495-506, 1994. 10 B Datta and A N Singh, History of Hindu Mathematics: A source book, Parts 1 and 2 (single volume), Asia Publishing House, Bombay, 1962.
10. George G Joseph, Crest of the Peacock, Non-European roots of mathematics, Third edition, Princeton University Press, Princeton, NJ, 2011.

Course Code	POLITICAL AND ECONOMIC THOUGHT FOR A HUMANE SOCIETY	L	T	P	C
MC2403		3	0	0	0

COURSE OBJECTIVES:

1. This course will begin with a short overview of human needs and desires and how different political-economic systems try to fulfil them. In the process, we will end with a critique of different systems and their implementations in the past, with possible future directions.

UNIT I INTRODUCTION 9

Considerations for humane society, holistic thought, human being's desires, harmony in self, harmony in relationships, society, and nature, societal systems. (Refs: A Nagaraj, M K Gandhi, JC Kumarappa)

UNIT II CAPATALISM AND MONOPOLIES 7

Capitalism – Free markets, demand-supply, perfect competition, laissez-faire, monopolies, imperialism. Liberal democracy. (Refs: Adam smith, J S Mill) Fascism and totalitarianism. World War I and II. Cold war.

UNIT III COMMUNISM 5

Communism – Mode of production, theory of labour, surplus value, class struggle, dialectical materialism, historical materialism, Russian and Chinese models. (Refs: Marx, Lenin, Mao, M N Roy)

UNIT IV HUMAN EMPOWERMENT 9

Welfare state. Relation with human desires. Empowered human beings, satisfaction. Gandhian thought. Swaraj, Decentralized economy & polity, Community. Control over one's lives. Relationship with nature. (Refs: M K Gandhi, Schumacher, Kumarappa)

UNIT V EDUCATION AND TECHNOLOGY 6

Essential elements of Indian civilization. (Refs: Pt Sundarlal, R C Mazumdar, Dharampal) Technology as a driver of society, Role of education in shaping of society. Future directions. (4 lectures) (Refs: Nandkishore Acharya, David Dixon, Levis Mumford)

TOTAL NUMBER OF PERIODS:39

COURSE OUTCOMES:

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

CO1 The students will get an understanding of how societies are shaped by philosophy, political and economic system, how they relate to fulfilling human goals & desires with some case studies of how different attempts have been made in the past and how they have fared.

REFERENCES:

1. Authors mentioned along with topics above. Detailed reading list will be provided

Course Code	STATE, NATION BUILDING AND POLITICS IN INDIA	L	T	P	C
MC2404		3	0	0	0

COURSE OBJECTIVES:

1. The objective of the course is to provide an understanding of the state, how it works through its main organs, primacy of politics and political process, the concept of sovereignty and its changing contours in a globalized world. In the light of this, an attempt will be made to acquaint the students with the main development and legacies of national movement and constitutional development in India, reasons for adopting a Parliamentary-federal system, the broad philosophy of the Constitution of India and the changing nature of Indian Political System. Challenges/ problems and issues concerning national integration and nation-building will also be discussed in the contemporary context with the aim of developing a future vision for a better India.

Understanding the need and role of State and politics. Development of Nation-State, sovereignty, sovereignty in a globalized world. Organs of State – Executive, Legislature, Judiciary. Separation of powers, forms of governmentunitary-federal, Presidential-Parliamentary, The idea of India. 1857 and the national awakening.

1885 Indian National Congress and development of national movement – its legacies. Constitution making and the Constitution of India. Goals, objective and philosophy. Why a federal system? National integration and nation-building.

Challenges of nation-building – State against democracy (Kothari) New social movements. The changing nature of Indian Political System, the future scenario. What can we do?

TOTAL NUMBER OF PERIODS:45

COURSE OUTCOMES:

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

CO1 It is expected that this course will make students aware of the theoretical aspect of the state, its organs, its operationalization aspect, the background and philosophy behind the founding of the present political system, broad streams and challenges of national integration and nation-building in India. It will equip the students with the real understanding of our political system/ process in correct perspective and make them sit up and think for devising ways for better participation in the system with a view to making the governance and delivery system better for the common man who is often left unheard and unattended in our democratic setup besides generating a lot of dissatisfaction and difficulties for the system.

REFERENCES:

1. Sunil Khilnani, The Idea of India. Penguin India Ltd., New Delhi.

2. Madhav Khosla, The Indian Constitution, Oxford University Press. New Delhi, 2012.

3. Brij Kishore Sharma, Introduction to the Indian Constitution, PHI, New Delhi, latest edition.

4. Sumantra Bose, Transforming India: Challenges to the World's Largest Democracy,

5. Picador India, 2013.

6. Atul Kohli, Democracy and Discontent: India's Growing Crisis of Governability, Cambridge University Press, Cambridge, U. K., 1991.

7. M. P. Singh and Rekha Saxena, Indian Politics: Contemporary Issues and Concerns, PHI, New Delhi, 2008, latest edition.

8. vii. Rajni Kothari, Rethinking Democracy, Orient Longman, New Delhi, 2005

Course Code	INDUSTRIAL SAFETY	L	T	P	C
MC2405		3	0	0	0

COURSE OBJECTIVES:

- To Understand the Introduction and basic Terminologies safety.
- To enable the students to learn about the Important Statutory Regulations and standards.
- To enable students to Conduct and participate the various Safety activities in the Industry.
- To have knowledge about Workplace Exposures and Hazards.
- To assess the various Hazards and consequences through various Risk Assessment Techniques.

UNIT I SAFETY TERMINOLOGIES 9

Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators-Flammability- Toxicity Time-weighted Average (TWA) - Threshold LimitValue (TLV) - Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects- Routes of Chemical Entry-Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS

UNIT II STANDARDS AND REGULATIONS 9

Indian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998- Hazard Identification and Risk Analysis- code of practice IS 15656:2006

UNIT III SAFETY ACTIVITIES 9

Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives- Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment

UNIT IV WORKPLACE HEALTH AND SAFETY 9

Noise hazard- Particulate matter- musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition- Electrical Hazards- Crane SafetyToxic gas Release.

UNIT V HAZARD IDENTIFICATION TECHNIQUES 9

Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk AssessmentChecklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment

TOTAL NUMBER OF PERIODS:45

COURSE OUTCOMES:

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

CO1 Understand the basic concept of safety.

CO2 Obtain knowledge of Statutory Regulations and standards.

CO3 Know about the safety Activities of the Working Place.

CO4 Analyse on the impact of Occupational Exposures and their Remedies

CO5 Obtain knowledge of Risk Assessment Techniques.

TEXTBOOKS:

1. R.K. Jain and Prof. Sunil S. Rao Industrial Safety, Health and Environment Management Systems KHANNA PUBLISHER

2. L. M. Deshmukh Industrial Safety Management: Hazard Identification and Risk Control McGraw-Hill Education

REFERENCES:

1. Frank Lees (2012) 'Lees' Loss Prevention in Process Industries.Butterworth-Heinemann publications, UK, 4th Edition.

2. John Ridley & John Channing (2008) Safety at Work: Routledge, 7th Edition.

3. Dan Petersen (2003) Techniques of Safety Management: A System Approach.

4. Alan Waring. (1996). Safety management system: Chapman &Hall, England Society of Safety Engineers, USA

Web Reference:

2. ISO 45001:2018 occupational health and safety (OH&S) International Organization for Standardization

3. https://www.iso.org/standard/63787.html

4. Indian Standard code of practice on occupational safety and health audit https://law.resource.org/pub/in/bis/S02/is.14489.1998.pdf

5. Indian Standard code of practice on Hazard Identification and Risk Analysis IS 15656:2006 https://law.resource.org/pub/in/bis/S02/is.15656.2006.pdf

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