Narula Institute of Technology
R23 [B. Tech CSE (AI & ML)]

Curriculum & Syllabus for B. Tech UnderAutonomy (NEP-2020 Implemented)

CSE (AI & ML)

(Effective from 2023-24 admission batch)

Department: CSE (AI & ML)

Curriculum Structure & Syllabus (Effective from 2023-24 admission batch)

		1st Year 1st Semester							
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	AM101	Programming for Problem Solving	3	0	0	3	3
2	SCI	Multidisciplinary	M(AM)101	Engineering Mathematics –I	3	0	0	3	3
3	SCI	Multidisciplinary	CH(AM)101	Engineering Chemistry	2	0	0	2	2
4	HUM	Ability Enhancement Course	HU101	Professional Communication	2	0	0	2	2
5	HUM	Value Added Course	HU102	Value and Ethics	2	0	0	2	2
6	HUM	Value Added Course	HU103	Constitution of India	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	AM191	Programming for Problem Solving Lab	0	0	3	3	1.5
2	HUM	Ability Enhancement Course	HU191	Professional Communication Lab	0	0	2	2	1
3	SCI	Skill enhancement Course	CH(AM)191	Engineering Chemistry Lab	0	0	2	2	1
4	ENGG	Skill Enhancement Course	ME(AM)191	Workshop & Manufacturing Practices Lab	0	0	3	3	1.5
Total of Theory and Practical								23	18

**HUM: Humanities; ENGG: Engineering; SCI: Science; PRJ: Project*

1st Year 2nd Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	AM201	Data Structures	3	0	0	3	3
2	ENGG	Minor	EE(AM)201	Basic Electrical and Electronics Engineering	3	0	0	3	3
3	SCI	Multidisciplinary	PH(AM)201	Engineering Physics	3	0	0	3	3
4	SCI	Multidisciplinary	M(AM)201	Engineering Mathematics – II	3	0	0	3	3
5	HUM	Value Added Course	HU204	Environmental Science	2	0	0	2	2
6	HUM	Value Added Course	HU205	Indian Knowledge System	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	AM291	Data Structures Lab	0	0	3	3	1.5
2	ENGG	Minor	EE(AM)291	Basic Electrical and Electronics Engineering Lab.	0	0	3	3	1.5
3	HUM	Ability Enhancement Course	HU292	Design Thinking	0	0	2	2	1
4	SCI	Skill enhancement course	PH(AM)291	Engineering Physics Lab	0	0	3	3	1.5
5	ENGG	Skill Enhancement Course	ME(AM)291	Engineering Graphics & Design Lab	0	0	3	3	1.5
Total of Theory and Practical								29	22

2nd Year 3rd Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	AM301	Computer Organization and Architecture	3	0	0	3	3
2	ENGG	Major	AM302	Design and Analysis of Algorithms	3	0	0	3	3
3	SCI	Minor	M(AM)301	Discrete Mathematics	3	0	0	3	3
4	ENGG	Minor	EC(AM)301	Analog and Digital Electronics	3	0	0	3	3
		B. PRACTICAL							
1	ENGG	Major	AM391	Computer Organization and Architecture Lab	0	0	3	3	1.5
2	ENGG	Major	AM392	Design and Analysis of Algorithms Lab	0	0	3	3	1.5
3	ENGG	Minor	EC(AM)391	Analog and Digital Electronics Lab	0	0	3	3	1.5
5	ENGG	Skill Enhancement Course	AM393	IT Workshop Lab (SciLab/MATLAB/C++)	0	1	3	4	2.5
Total of Theory and Practical								26	19

2nd Year 4th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	AM401	Operating Systems	3	0	0	3	3
2	ENGG	Major	AM402	Formal Language and Automata Theory	3	0	0	3	3
3	ENGG	Major	AM403	Object Oriented Programming using Java	3	1	0	3	4
4	SCI	Minor	M(AM)401	Probability and Statistics	3	0	0	3	3
5	HUM	Ability Enhancement Course	HU(AM)401	Principles of Management	2	0	0	2	2
B. PRACTICAL									
1	ENGG	Major	AM491	Operating Systems Lab	0	0	3	3	1.5
2	ENGG	Minor	M(AM) 492	Numerical Methods Lab	0	0	3	3	1.5
3	ENGG	Major	AM493	Object Oriented Programming Lab using Java	0	0	3	3	1.5
4	ENGG	Major	AM494	Programming Using Python	0	0	3	3	1.5
5	HUM	Ability Enhancement Course	HU(AM)491	Soft Skill & Aptitude	2	0	0	2	1
Total of Theory and Practical								27	22

3rd Year 5th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	AM501	Artificial Intelligence	3	0	0	3	3
2	ENGG	Major	AM502	Database Management Systems	3	0	0	3	3
3	ENGG	Major	AM503	Computer Networks	3	0	0	3	3
4	ENGG	Major	AM504A	Compiler Design	3	0	0	3	3
			AM504B	Cryptography and Network Security					
			AM504C	Computer Graphics					
5	HUM	Minor	HU(AM)501	Economics for Engineers	2	0	0	2	2
B. PRACTICAL									
1	ENGG	Major	AM591	Artificial Intelligence Lab	0	0	3	3	1.5
2	ENGG	Major	AM592	Database Management Systems Lab	0	0	3	3	1.5
3	ENGG	Major	AM593	Computer Networks Lab	0	0	3	3	1.5
4		Internship	AM581	Internship/Industrial Training	0	0	2	2	2
Total of Theory and Practical								25	20.5

3rd Year 6th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	AM601	Machine Learning	3	1	0	4	4
2	ENGG	Major	AM602	Digital Image Processing	3	0	0	3	3
3	ENGG	Major	AM603	Natural Language Processing	3	0	0	3	3
4	ENGG	Major	AM604A	Mobile Computing	3	0	0	3	3
			AM604B	Quantum Computing					
			AM604C	Cloud Computing					
5	HUM	Minor	HU(AM)605	Cyber Law and Ethics	3	0	0	3	3
B. PRACTICAL									
1	ENGG	Major	AM691	Machine Learning Lab	0	0	3	3	1.5
2	ENGG	Major	AM692	Digital Image Processing Lab	0	0	3	3	1.5
3	ENGG	Major	AM693	Natural Language Processing Lab	0	0	3	3	1.5
Total of Theory and Practical								25	20.5

4th Year 7th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	AM701	Neural Networks and Deep Learning	3	0	0	3	3
2	ENGG	Major	AM702A	Computer Vision	3	0	0	3	3
			AM702B	Parallel Computing					
			AM702C	Web Technology					
3	ENGG	Major	AM703A	Information Retrieval and Data Mining	3	0	0	3	3
			AM703B	Soft Computing					
			AM703C	Software Engineering					
4	HUM	Minor	HU(AM)701	Human Resource Development and Organizational Behavior	2	0	0	2	2
B. PRACTICAL									
1	ENGG	Major	AM791	Neural Networks and Deep Learning Lab	0	0	3	3	1.5
2	ENGG	Major	AM792A	Computer Vision Lab	0	0	3	3	1.5
			AM792B	Parallel Computing Lab					
			AM792C	Web Technology Lab					
3	ENGG	PRJ	AM781	Major Project-I	0	0	12	12	6
Total of Theory and Practical								29	20

4th Year 8th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	AM801A	Big Data Analytics	3	1	0	4	4
			AM801B	Block Chain and Crypto Currency Technologies					
			AM801C	Cyber Security					
2	ENGG	Major	AM802A	VLSI Design and Application	3	1	0	4	4
			AM802B	Bioinformatics					
			AM802C	Robotics					
3	ENGG	Minor	CS(AM)803A	Wireless Sensor Network and IoT	3	0	0	3	3
			CS(AM)803B	Information Theory and Coding					
			CS(AM)804C	Optimization Techniques					
B. PRACTICAL									
1	ENGG	Minor	CS(AM)893A	Wireless Sensor Network and IoT Lab	0	0	3	3	1.5
			CS(AM)893B	Information Theory and Coding Lab					
			CS(AM)893C	Optimization Techniques Lab					
2	ENGG	PRJ	PR(AM)881	Major Project-II	0	0	12	12	06
3			AM882	Grand Viva	0	0	0	0	1.5
Total of Theory and Practical								26	20

Total Credit = 162

		1st Year 1st Semester							
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	AM101	Programming for Problem Solving	3	0	0	3	3
2	SCI	Multidisciplinary	M(AM)101	Engineering Mathematics –I	3	0	0	3	3
3	SCI	Multidisciplinary	CH(AM)101	Engineering Chemistry	2	0	0	2	2
4	HUM	Ability Enhancement Course	HU101	Professional Communication	2	0	0	2	2
5	HUM	Value Added Course	HU102	Value and Ethics	2	0	0	2	2
6	HUM	Value Added Course	HU103	Constitution of India	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	AM191	Programming for Problem Solving Lab	0	0	3	3	1.5
2	HUM	Ability Enhancement Course	HU191	Professional Communication Lab	0	0	2	2	1
3	SCI	Skill enhancement Course	CH(AM)191	Engineering Chemistry Lab	0	0	2	2	1
4	ENGG	Skill Enhancement Course	ME(AM)191	Workshop & Manufacturing Practices Lab	0	0	3	3	1.5
Total of Theory and Practical								23	18

Course Name: PROGRAMMING FOR PROBLEM SOLVING
Course Code: AM101
Contact (Periods/Week):3L/Week
Total Contact Hours: 36
Credits: 3

Course Outcome(s):

CO1: To identify the working principle of input and output devices of Computers memorize the basic terminology used in computer programming.

CO2.: To express programs in C language and use different data types for writing the programs.

CO3: To implement programs using the dynamic behaviour of memory by the use of pointers.

CO4: To explain the difference between call by value and call by address.

CO5: To write programs using basic data files and developing applications for real world problems.

CO-PO-PSO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO1 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	2						2	3	2	3	3
CO2	2	2	3	3	3							3	2	2	3
CO3	2	3	2	2	2							3	2	3	2
CO4	3	2	2	3	3							2	2	2	2
CO5	2	2	2	1	1						2	3	3	3	3

Course Content:

Module-1: Fundamentals of Computer 9L

History of Computer, Generation of Computer, Classification of Computers, Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices.

Number System: basic of Binary, Octal, Decimal and Hexadecimal number systems; Representation and interchanging of number in different number systems. Introduction to complements system, Representation of signed and unsigned numbers in singed magnitude singed 1's complement system and signed 2's complement system.

Arithmetic– Addition and Subtraction (using1'scomplementand2'scomplement).Representation of Characters-ASCII Code, Basics of Compiler, Interpreter and Assembler

Problem solving – Basic concept of Algorithm. Representation of algorithm using flow chart and pseudocode, Some basic examples.

Module-2: Introduction to C Programming 5L

Overview of Procedural vs Structural language; History of C Programming Language.Variable and Data Types: The C characters identifiers and keywords, data type & sizes, variable names, declaration, statements.

Operators & Expressions: Arithmetic operators, relational operators, Logical operators, increment and decrement operators, bitwise operators, Assignment operators, conditional operators, special operators- type conversion, C expressions, precedence and associativity.

Input and Output: Standard input and output, formatted output–print f, formatted input scan f.

Module-3: Branch and Loop 5L

Branching: Concept of Statement and Blocks in C, Simple if, if -else, nested if-else and if-else ladder.Switch Case: break and continue; switch-case, concept of goto and labels

Loops - while, for, do while

Module-4: Program Structures 4L

Function: Basics of Functions, function types, function prototypes, formal and actual parameter, functioncalling, functions returning values, functions not returning values. Recursion and Recursive

Function.
Storage Class in C: Storage Class-auto, external, static and register storage class, scope rules and life time ofvariables
C pre-processor: Pre-processing directive and macro, parameterized macro.

Module-5: Array and Pointer 7L

Arrays: One dimensional array, Two-dimensional arrays
Passing an array to a functionPointers: Pointers, Pointer and Array, Pointer and functions.
Strings: Character array and string, array of strings, Passing a string to a function, String related functions, Pointer and String.
Dynamic memory allocation: Malloc, calloc, realloc and free with example.

Module-6: Structures, Unions and Enum 3L

Basic of structures, arrays of structures, structures and pointers, bit fields. Basics of union and enum, difference structure and union.

Module-7: File in C 3L

Files handling- opening and closing a file in different mode, formatted and unformatted files, Command line arguments, f open, f close, f get c, f put c, f print f, f scan f function.

Textbook:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. Kanetkar Y.-LetusC, BPBPublication,15th Edition

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. K R Venugopal & S R Prasad – MASTERING C, TMH, 2nd Edition

Course Name: Engineering Mathematics - I
Paper Code: M(AM)101
Contact (L: T: P): 3 : 0 : 0
Total Contact Hours: 36
Credit: 3

Prerequisites:

The students to whom this course will be offered must have the concept of (10+2) standard matrix algebra, and calculus.

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in matrix algebra and calculus. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes (COs):

On successful completion of the learning sessions of the course, the learner will be able to:

CO1: Recall the properties related to matrix algebra and calculus.

CO2: Determine the solutions of the problems related to matrix algebra and calculus.

CO3: Apply the appropriate mathematical tools of matrix algebra and calculus for the solutions of the problems.

CO4: Analyze different engineering problems linked with matrix algebra and calculus.

CO-PO/PSO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO4	2	3	1	2	-	-	-	-	-	-	-	1
M(ME) 101	**2.75**	**2.25**	**1.5**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.25**

Weightage Values: Strongly mapped: '3', Moderately mapped: '2', Weakly mapped: '1', Not mapped: '-'

Course Content:

Module I: Liner Algebra (11L)
Echelon form and normal (canonical) form of a matrix; Inverse and rank of a matrix; Consistency and inconsistency of system of linear equations, Solution of system of linear equations; Eigenvalues and eigenvectors; Diagonalization of matrix, Cayley-Hamilton theorem.

Module II: Single Variable Calculus (5L)
Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Concept of sequence and series, Power series; Taylor's series.

Module III: Multivariable Calculus (Differentiation) (13L)
Function of several variables; Concept of limit, continuity and differentiability;Partial derivatives, Total derivative and its application; chain rules, Derivatives of implicit functions Euler's theorem on homogeneous function; Jacobian; Maxima and minima of functions of two variables.

Module IV: Multivariable Calculus (Integration) (7L)
Double Integral, Triple Integral;Change of order in multiple integrals; Line Integral, Surface Integral, Volume Integral. Change of variables in multiple integrals.

Text Books:

1. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Reference Books:

1. Guruprasad, S. A text book of Engineering Mathematics-I, New age International Publishers.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
5. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
6. Apostol, M., Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
7. Kumaresan, S., Linear Algebra - A Geometric approach, Prentice Hall of India, 2000.
8. Poole, D., Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
9. Bronson, R., Schaum's Outline of Matrix Operations. 1988.
10. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969.

Course Name: ENGINEERING CHEMISTRY
Paper Code: CH(AM)101
Total Contact Hours: 24
Credit: 2
Prerequisites:

COURSE CONTENT

Module 1 - Elements and their properties (6L)

1. **Elements and their properties (3L)**
   Bohr's theory for one electron system, Hydrogen spectrum, Quantum numbers, atomic orbitals, Pauli's exclusion principle, Hund's rule, exchange energy, Aufbau principle, Electronic configuration and Magnetic properties.
2. **Periodic Table for Engineers (3L)**
   Modern Periodic table, Periodic properties, study of advanced functional materials like Silicones, Silicates, Zeolite and alloys like steel, mischmetall, Neodymium alloy and their applications

Module 2 - Energy devices and Semiconductors (6L)

1. **Use of free energy in chemical equilibria (3L)**
   Laws of Thermodynamics, Enthalpy, Entropy, Spontaneity, Electrochemical Cell, Dry Cell, Mercury Cell, Lead Storage batteries, Ni-Cd Cells, Fuel Cells, Solar Cells, Nernst equation and applications, Electrochemical sensors
2. **Crystals and Semiconductors (3L)**
   Crystals and their defects, Stoichiometric and Non-stoichiometric defects, Band theory and Doping, n-type and p-type semiconductors, Superconductors

Module 3 –Industrial Applications of Chemistry (8L)

1. **Advanced Polymeric materials (3L)**
   Classification, Engineering Plastics, conducting polymers, bio polymers, polymer composites
2. **Industrial corrosion (2L)**
   Classification, Effects of corrosion, Preventive measures
3. **Analysis of Water Quality (1L)**
   Physicochemical and Biological parameters
4. **Nano materials (1L)**
   Synthesis of Nano materials, Applications in modern devices
5. **Basic Computational Chemistry (1L)**
   Introduction of computational chemistry and their applications

Module 4 – Organic Reaction Products and their spectroscopic analysis (4L)

1. **Organic Reactions (2L)**
   Substitution, Elimination and Addition reactions
2. **Drug designing and synthesis (1L)**
   Paracetamol, Aspirin
3. **Spectroscopic Analysis (1L)** UV – Visible Spectra, IR spectra

Course Name: Professional Communication
Paper Code: HU101
Contact: 2:0:0
Total Contact Hours: 24
Credit: 2

Pre-requisites:	Basic (10+2) level of knowledge of English grammar,vocabulary reading and writing skills.
Course Objectives	The course aims to impart domain and industry-specific communication skills in a globalized context and to promote the understanding of business communication practices and cross cultural dynamics.
Course Outcomes:	By pursuing this course the students shall be able to
	1. Define, describe and classify the modalities and nuances of communication in a workplace context.
	2. Review, appraise and understand the modes, contexts and appropriacy of communicating across cultures and societies.
	3. Identify, interpret and demonstrate the basic formats, templates of business and official communication.
	4. Identify, compare and illustrate reading strategies and basic writing strategies.
	5.Interpret, analyze and evaluate semantic-structural, interpersonal and multicultural dynamics in business communication.

Course Content:

Module 1 :
Verbal and Non verbal communication **4 L**
Definition, Relevance and Effective Usage
Components of Verbal Communication: Written and Oral Communication
Components of Non-verbal Communication: Kinesics, Proxemics, Chronemics, Haptics
Paralanguage
Barriers to Effective Communication

Module 2:
Workplace Communication Essentials and Cross-Cultural Communication **4L**
Communication at the Workplace—Formal and Informal Situations
Language in Use—Jargon, Speech Acts/Language Functions, Syntactical and Grammatical Appropriacy
Cultural Contexts in Global Business: High Context and Low Context Cultures
Understanding Cultural Nuances and Stereotyping
Achieving Culturally Neutral Communication in Speech and Writing

Module 3: **4L**
Reading Strategies and Basic Writing Skills
Reading: Purposes and Nature of Reading
Reading Sub-Skills—Skimming, Scanning, Intensive Reading
Reading General and Business Texts(Reading for Comprehension and Detailed Understanding)
Basic Writing Skills—Paragraph and Essay writing, writing technical documents
Writing Technicalities—Paragraphing, Sentence Structure and Punctuatio

Module 4: **4L**
Report Writing
Nature and Function of Reports
Types of Reports
Researching for a Business Report
Format, Language and Style
Report Documentation

Module 5:
Employment Communication
a. Writing Business Letters—(Enquiry,Order, Sales,Complaint, Adjustment, Job Application,Offer) **2L**
b. Creating an Employee Profile-- Preparing a CV or Résumé.
Creating a Digital/Online Profile – LinkedIn (Résumé/Video Profile) **2L**
c. Writing Other Interoffice Correspondence--E-mails: types, convention, and etiquette, Memo, Notices and Circulars **2L**
d. Preparing Meeting Documentation—Drafting Notice and Agenda of Meetings, Preparing Minutes of Meetings. **2L**

References :-

1. Meenakshi Raman and Sangeetha Sharma. *Technical Communication*. 3rd edition. New Delhi: Oxford University Press, 2015.
2. Mark Ibbotson. *Cambridge English for Engineering*. Cambridge: Cambridge University Press, 2008.
3. Mark Ibbotson. *Professional English in Use: Engineering*. Cambridge: Cambridge UP, 2009.

4. Lesikar et al. *Business Communication: Connecting in a Digital World*. New Delhi: Tata McGraw-Hill, 2014.
5. John Seeley. *Writing Reports*. Oxford: Oxford University Press, 2002.
6. Judith Leigh. *CVs and Job Applications*. Oxford: Oxford University Press, 2002.
7. Judith Leigh. *Organizing and Participating in Meetings*. Oxford: Oxford University Press, 2002.
8. Michael Swan. *Practical English Usage*. Oxford: OUP, 1980.
9. Pickett, Laster and Staples. *Technical English: Writing, Reading & Speaking.* **8th ed. London: Longman, 2001.**
10. Diana Booher. *E-writing: 21st Century Tools for Effective Communication*.

Links:-

1. Purdue University's Online Writing Lab (OWL)- https://owl.purdue.edu/

2. Business English Pod- https://www.businessenglishpod.com/

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO.1	-	-	-	-	-	2	1	1	2	3	-	2
CO.2	-	-	-	-	-	1	1	2	2	3	-	3
CO.3	-	-	-	-	-	3	3	1	1	3	2	3
CO.4	-	-	-	-	-	3	3	1	-	3	-	3
CO.5						2	2	2	2	3	-	3

Course Name: Values and Ethics
Course Code: HU102
Contacts: 2:0:0
Total Contact Hours: 24
Credit: 2
Prerequisite: None

Module: 1 Introduction: (4L)
Definition of Ethics; Approaches to Ethics: Psychological, Philosophical, and Social
Types of values-Social, Psychological, Aesthetic, Spiritual, and Organizational
Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.

Module 2: Universal Human Harmony. (4L)
Basic Human Aspirations, Happiness and Prosperity, Self-Exploration, Self and the Body Understanding the harmony in the Nature.
Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self- regulation in nature.
Values Crisis in contemporary society Nature of values: Value Spectrum of a good life (Maslow's Pyramid)

Module: 3 Ethical Concerns: (6L)
Renewable Energy Resources, Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics

Rapid Technological growth and depletion of resources,Reports of the Club of Rome.

Problems of Technology transfer- Technology assessment impact analysis -Human Centered Technology.

Module: 4 Ethics of Profession: **(4L)**
Work Ethics and Work Values, Business Ethics, Human values in organizations:
Social and ethical responsibilities of Technologists. Codes of professional ethics.

Types of Ethical issues - Internal Ethics of Business –
Whistle Blowing
Impact of Ethics on Business Policies and Strategies – Ethical Leadership – Characteristics

Module: 5 Self Development AND Gender Awareness (6L)
Definition of Gender, Basic Gender Concepts and Terminology, Exploring Attitudes towards Gender, Social Construction of Gender
Gender Roles and Relations, Types of Gender Roles, Gender Roles and Relationships Matrix, Gender-based Division and Valuation of Labour. Gender Development Issues, Identifying Gender Issues

Text Books:
1. Beneria, Lourdes. (2004). Gender, Development, and Globalization: Economics as if All People Mattered. Roultedge Press. (GDGE)
2. Molyneux and Razavi. (2002). Gender Justice, Development and Rights. Oxford University Press (GJDR or WGD)
3. Visvanathan, Duggan,Wiegersma and Nisonoff. (2011).

4. The Women, Gender and Development Reader. 2nd Edition. Zed Press (WGD)
5. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
6. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
7. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

Course Outcomes:

CO 1	Understand the significance of values, various approaches to ethics and its applications in life and profession.
CO2	Able to distinguish Self and the Body, to understand Harmony in the Self
CO3	To identify and eradicate environmental concerns through technology
CO4	Demonstrate work ethics and analyse business strategies
CO5	Ability to understand gender terminologies and to identify gender issues

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

Paper Name: Constitution of India
Paper Code: HU103
Credit: 01
No. of lectures: 12

Module 1: History of Making of the Indian Constitution: History. Drafting Committee, (Composition & Working)
Philosophy of the Indian Constitution: Preamble Salient Features **3L**

Module 2: Fundamental Rights, Fundamental Duties, Directive Principles of State Policy: 6L
The Right to Equality
The Right to Freedom: I (Article 19)
The Right to Freedom: II (Articles 20, 21 and 22)
The Right against Exploitation
The Right to freedom of Religion
Cultural and Educational rights
The Right to Property
The Right to Constitutional Remedies
Fundamental Duties

Module-3: Organs of Governance: 3L
Parliament - Composition - Qualifications and Disqualifications -Powers and Functions – Executive- President -Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions

Text / Reference Books:

1) Indian Constitution by D.D.Basu, The Publisher, LexisNexis
2) Constitution of India by Subhas C Kasyap, Vitasta Publishing
3) The Constitution of India, P.M Bakshi, Universal Law Publishing Co.Ltd, New Delhi, 2003.
4) Indian Constitution Text Book - Avasthi, Avasthi, Publisher: LAKSHMI NARAIN AGARWAL
5) Introduction to the Constitution of India, Brij Kishore Sharma, PHI

Course Name: PROGRAMMING FOR PROBLEM SOLVING LAB
Course Code: AM191
Contact Hours: 3L/Week
Total Contact Hours: 36
Credits: 1.5

Course Outcomes	Name of Course Outcomes
CO1	To identify the working of different operating systems like DOS, Windows, Linux
CO2	To express programs in C language
CO3	To implement programs connecting decision structures, loops
CO4	To experiment with user defined functions to solve real time problems
CO5	To write C programs using Pointers to access arrays, strings, functions, structures and files

CO-PO-PSO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	2						2	3	2	3	3
CO2	2	2	3	3	3							3	2	2	3
CO3	2	3	2	2	2							3	2	3	2
CO4	3	2	2	3	3							2	2	2	2
CO5	2	2	2	1	1						2	3	3	3	3

Course Content:

Module-1: Familiarization with some basic commands of DOS and Linux. File handling and Directory structures, file permissions, creating and editing simple C program in different editor and IDE, compilation and execution of C program. Introduction to Code block.

Module-2: Problem based on

a) Basic data types
b) Different arithmetic operators.
c) Print f( ) and scan f( ) functions.
d)

Module-3: Problem based on conditional statements using

a) if-else statements
b) different relational operators
c) different logical operators

Module-4: Problem based on

a) **for** loop
b) **while** loop
c) **do-while** loop

Module-5: Problem based on

a) How to write a menu driven program using switch-case statement
b) How to write a function and passing values to a function
c) How to write a recursive function.

Module-6: Problem based on

a) How to use array (both I-Dand2-D).
b) How to pass an array to a function.

Module-7: Problem based on manipulation of strings in different way.

Module-8: Problem based on

a) How to handle compound variables in C
b) How to handle file in C
c) How to use command line argument in C

Textbook:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. KanetkarY.-LetusC,BPBPublication,15th Edition

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
K R Venugopal & S R Prasad – MASTERING C, TMH, 2nd Edition

Paper Name: Professional Communication Lab
Paper Code: HU191
Contact: (0:0:2)
Total Contact Hours: 24
Credit: 1

Pre requisites: Basic knowledge of LSRW skills.

Course Objectives: To train the students in acquiring interpersonal communication skills by focussing on language skill acquisition techniques and error feedback.

Course Outcome:
By pursuing this course the students will be able to:
CO1: Recognize, identify and express advanced skills of Technical Communication in English through Language Laboratory.
CO2: Understand, categorize, differentiate and infer listening, speaking, reading and writing skills in societal and professional life.
CO3: Articulate and present the skills necessary to be a competent Interpersonal communicator.
CO4: Deconstruct, appraise and critique communication behaviours.
CO5: Adapt, negotiate and facilitate with multifarious socio-economical and professional arenas with effective communication and interpersonal skills.

Course Contents:
Module 1: Introduction to the Language Lab
a. The Need for a Language Laboratory
b. Tasks in the Lab
c. Writing a Laboratory Note Book

Module 2: Active Listening
a. What is Active Listening?
b. Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating, Note-taking
c. Listening in Business Telephony

Module 3: Speaking
a. Speaking—Accuracy and Fluency Parameters
b. Pronunciation Guide—Basics of Sound Scripting, Stress and Intonation
c. Fluency-focussed activities—JAM, Conversational Role Plays, Speaking using Picture/Audio Visual inputs
d. Accuracy-focussed activities—Identifying Minimal Pairs, Sound Mazes, Open and Closed Pair Drilling, Student Recordings (using software)
e. Group Discussion: Principles and Practice
f. Giving a Presentation—Learning Presentation Basics and Giving Micro Presentations

Module 4: Lab Project Work
a. Writing a Book Review
b. Writing a Film Review
c. Scripting a Short Presentation (2 minutes)
d. Making a short video CV (1-2 minutes)

References:
1.IIT Mumbai**, Preparatory Course in English** syllabus
2. IIT Mumbai, **Introduction to Linguistics** syllabus
3. Sasikumar et al. *A Course in Listening and Speaking*. New Delhi: Foundation Books, 2005.
4. Tony Lynch, *Study Listening*. Cambridge: Cambridge UP, 2004.

CO-PO Mapping

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

Course Name: ENGINEERING CHEMISTRY LAB
Paper Code: CH(AM)191
Total Contact Hours: 24
Credit: 1
Prerequisites:

COURSE CONTENT

1. Synthesis of Silver Nanoparticles doped organic thin film for organic transistors.
2. Preparation of Si-nano crystals for future memory devices.
3. Determination of the concentration of the electrolyte through conductance measurement.
4. Green Synthesis of ZnO based Polymer Nano composites.
5. Determination of the concentration of the electrolyte through pH measurement.
6. Determination of water quality measurement techniques.
7. Isolation of graphene from dead dry batteries and their use for temporary soldering.
8. Synthesis of polymers for electrical devices and PCBs.
9. Determination of Partition Coefficient of acetic acid between two immiscible liquids.
10. Computational optimization of molecular geometry
11. Drug design and synthesis
12. Rheological properties of the Newtonian fluids

COURSE NAME: Workshop and Manufacturing Practices Lab
COURSE CODE: ME(AM)191
CONTACT: 0:0:3
CREDITS: 1.5

Prerequisite: Physics & Mathematics (10+2 Level)

CO1: Gain basic knowledge of Workshop Practice and Safety useful for our daily living.
CO2: Understand the use of Instruments of a pattern shop like Hand Saw, Jack Plain, Chisels etc.
CO3: Apply and performing operations like such as Marking, Cutting etc used in manufacturing processes.
CO4: Analyse the various operations in the Fitting Shop using Hack Saw, various files, Scriber, etc to understand the concept of tolerances applicable in all kind of manufacturing.
CO5: Get hands on practice of in Welding and apply various machining processes which give alot of confidence to manufacture physical prototypes in project works.

Course Content:

3P

(i) Theoretical discussions:

1. **Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods**
2. **Fitting operations & power tools**
3. **Carpentry**
4. Welding (arc welding & gas welding), brazing
5. Electrical & Electronics
6. Metal casting
7. CNC machining, Additive manufacturing, 3D Printing
8. Plastic moulding & Glass Cutting

(ii) Workshop Practice:

At least 6 modules should be covered

Module 1 - Machine shop **6P**
Typical jobs that may be made in this practice module:
i. To make a pin from a mild steel rod in a lathe.
ii. To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Module 2 - Fitting shop 6P
Typical jobs that may be made in this practice module: To make a Gauge from MS plate.

Module 3 – Carpentry Shop 6P
Typical jobs that may be made in this practice module: To make wooden joints and/or a pattern or like.

Module 4 - Welding & Soldering shop 6P
Typical jobs that may be made in this practice module:
i. Arc Welding: To join two thick (approx 5mm) MS plates by manual metal arc welding.
ii. Gas Welding: To join two thin mild steel plates or sheets by gas welding.
iii. House wiring, soft Soldering

Module 5 – Smithy & Casting 6P

Typical jobs that may be made in this practice module:

i. A simple job of making a square rod from a round bar or similar.
ii. One/ two green sand moulds to prepare, and a casting be demonstrated**.**

Module 6 – CNC Machining & Laser Cutting 6P

Typical jobs that may be made in this practice module:

i. At least one sample shape on mild steel plate should be made using CNC Milling / CNC Lathe Machine
ii. At least one sample shape on glass should be made using laser cutting machine.

Module 7 – 3D Printing 6P

i) Exposure to a 3D printing machine,
ii) 3D printing of at least one sample model using available materials.

Examinations could involve the actual fabrication of simple components, utilizing one or more ofthe techniques covered above.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., ―Elements of Workshop Technology‖, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Rao P.N., ―Manufacturing Technology‖, Vol. I and Vol. II, Tata McGrawHill House, 2017.

Reference Books:

1. Gowri P., Hariharan and A. Suresh Babu, ManufacturingTechnology – I, Pearson Education, 2008.
2. Roy A. Lindberg, ―Processes and Materials of Manufacture‖, 4th edition, Prentice Hall India, 1998.
3. Kalpakjian S. and Steven S. Schmid, ManufacturingEngineering and Technology, 4th edition, Pearson Education India Edition, 2002.
4. Manufacturing Science by A. Ghosh and A.K. Mallick,Wiley Eastern.
5. Principles of Metal Cutting/Principles of Machine Tools by G.C. Sen and A. Bhattacharya, New Central Book Agency, Kolkata.

CO-PO/PSO Mapping:

CO Codes	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3						2		2	2					
CO2	3						2		2	2					
CO3	3						2		2	2			2		2
CO4	3						2		2	2			2		2
CO5	3	2	2				2		2	2					

1st Year 2nd Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	AM201	Data Structures	3	0	0	3	3
2	ENGG	Minor	EE(AM)201	Basic Electrical and Electronics Engineering	3	0	0	3	3
3	SCI	Multidisciplinary	PH(AM)201	Engineering Physics	3	0	0	3	3
4	SCI	Multidisciplinary	M(AM)201	Engineering Mathematics – II	3	0	0	3	3
5	HUM	Value Added Course	HU204	Environmental Science	2	0	0	2	2
6	HUM	Value Added Course	HU205	Indian Knowledge System	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	AM291	Data Structures Lab	0	0	3	3	1.5
2	ENGG	Minor	EE(AM)291	Basic Electrical and Electronics Engineering Lab.	0	0	3	3	1.5
3	HUM	Ability Enhancement Course	HU292	Design Thinking	0	0	2	2	1
4	SCI	Skill enhancement course	PH(AM)291	Engineering Physics Lab	0	0	3	3	1.5
5	ENGG	Skill Enhancement Course	ME(AM)291	Engineering Graphics & Design Lab	0	0	3	3	1.5
Total of Theory and Practical								29	22

Course Name: Data Structures
Course Code: AM201
Contact (Periods/Week):=3L/Week
Total Contact Hours: 36
Credits: 3

Course Objectives:
1. To learn the basics of abstract data types.
2. To learn the principles of linear and nonlinear data structures.
3. To build an application using sorting and searching.

Course Outcomes	Name of Course Outcomes
CO1	To identify how the choices of data structure & algorithm methods impact the performance of program.
CO2	To express problems based upon different data structure for writing programs.
CO3	To implement programs using appropriate data structure & algorithmic methods for solving problems.
CO4	To explain the computational efficiency of the principal algorithms for sorting, searching, and hashing.
CO5	To write programs using dynamic and static data structures and building applications for real world problems.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2		2	3						1	3	1	1	1
CO2	3	2	2	2	2							2	3	2	2
CO3	2	3	3	2	3						1	2	3	3	3
CO4	2	2	2	3	1							1	2	1	2
CO5	2	3	3	3	2						1	2	3	3	3
	2.40	2.40	2.50	2.40	2.20							2.00	2.40	2.00	2.20

Course Content:

Module 1: Introduction [4L]

Concepts of data and information; Concept of Abstract Data Type, Data Structure and Data Type. Classification of Data Structures- Primitive and Non-Primitive Data Structure, Linear and Non-Linear Data Structure. Need of Data Structures. (1L)
Concept of algorithms and programs, Different methods of representing algorithm; Algorithm analysis, time and space analysis of algorithms – Asymptotic notations like Big Oh (O), Small Oh(o), Big Omega(Ω), Small Omega(ω) and Theta(Θ) notation (definition and significance). (3L)

Module 2: Non-Restricted Linear Data Structure[9L]
List or Linear List: Definition and Example, List as ADT. Representation of Linear List- Sequential Representation and Linked Representation.
Array: Introduction to sequential representation, Linearization of multidimensional array. Application of array- representation of polynomial using array, Representation of Sparse matrix using array.
Linked List: Introduction to linked representation, Implementation of different types of linked list- Singly linked list, Doubly linked list, Circular linked list, Circular Doubly Linked List. Application of Linked list- Representation of polynomial.

Module 3: Restricted Linear Data Structure [6L]
Stack: Definition of Stack, implementations of stack using array and linked list, Applications of stack- infix to postfix conversion, Postfix Evaluation
Recursion: Principles of recursion - use of stack, tail recursion. Tower of Hanoi using recursion.
Queue: Definition of Queue; Implementation of queue using array-physical, linear and circular model; Implementation of queue using linked list.
Dequeue - Definition and different types of dequeue.

Module 4: Nonlinear Data structures [9L]
Trees and Binary Tree:
Basic terminologies; Definition of tree and binary tree. Difference between tree and binary tree, Representation of binary tree (using array and linked list)
Binary tree traversal (pre-, in-, post- order); Threaded binary tree- definition, insertion and deletion algorithm; Binary search tree- Definition, insertion, deletion, searching algorithm;
Height balanced binary tree: AVL tree- definition, insertion and deletion with examples only.
m –Way Search Tree: B Tree – Definition, insertion and deletion with examples only; B+ Tree – Definition, insertion and deletion with examples only.
Heap: Definition (min heap and max heap), creation, insertion and deletion algorithm. Application of heap (priority queue and sorting).
Graphs: Definition and representation (adjacency matrix, incidence matrix and adjacency list).
Graph traversal– Depth-first search (DFS), Breadth-first search (BFS) - concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge).

Module 5: Sorting and Searching [8L]
Sorting Algorithms: Definition and need of sorting, different types of sorting algorithm (internal, external, stable, in-place, comparison based); Factors affecting sorting Methods, Bubble sort, Insertion sort, Selection sort, Quick sort, Merge sort, Radix sort – algorithm with analysis (time complexity)
Searching: Factors affecting searching Methods; Sequential search –algorithm with analysis (time complexity); improvement using sentinel.
Binary search and Interpolation Search algorithm with analysis (time complexity)
Hashing: Introduction and purpose of Hashing and Hash functions (division, folding and mid-square), Collision resolution techniques.

Text book:

1. Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications
2. Fundamentals of Data Structures of C by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed 2nd Edition, Universities Press

Reference Books:

1. Data Structures, Algorithms, and Software Principles in C by Thomas A. Standish, 1 Edition, Pearson.
2. Data Structures by S. Lipschutz, Special Indian Edition, Tata McGraw Hill Education (India) Private Limited
3. Data Structures and Program Design in C by Robert L. Kruse, Bruce P. Leung 2nd Edition, Pearson
4. Data Structures in C by Aaron M. Tenenbaum, 1St Edition, Pearson

Paper Name: BASICS ELECTRICAL AND ELECTRONICS ENGINEERING
Paper Code: EE(AM)201
Category: -Major (Core)
L-T-P: 3-0-0
Credit: 3
Total Lecture: 36

CO	Statement
CO1	Apply fundamental concepts and circuit laws to solve simple DC electric circuits
CO2	To solve simple ac circuits in steady state
CO3	Impart the knowledge of Basic Electronics Devices and ICs.
CO4	Analyze the simple electronics circuits

MODULE 1: Elementary Concepts of Electric Circuits 6L

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with independent sources only (Steady state)
Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)

MODULE 2: Electrical machine 8L

Transformer: Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency.
DC Machines: Brief idea on constructional features, classifications, working principle of both motor and generator. Simple problems on Voltage equation.

MODULE 3: Fundamentals of Semiconductor Devices: 6L

Introduction to Semiconductor: Concept of energy band diagram; Comparison among metal, insulator, semiconductor; Semiconductors-classifications and Fermi energy level; Charge neutrality and Mass-Action law in semiconductor; Current flow in semiconductor due to drift & diffusion process; Einstein relation.

MODULE 4: PN Junction Diode: 4L

Principle of operation; V-I characteristics; principle of avalanche & Zener breakdown; Junction resistances and capacitances; V-I characteristics of Zener diode.

MODULE 5: Bipolar Junction Transistors: 4L

PNP and NPN structures; Principle of operation; Current gains in CE, CB and CC mode; input and output characteristics; Biasing & Stability Analysis-Concept of Fixed Bias, Collector to base Bias & voltage divider bias.

MODULE 6: Introduction to IC: 8L

Integrated circuit-Basic idea, classifications, advantages, disadvantages; OPAMP(IC741)-Pin configuration and equivalent circuit; Characteristics of OPAMP(IC741); Inverting & Non-Inverting Amplifier; Adder, Subtractor, Differentiator & Integrator Circuit.

Textbooks:

1. A Textbook of Electrical Technology - Volume I (Basic Electrical Engineering) & Volume II (Ac & DC Machines)-B. L Theraja & A.K. Teraja, S. Chad,23rd Edition, 1959
2. D. Chattopadhyay, P.C Rakshit, "Electronics Fundamentals and Applications", New Age International (P) Limited Publishers, Senenth Edition,2006
3. Basic Electrical & Electronics Engineering by J.B. Gupta , S.K. Kataria & Sons,2013
4. Basic Electrical and Electronics Engineering-I by Abhijit Chakrabarti and Sudip Debnath, McGraw Hill, 2015
5. M.S.Sukhija andT.K.Nagsarkar,Basic Electrical and Electronics Engineering, Oxford University Press,2012.
6. DP Kothari and IJ Nagrath,"Basic Electrical & Electronics Engineering", Tata McGraw Hill,2020.

ReferenceBooks

1. DC Kulshreshtha,"Basic Electrical Engineering",TataMcGrawHill,2010.
2. T.K. Nagsarkar, M.S.Sukhija,"BasicElectricalEngineering",OxfordHigherEducation.
3. Hughes,"Electrical and ElectronicTechnology",Pearson Education".
4. Parker and Smith,"Problems in Electrical Engineering",CBS Publishers and Distributors.
5. Anant Agarwal, Jeffrey Lang, Foundations of Analog and Digital Electronic Circuits, Morgan Kaufmann Publishers, 2005.
6. Bernard Grob,Basic Electronics,McGrawHill.
7. Chinmoy Saha, Arindham Halder and Debarati Ganguly, Basic Electronics-Principles and Applications, Cambridge University Press, 2018.

CO-PO Course Articulation Matrix Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	3	2	1	-	-	-	-	-	-	2	2
CO2	3	3	2	1	-	-	-	-	-	-	2	2
CO3	3	2	2	1	-	-	-	-	-	-	1	2
CO4	2	3	2	1	-	-	-	-	-	-	2	1

Course Name: Engineering Physics
Course Code: PH(AM)201
Contact: (3:0:0)
Total Contact Hours: 36
Credits: 3
Prerequisites: Knowledge of Physics up to 12th standard.

Course Objectives:

The aim of courses in Physic-I is to provide adequate exposure and develop insight about the basic principles of physical sciences and its practical aspects which would help engineers to learn underlying principles of various tools and techniques they use in core engineering and related industrial applications. The course would also inculcate innovative mindsets of the students and can create awareness of the vital role played by science and engineering in the development of new technologies.

Course Outcomes (COs):
After attending the course students' should be able to

CO	Description
CO1	explain basic principles of laser and optical fibers.
CO2	understand the properties of Nano material.
CO3	analyze different crystallographic structures according to their co-ordination number and packing factors.
CO4	analyze the structure, function and characteristics of different storage devices.
CO5	justify the need of a quantum mechanics as remedy to overcome limitations imposed by classical physics.

Course Content:

Module 1 (12L)
Modern Optics
1.01- Laser: Concepts of various emission and absorption processes, Einstein A and B coefficients and equations, working principle of laser, metastable state, population inversion, condition necessary for active laser action, optical resonator, illustrations of Ruby laser, He-Ne laser, Semiconductor laser, applications of laser, related numerical problems. 6L
1.02-Fibre Optics-Principle and propagation of light in optical fibers (Step index, Graded index, single and multiple modes) - Numerical aperture and Acceptance angle, Basic concept of losses in optical fiber, related numerical problems. 3L
1.03-Holography-Theory of holography, viewing of holography, applications 3L

Module 2 (6L)
Solid State Physics
2.01 Crystal Structure: Structure of solids, amorphous and crystalline solids (definition and examples), lattice, basis, unit cell, Fundamental types of lattices –Bravais lattice, simple cubic, fcc and bcc lattices, Miller indices and miller planes, co-ordination number and atomic packing factor, Bragg's equation, applications, numerical problems. 3L
2.02 Semiconductor: Physics of semiconductors, electrons and holes, metal, insulator and semiconductor, intrinsic and extrinsic semiconductor, p-n junction. 3L

Module 3 (8L)
Quantum Mechanics
3.01 Quantum Theory: Inadequacy of classical physics-concept of quantization of energy, particle concept of

electromagnetic wave (example: photoelectric and Compton Effect; no derivation required, origin of modified and unmodified lines), wave particle duality; phase velocity and group velocity; de Broglie hypothesis; Davisson and Germer experiment, related numerical problems. 4L

3.02 Quantum Mechanics 1: Concept of wave function, physical significance of wave function, probability interpretation; normalization of wave functions-Qualitative discussion; uncertainty principle, relevant numerical problems, Introduction of Schrödinger wave equation (only statement).

4L

Module 4 (4L)

Physics of Nanomaterials

Reduction of dimensionality, properties of nanomaterials, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Quantum size effect and Quantum confinement. Carbon allotropes. Application of nanomaterials (CNT, graphene, electronic, environment, medical).

Module 5 (6L)

Storage and display devices

Different storage and display devices-Magnetic storage materials, Hard disc (examples related to computers compared with semiconductor storage viz. Pendrive), Operation and application of CRT, CRO, Liquid crystal display (LCD), LED, OLED, Plasma display, Thin film transistor display).

Recommended Text Books for Engineering Physics:

Modern Optics:

1. A text book of Light- K.G. Mazumder & B.Ghoshs (Book & Allied Publisher)
2. A text book of Light-Brijlal & Subhramanium, (S. Chand publishers)
3. Modern Optics-A. B. Gupta (Book & Allied Publisher)
4. Optics-Ajay Ghatak (TMH)
5. Optics-Hecht
6. Optics-R. Kar, Books Applied Publishers
7. Physical Optics Möler
8. Concepts of Modern Physics-Arthur Beiser, McGraw Hill

Solid State Physics:

Solid state physics-Puri & Babbar (S. Chand publishers)
Materials Science & Engineering-Kakani Kakani
Solid state physics- S. O. Pillai
Introduction to solid state physics-Kittel (TMH)
Solid State Physics and Electronics-A. B. Gupta and Nurul Islam (Book & Allied Publisher)
Problem in Solid state physics -S.O. Pillai (a. b.)

Quantum Mechanics:

Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
Quantum Mechanics-Bagde and Singh (S. Chand Publishers)
Perspective of Quantum Mechanics-S. P. Kuilla (New Central Book Agency)
Quantum Mechanics-Binayak Datta Roy (S. Chand Publishers)
Quantum Mechanics-Bransden (Pearson Education Ltd.)
Perspective of Modern Physics-A. Beiser (TMH)
Quantum mechanics -A.K. Ghatak and S Lokenathan
Modern Physics -E.E. Anderson
Physics Volume 2 -Haliday, Resnick & Krane, Published by Wiley India

Physics of Nanomaterials

Nanostructure and Nanomaterials, B.K. Parthasarathy
Introduction to Nanotechnology, B.K. Parthasarathy
Essentials of Nanotechnology, Rishabh Anand
Nanomaterials Handbook (Advanced Materials and Technologies)-YuryGogotsi (Editor).
Nanotechnology-Rakesh Rathi (S. Chand Publishers)
Integrated Electronics-Millman Halkias (TMH)
Nanotechnology-Rakesh Rathi (S. Chand Publishers)
Nanoscience-H. E. Schaefer (Springer)

Storage and display devices
Optics-A. K. Ghatak (McGraw Hill India)
2. Optics-B.D. Gupta (Books and Allied Pvt. Ltd.)

Text Books:

Refresher courses in physics (Vol. 1, Vol. 2 & Vol. 3)-C. L. Arora (S. Chand Publishers)
Basic Engineering Physics-Amal Chakraborty (Chaya Prakashani Pvt. Ltd.)
Perspective & Concept of Modern Physics -Arthur Baiser
Principles of engineering physics – Md. N Khan and S Panigrahi.
Basic Engineering Physics-Sujoy Bhattacharya, Saumen Pal (MG)
Engineering Physics (Vol. 1, Vol. 2)-S.P. Kuila (S. Chand Publishers)
Engineering Physics-A. S. Vasudeva

Course Name: Engineering Mathematics - II
Paper Code: M(AM)201
Contact (L: T: P): 3 : 0 : 0
Total Contact Hours: 36
Credit: 3

Prerequisites:

The students to whom this course will be offered must have the concept of (10+2) standard calculus.

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in ordinary differential equations, Laplace transform and numerical methods. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes (COs):

On successful completion of the learning sessions of the course, the learner will be able to:

CO1: Recall the properties related to ordinary differential equations, Laplace transform and numerical techniques.

CO2: Determine the solutions of the problems related to ordinary differential equations, Laplace transform and numerical techniques.

CO3: Apply appropriate mathematical tools of ordinary differential equations, Laplace transform and numerical techniques for the solutions of the problems.

CO4: Analyze engineering problems by using ordinary differential equation, Laplace transform and numerical Methods.

CO-PO/PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO4	2	3	1	2	-	-	-	-	-	-	-	1
M(CST) 201	2.75	2.25	1.5	2	-	-	-	-	-	-	-	1.25

Weightage Values: Strongly mapped: ‘3’, Moderately mapped: ‘2’, Weakly mapped: ‘1’, Not mapped: ’-‘.

Course Content:

Module I: First Order Ordinary Differential Equations (ODE) (9L)

Solution of first order and first degree ODE: Exact ODE, Rules for finding Integrating factors, Linear ODE, Bernoulli's equation.

Solution of first order and higher degree ODE: solvable forp, solvable for y and solvable for x and Clairaut's equation.

Module II: Second Order Ordinary Differential Equations (ODE) (8L)

Solution of second order ODE with constant coefficients: C.F. &P.I., Method of variation of parameters, Cauchy-Euler equations.

Module III: Laplace Transform (LT) (12L)

Concept of improper integrals; Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of tf(t), LT of f(t)t, LT of derivatives of f(t), LT of integral of f(t), Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties, Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT.

Module IV: Numerical Methods (7L)

Introduction to error analysis, Calculus of finite difference. **Interpolation:** Newton forward and backward interpolation, Lagrange's interpolation. **Numerical integration:** Trapezoidal rule, Simpson's 1/3 rule. **Numerical solution of ordinary differential equation:** Euler method, Fourth order Runge - Kutta method.

Text Books:

1. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Reference Books:

1. Guruprasad, S. A text book of Engineering Mathematics-I, New age International Publishers.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
5. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
6. Apostol, M., Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
7. Kumaresan, S., Linear Algebra - A Geometric approach, Prentice Hall of India, 2000.
8. Poole, D., Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
9. Bronson, R., Schaum's Outline of Matrix Operations. 1988.
10. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969.

Course Name: Environmental Science
Paper Code: HU204
Contact (L: T: P): 2 : 0 : 0
Total Contact Hours: 24
Credit: 2

Course Objective(s)

This course will enable the students to,

- Realize the importance of environment and its resources.
- Apply the fundamental knowledge of science and engineering to assess environmental and health risk.
- Know about environmental laws and regulations to develop guidelines and procedures for health and safety issues.
- Solve scientific problem-solving related to air, water, land and noise pollution.

Module 1 - Resources and Ecosystem (6L)

Resources (2L)
Types of resources, resistance to resources, Human resource, Population Growth models: Exponential Growth, logistic growth
Ecosystem (3L)
Components of ecosystem, types of ecosystem, Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Food chain, Food web.
Energy and Environment(1L)
Conventional energy sources, coal and petroleum, Green energy sources, solar energy, tidal energy, geothermal energy, biomass

Module 2 – Environmental Degradation (9L)

Air Pollution and its impact on Environment (3L)
Air Pollutants, primary & secondary pollutants, Criteria pollutants, Smog, Photochemical smog and London smog, Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion.
Water Pollution and its impact on Environment (3L)
Water Pollutants, Oxygen demanding wastes, heavy metals, BOD, COD, Eutrophication, Hardness, Alkalinity, TDS and Chloride, Heavy metal poisoning and toxicity.
Land Pollution and its impact on Environment (2L)
Solid wastes, types of Solid Waste, Municipal Solid wastes, hazardous wastes, bio-medical wastes, E-wastes
Noise Pollution and its impact on Environment (1L)
Types of noise, Noise frequency, Noise pressure, Noise intensity, Noise Threshold limit, Effect of noise pollution on human health.

Module 3 – Environmental Management (6L)

Environmental Impact Assessment (1L)
Objectives of Environmental management, Components of Environmental Management, Environmental Auditing, Environmental laws and Protection Acts of India
Pollution Control and Treatment (2L)
Air Pollution controlling devices, Catalytic Converter, Electrostatic Precipitator, etc., Waste Water Treatment, Noise pollution control.

Waste Management (3L)
Solid waste management, Open dumping, Land filling, incineration, composting, E-waste management, Biomedical Waste management.

Module 4 – Disaster Management (3L)

Study of some important disasters (2L)
Natural and Man-made disasters, earthquakes, floods drought, landside, cyclones, volcanic eruptions, tsunami, Global climate change. Terrorism, gas and radiations leaks, toxic waste disposal, oil spills, forest fires.
Disaster management Techniques (1L)
Basic principles of disasters management, Disaster Management cycle, Disaster management policy, Awareness generation program

Paper Name: Indian knowledge System
Paper Code: HU205
Credit: 01
Contact Hours: 12

Module-1 (3L)

An overview of Indian Knowledge System (IKS): Importance of Ancient Knowledge - Definition of IKS - Classification framework of IKS - Unique aspects of IKS.
The Vedic corpus: Vedas and Vedangas - Distinctive features of Vedic life.
Indian philosophical systems: Different schools of philosophy.

Module-2 (3L)

Salient features of the Indian numeral system - Importance of decimal representation - The discovery of zero and its importance - Unique approaches to represent numbers.

Highlights of Indian Astronomy: Historical development of astronomy in India

Module-3 (3L)

Indian science and technology heritage - Metals and metalworking - Mining and ore extraction – Physical structures in India - Irrigation and water management - Dyes and painting technology - Surgical Techniques - Shipbuilding

Module-4 (3L)

Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, Traditional Knowledge in agriculture, Traditional societies depend on it for their food and healthcare needs.

References:

1. Introduction to Indian knowledge system: concepts and applications-Mahadevan B.Bhat, Vinayak Rajat, Nagendra Pavana R.N.,PHI
2. Traditional Knowledge system in India, Amit Jha, Atlantic Publishers
3. S. N. Sen and K. S. Shukla, *History of Astronomy in India*, Indian National Science Academy, 2nd edition, New Delhi, 2000

Course Name: DATA STRUCTURES LAB
Course Code: AM291
Contact (Periods/Week) :3L/Week
Total Contact Hours: 36
Credits: 1.5

Course Outcomes	Name of Course Outcomes
CO1	To identify the appropriate data structure as applied to specified problem definition.
CO2	To summarize operations like searching, insertion, deletion, traversing mechanism used on various data structures.
CO3	To implement practical knowledge of data structures on the applications.
CO4	To illustrate how to store, manipulate and arrange data in an efficient manner.
CO5	To write programs to access queue and stack using arrays and linked list, binary tree and binary search tree.

CO-PO-PSO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	3	-	-	-	-	-	-	2	1	1	1
CO2	3	2	2	3	3	-	-	-	-	-	3	2	3	2	2
CO3	2	3	3	-	2	-	-	-	-	-	-	2	3	3	3
CO4	2	2	1	3	2	-	-	-	-	-	2	3	2	1	2
CO5	2	2	3	1	2	-	-	-	-	-	-	3	3	3	3
	2.4	2.4	2.4	2.3	2.4	-	-	-	-	-	2.5	2.4	2.4	2	2.2

Course Content:

Module 1: Implementing Non-Restricted Linear Data Structure [2 Lab]
Problem based on Implementation of Non-Restricted Linear Data Structure like- Implementation of list as data structure using array. Implementation of list as data structure using linked list of different types. Implementation of polynomial as data structure using array and linked list. Implementation of sparse matrix as data stricture using array.

Module 2: Implementing Restricted Linear Data Structure [3 Lab] Problem based on Implementation of Restricted Linear Data Structure like- Implementation of stack as data structure using array. Implementation of stack as data structure using linked list. Implementation of queue as data structure using array (physic al, linear and circular model). Implementation of queue as data

structure using linked list. Converting infix to post-fix and evaluating post-fix expression using stack. Implementing Tower-of-Hanoi problem.

Module 3: Implementing Non-Linear Data Structure [2 Lab]
Problem based on Implementation of Non-Linear Data Structure like Implementation of Binary Tree as data structure using array and linked list. Implementation of Binary Search Tree (BST) as data structure using linked list. Implementation of Heap as data structure using array. Implementation of Priority Queue as data structure using Heap.

Module 4: Implementing Sorting and Searching algorithm [5 Lab] Problem based on Implementation of Sorting and Searching algorithm
Implementation of Bubble sort using appropriate data structure.
Implementation of Selection sort using appropriate data structure.
Implementation of Insertion sort using appropriate data structure. Implementation of Quick sort using appropriate data structure.
Implementation of Merge sort using appropriate data structure.
Implementation of Heap sort using appropriate data structure.
Implementation of Radix sort using appropriate data structure.
Implementation of Sequential Search using appropriate data structure.
Implementation of Binary Search using appropriate data structure.
Implementation of hashing with collision resolution using linear and quadratic probing.

Text books:
1.Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications.
2. Fundamentals of Data Structures of C by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed 2nd Edition, Universities Press.

Reference books:
1. Data Structures, Algorithms, and Software Principles in C by Thomas A. Standish, 1 Edition, Pearson.
2. Data Structures by S. Lipschutz, Special Indian Edition, Tata McGraw Hill Education (India) Private.
3. Limited Data Structures and Program Design In C by Robert L. Kruse, Bruce P. Leung 2nd Edition, Pearson.
4. Data Structures in C by Aaron M. Tenenbaum, 1St Edition, Pearson

Name: BASICS ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY
Paper Code: EE(AM)291
Category: -Major (Core)
L-T-P: 0-3-0
Credit: 1.5
Total Lecture: 36

CO	Statement
CO1	To Analyze a given network by applying KVL and KCL.
CO2	To Examine the Operation of DC Motor.
CO3	To Examine the Operation of Basic Electronics Devices and ICs.
CO4	To design simple electronics circuits.

List of Experiments: -

1. **Familiarization with different passive and active electrical & electronic components.**
2. **Familiarization with different Electrical & Electronics Instruments.**
3. **Verification of KVL and KCL.**
4. **Forward and reversal of DC shunt motor.**
5. **Speed control of DC shunt motor.**
6. **Study of the P-N junction diode V-I characteristics (Forward & Reverse Bias).**
7. **Study of the Characteristics of Zener diode (Forward & Reverse Bias).**
8. **Study of the Input and Output characteristics of BJT in CE mode.**
9. **Determination of offset voltage, offset current & bias current of OPAMP(IC741).**
10. **Determination of CMRR and slew rate of OPAMP(IC741).**
11. **Determination of inverting and non-inverting gain of OPAMP(IC741).**
12. **Extramural Experiment.**

Textbooks:

7. Handbook of Laboratory Experiments in Electronics Engineering Vol. 1, Author Name: A.M. Zungeru, J.M. Chuma, H.U. Ezea, and M. Mangwala, Publisher -Notion Press Electronic Devices and Circuit Theory by Robert Boylestad Louis Nashelsky,7th Edition, Prentice Hall
8. Experiments Manual for use with Grob's Basic Electronics 12th Edition by Wes Ponick, Publisher-McGraw Hill,2015

9. Laboratory Manual for 'Fundamentals of Electrical & Electronics Engineering': A handbook for Electrical & Electronics Engineering Students by Manoj Patil (Author), Jyoti Kharade (Author), 2020
10. The Art of Electronics, Paul Horowitz, Winfield Hill,Cambridge University Press, 2015.
11. A Handbook of Circuit Math for Technical Engineers, Robert L. Libbey
CRC Press, 05-Jun-1991

Reference Books

1. Basic Electrical and Electronics Engineering, Author:S. K. Bhattacharya, Publisher: Pearson Education India,2011
2. Practical Electrical Engineering
3. By Sergey N. Makarov, Reinhold Ludwig, Stephen J. Bitar, Publisher: Springer International Publishing, 2016
4. Electronics Lab Manual (Volume 2) By Navas, K. A. Publisher: PHI Learning Pvt. Ltd. 2018
5. Practical Electronics Handbook, Ian R. Sinclair and John Dunton, Sixth edition 2007, Published by Elsevier Ltd.

CO-PO Course Articulation Matrix Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	2	3	2	-	2	-	-	2	-	2	3
CO2	3	3	2	3	-	2	-	-	3	-	2	2
CO3	3	2	2	3	-	2	-	-	2	-	3	3
CO4	3	3	2	2	-	2	-	-	3	-	2	3

Paper Name: Design thinking
Paper Code: HU292
Credit: 01
L:T:P: 0:0:2

Module 1: Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting. **(2)**

Module 2: Memory: process, Sensory memory, STM and LTM, Problems in retention, Memory enhancement techniques. **(4)**

Module 3: Emotions: Experience & Expression Understanding Emotions, Empathy, And Concept of Emotional Intelligence. **(2)**

Module 4: Basics of Design Thinking Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) – Empathize, Define, Ideate, Prototype, Test. **(6)**

Module 5: Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving **(4)**

Unit 6: Prototyping & Testing -Rapid Prototype Development process, Testing, Sample Example, Test Group Marketing **(2)**

Module-7: Design thinking for strategic innovations Growth –Change- Examples of Customer Challenges, Use of Design Thinking to Enhance Customer Experience -Value redefinition - Extreme Competition –Standardization —Strategy– Business Model design. **(4)**

References:

1. John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) second Edition, 2013.

2. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.

3. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013

4. George, E, Dieter, Linda, C, Schmidt. (2017). Engineering Design, McGraw Hill publisher, 4th edition

Course Name: Engineering Physics Lab
Code: PH(AM)291
Contact Hours: 0:0:3
Credit: 1.5
Prerequisites: Knowledge of Physics up to 12th standard.

Course Objectives:
The aim of course is to provide adequate exposure and develop insight about the basic principles of physical sciences and its practical aspects which would help engineers to learn underlying principles of various tools and techniques they use in core engineering and related industrial applications. The course would also inculcate innovative mindsets of the students and can create awareness of the vital role played by science and engineering in the development of new technologies.

Course Outcomes (COs):
After attending the course students' will be able to
CO1: demonstrate experiments allied to their theoretical concepts
CO2: conduct experiments using LASER, Optical fiber.
CO3: participate as an individual, and as a member or leader in groups in laboratory sessions actively
CO4: analyze experimental data from graphical representations, and to communicate effectively them in Laboratory reports including innovative experiment.
CO5: Design solutions for real life challenges.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	3	3	--	--	--	--	--	--	--
CO2	2	3	2	3	3	--	--	--	--	--	--	--
CO3	2	3	2	3	3	--	--	--	--	--	--	--
CO4	2	2	3	2	3	--	--	--	--	--	--	--
CO5	2	2	3	2	3	--	--	--	--	--	--	--

Course Content:

General idea about Measurements and Errors (One Mandatory):
i.Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment.

Experiments on Classical Physics (Any 4 to be performed from the following experiments):

1. Study of Torsional oscillation of Torsional pendulum & determination of time using various load of the oscillator.
2. Determination of Young's moduli of different materials.
3. Determination of Rigidity moduli of different materials.
4. Determination of wavelength of light by Newton's ring method.
5. Determination of wavelength of light by Laser diffraction method.
6. Optical Fibre-numerical aperture, power loss.

Experiments on Quantum Physics (Any 2 to be performed from the following experiments):

7. Determination of Planck's constant using photoelectric cell.
8. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
9. Determination of Stefan's Constant.
10. Study of characteristics of solar cell.

Perform at least one of the following experiments:

11. Calibration of an oscillator using Lissajous Figure.
12. Determination of specific charge of an electron (e/m) by J. J Thompson Method.

**In addition it is recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:

1. Study of dispersive power of material of a prism.
2. Study of viscosity using Poiseuille's capillary flow method/using Stoke's law.
3. Determination of thermal conductivity of a bad/good conductor using Lees-Charlton / Searle apparatus.
4. Determination of the angle of optical rotation of a polar solution using polarimeter.
5. Any other experiment related to the theory.

Recommended Text Books for Engineering Physics Lab:

Waves & Oscillations:
1. Vibration, Waves and Acoustics- Chattopadhyay and Rakshit Classical & Modern

Optics:
2. A text book of Light- K.G. Mazumder & B.Ghosh (Book & Allied Publisher)

Quantum Mechanics-I
1. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)

Solid State Physics:
1. Solid State Physics and Electronics-A. B. Gupta and Nurul Islam (Book & Allied Publisher)

Text Books:
1. Practical Physics by Chatterjee & Rakshit (Book & Allied Publisher)
2. Practical Physics by K.G. Mazumder (New Central Publishing)
3. Practical Physics by R. K. Kar (Book & Allied Publisher)

COURSE NAME: Engineering graphics & design lab
COURSE CODE: ME(AM)291
CONTACT: 0:0:3
CREDITS: 1.5

Prerequisites: Basic knowledge of geometry

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

CO1: Learn the basics of drafting

CO2: Understand the use of drafting tools which develops the fundamental skills of industrial drawings.
CO3: Apply the concept of engineering scales, dimensioning and various geometric curves necessary to understand design of machine elements.
CO4: Analyse the concept of projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts.
CO5: Evaluate the design model to different sections of industries as well as for research & development.

Course Contents:

Basic Engineering Graphics: (3P)

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Module 1: Introduction to Engineering Drawing (6P)

Principles of Engineering Graphics and their significance, Usage of Drawing instruments, lettering, Conic sections including Rectangular Hyperbola (General method only); Cycloid, Epicycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

Module 2: Orthographic & Isometric Projections (6P)

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes on inclined Planes - Auxiliary Planes; Projection of Solids inclined to both the Planes- Auxiliary Views; Isometric Scale, Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa.

Module 3: Sections and Sectional Views of Right Angular Solids (6P)

Drawing sectional views of solids for Prism, Cylinder, Pyramid, Cone and project the true shape of the sectioned surface, Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw sectional orthographic views of objects from industry and dwellings (foundation to slab only).

Computer Graphics: (3P)

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling.

Module 4: Overview of Computer Graphics: (3P)

Demonstration of CAD software [The Menu System, Toolbars (Standard, Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Zooming methods, Select and erase objects].

Module 5: CAD Drawing, Customization, Annotations, layering (6P)

Set up of drawing page including scale settings, ISO and ANSI standards for dimensioning and tolerance; Using various methods to draw straight lines, circles, applying dimensions and annotations to drawings; Setting up and use of Layers, changing line lengths (extend/lengthen); Drawing sectional views of solids; Drawing annotation, CAD modeling of parts and assemblies with animation, Parametric and nonparametric solid, surface and wireframe modeling, Part editing and printing documents.

Module 6: Demonstration of a simple team design project (3P)

Illustrating Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; Meshed topologies for engineering analysis and tool-path generation for component manufacture, use of solid-modeling software for creating associative models at the component and assembly levels.

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R, (2014), Engineering Drawing, Charotar Publishing House
2. K. Venugopal, Engineering Drawing + AutoCAD, New Age International publishers

Reference Books:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
2. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

CO-PO/PSO Mapping:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2			2									2	2	2
CO2	2			2									2	2	2
CO3	3			2									2	2	2
CO4	3			3									3	3	2
CO5	3	2		3	2								3	3	2

2nd Year 3rd Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	AM301	Computer Organization and Architecture	3	0	0	3	3
2	ENGG	Major	AM302	Design and Analysis of Algorithms	3	0	0	3	3
3	SCI	Minor	M(AM)301	Discrete Mathematics	3	0	0	3	3
4	ENGG	Minor	EC(AM)301	Digital Logic and Electronics	3	0	0	3	3
		B. PRACTICAL							
1	ENGG	Major	AM391	Computer Organization and Architecture Lab	0	0	3	3	1.5
2	ENGG	Major	AM392	Design and Analysis of Algorithms Lab	0	0	3	3	1.5
3	ENGG	Minor	EC(AM)391	Digital Logics and Electronics Lab	0	0	3	3	1.5
4	ENGG	Skill Enhancement Course	AM393	IT Workshop Lab (SciLab/MATLAB/C++)	0	1	3	4	2.5
Total of Theory and Practical								26	19

Course Name: Computer Organization and Architecture
Course Code:AM301
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: Digital Electronics
Course Outcomes (COs):

After attending the course students should be able to

CO1	Illustrate the basic concept of computer architecture and its performance measurement, parallel processing, Flynn's classification and Amdahl's law and apply this knowledge in designing solutions for real life engineering problems.
CO2	Summarize the basic concept of pipeline, instruction pipeline, arithmetic pipeline hazards detection and prevention and use this knowledge for designing and implementing mathematical and engineering problems leading to lifelong learning.
CO3	Identify the concept of Instruction-Level Parallelism to solve engineering problems.
CO4	Illustrate and compare the concept of Multiprocessor architecture and parallel architecture and apply this knowledge for developing an approach by means of existing and new methods as a team work.
CO5	Understand the concept of message passing architecture and interconnection network and design an optimized model for building a new solution as a professional engineering practice as a team.

Course Contents:

Module 1[8L]: Introduction to CPU and concepts of ALU[2L], Instruction format and Instruction Cycle[1L], Addressing Modes [1L] Fixed-point multiplication -Booth's algorithm. [2L], Fixed-point division - Restoring and non-restoring algorithms[1L], Floating-point number representation-IEEE754 format and Floating-point arithmetic operation[1L].

Module 2 [7L]: Introduction to basic computer architecture [1L], Stored Program Concepts: Von Neumann & Harvard Architecture [1L], RISC VS CISC [1L], Amdahl's law [1L], Performance measurement parameters – MIPS, MFLOPS, SPEC ratings, CPI etc. [2L] Micro programmed and hardwired control unit [1L].

Module 3[8L]: Pipelining: Basic concepts, instruction and arithmetic pipeline[2L], data hazards, control hazards and structural hazards, techniques for handling hazards[2L] Pipeline vs. Parallelism, Levels of parallelism [1L], Instruction-Level Parallelism: Basic Concepts, Techniques for Increasing ILP, Superscalar, Super Pipelined and VLIW Processor Architectures [2L], Array and Vector Processors [1L]

Module 4[9L]: Introduction to memory-RAM and ROM [1L], Register transfer, memory transfer, Tri-state bus buffer, Memory Hierarchy: Secondary memory [1L], Main Memory [1L], Cache Memory [1L], Mapping Technique in cache memory: Direct, Full Associative and Set Associative [2L], Performance Implementation in Cache Memory [1L], Virtual memory Concepts [1L], page replacement policies [1L].

Module 5[4L]: Multiprocessor architecture: taxonomy of parallel architectures; Flynn's Classification [1L], Centralized and Shared- memory architecture: synchronization [1L], Interconnection Network (Omega, Baseline, Butterfly, Crossbar) [2L].

Text Books:

1. Advanced Computer Architecture Parallelism Scalability Programmability ‘, Tata McGraw-Hill Education
Private Limited ISBN-13: 978-0-07-053070-6 ISBN-10: 0-07-053070-X
2. Hwang & Briggs—Computer Architecture & Parallel Processing, TMH

Reference Books:

1. Patterson D.A. and Hennessy, J.L. ―Computer architecture a quantitative approach‖, 2nd ed. Morgan Kaufman, 1996
2. Hayes J. P., ―Computer Architecture & Organization‖, McGraw Hill
3. Siegel, H.J., ―Interconnection Network for Large Scale parallel Processing‖, 2nd Ed. McGraw Hill, 1990
4. Design and Analysis of Parallel Algorithm-Schim G. Ak

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	-	-	-	-	-	-	-	-
CO2	3	3	3	3	-	-	-	-	-	-	-	3
CO3	2	2	2	3	-	-	-	-	-	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-

CO-PSO Mapping

Cos	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Design & Analysis of Algorithm
Course Code: AM302
Contact: 3:1:0
Total Contact Hours: 36
Credits: 3

Prerequisites: To know data-structure and basic programming ability

Course Outcomes (COs):
After attending the course students should be able to

CO1	To understand and illustrate the concepts of time and space complexity, worst case, average case and best-case complexities and the asymptotic notation.
CO2	To analyze and apply the design principles and concepts to various basic algorithm design viz. dynamic programming, greedy methods etc.
CO3	To understand and analyze various string matching and graph algorithms.
CO4	To understand, illustrate and analyze the different complexity classes
CO5	To discuss, implement and analyze, verify the efficiency of the randomized and approximation algorithms.

Course Content:

Module-1 [4L]

Algorithm Development & Complexity Analysis: [4L] Stages of algorithm development for solving a problem: Describing the problem, identifying a suitable technique, Design of an algorithm, Proof of Correctness of the algorithm. Time and Space Complexity, Different Asymptotic notations – their mathematical significance. Solving Recurrences: Substitution Method, Recurrence Tree Method, Master Theorem (Statement Only).

Module-2 [14L]

Algorithm Design Techniques: Brute force techniques – Traveling Salesman Problem, Divide and Conquer - Matrix multiplication: Strassen‘s algorithm, Greedy techniques - Fractional Knapsack problem, Job Sequencing with Deadline, Graph Coloring, Finding Minimum Cost Spanning Tree, Dynamic programming - O/1 Knapsack problem, Matrix chain multiplication, Travelling Salesman Problem, Backtracking-N-Queens Problem, Knights Tour on Chess Board.

Module-3 [3L]

String matching problem: Different techniques – Naive algorithm, string matching using finite automata, and Knuth, Morris, Pratt (KMP) algorithm with their complexities.

Module-4 [5L]

Graph Algorithms Single Source Shortest Path – Dijkstra‘s Algorithm, All pair shortest path – Floyd-Warshall Algorithm. Network Flows, Maximum Flows – Ford-Fulkerson Algorithm, Push Re-label Algorithm, Minimum Cost Flows – Cycle Cancelling Algorithm.

Module-5 [5L]

Complexity Classes: The Class P, The Class NP, Reducibility and NP-completeness – SAT (without proof), 3-SAT, Vertex Cover, Independent Set, Maximum Clique.

Module-6 [5L]

Approximation and Randomized Algorithms [3L], Approximation Algorithms - The set-covering problem – Vertex cover, K-center clustering. Randomized Algorithms - The hiring problem, Finding the global Minimum. Recent Trends [2L]

Text book:

1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.

2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman. 3. "Algorithm Design" by Kleinberg and Tardos**.**

3. Design & Analysis of Algorithms, Gajendra Sharma, Khanna Publishing House, New Delhi Reference Books:

4. ―Design Analysis and Algorithms‖ by Hari Mohan Pandey

CO-PO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	-	-	-	-	-	-	-	2
CO2	3	3	3	3	-	-	-	-	-	-	-	2
CO3	3	3	3	3	-	-	-	-	-	-	-	2
CO4	3	3	3	3	-	-	-	-	-	-	-	2
CO5	3	3	3	3	-	-	-	-	-	-	-	2

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Discrete Mathematics
Course Code: M(AM)301
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites: Higher Secondary Level Mathematics

Course Outcome(s):
After completion of the course students will be able to

CO1	Understand the fundamental concepts of Set Theory to Explain or Illustrate and Identify problems where students can Apply the concept appropriately to Solve them.
CO2	Understand the fundamental concepts of Mathematical Logic and Proof Techniques so that they can Prove theorems using Proof Techniques and Mathematical Logic Frameworks to justify a claim.
CO3	Explain or illustrate the fundamental Theory of Numbers and Identify problems where students can Use the concept appropriately to Solve them.
CO4	Explain or illustrate the fundamental principles of Algebraic Structures and Identify problems where students can Apply the concept appropriately to Solve them.
CO5	Develop ideas to Propose solutions to the problems of Graph Theory and Identify problems where students can Apply the concept appropriately and analyze the effectiveness as well as limitations of solutions making the students aware of its utilitarian importance for further explorations leading towards lifelong learning.

Course Content:

Module -1: Set Theory [8L] Set: Operations and Properties of set, Finite Set, Power Set, Cardinality of finite set, Cartesian Product, Relation: Types of Relations, Properties of Binary Relation, Equivalence Relation, Partial Ordering Relation and Poset, Lattice. [4L] Combinatorics and Counting: Sum and product rule, Permutation and Combination Principle of Inclusion Exclusion. Pigeon Hole Principle. [2L] Generating Functions and Recurrence Relations: Recursively defined relation and functions, Discrete Numeric Function, Growth of Functions, Problems on Recurrence Relations and their solutions using different methods. [2L]

Module-2:

Mathematical Logic and Proof Techniques [8L] Propositional Logic: Basics of Boolean Logic, Idea of Propositional Logic, well-formed formula, Truth tables, Tautology, Satisfiability, Contradiction, Algebra of proposition, Inference theory of Propositional Logic.[3L] Predicate Logic: Idea of First Order Predicate Logic and Quantifiers, well-formed formula of predicate, Inference theory of Predicate Logic.[3L] Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.[2L].

Module-3:

Theory of Numbers [4L] Well-Ordering Principle, Divisibility theory and properties of Divisibility, Fundamental theorem of Arithmetic, Prime and Composite Numbers. [2L] Greatest Common Divisor and Euclidean Algorithm, Congruence, Residue Classes. [2L]

Module-4:

Algebraic Structures [8L] Concepts of Groups, Subgroups and Order, Cyclic Groups, Cosets, Normal Subgroups, Permutation and Symmetric groups, Group Homomorphisms. [5L] Elementary properties of Rings and related problems[1L] Elementary properties of Fields and related problems. [1L] Elementary properties of Vector Space and related problems. [1L]

Module-5:

Graph Theory [8L] Graph Terminologies and their properties: Degree, Connectivity, Path, Cycle, Sub-Graph, Isomorphism, Eulerian and Hamiltonian Walks, Matrix representation of graphs, Shortest Path in Graph. [2L] Graph Colouring and Matching: Colouring Vertices and Chromatic Number, Colouring Edges and Total Colouring, Independence and Chromatic Partitioning, Cliques, Perfect Graphs, Bounds on Chromatic Numbers, Chromatic Polynomials, Matching. [3L] Tree: Rooted Trees, Binary Search Tree and Tree Sorting, Spanning Tree, Weighted Trees and prefix codes. [3L]

Textbook:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill.
2. Susanna S. Epp, Discrete Mathematics with Applications,4th edition, Wadsworth Publishing Co. Inc.

Reference Books:

1. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.
2. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and Its Application toComputer Science‖,
TMG Edition, Tata McGraw-Hill
3. Seymour Lipschutz, Marc Lipson, Discrete Mathematics (Schaum‘s Outlines Series), Tata McGraw - Hill.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	3	-	-	-	-	-	-	-	-

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	2	2	2
CO4	2	2	2
CO5	2	2	2

Course Name: Digital Logic and Electronics
Course Code: EC(AM)301
Contact: 3:0:0
Credit: 3
Total Contact Hours: 36

Pre-requisite:

Basic concepts of Logic gates, Truth Tables, Concept of basic components of a digital computer.

Course Outcome(s):

CO1: To realize basic gate operations and laws Boolean algebra.
CO2: To understand basic mechanism of digital computers and digital logic behind different arithmetic and control unit operations.
CO3: To design combinational circuits and combinational functions for larger more complex circuits. **CO4:** To perform different operations with sequential circuits.
CO5: To understand fundamental concepts and techniques used in Logic families and PLDs

.

Course Content: –

Module – 1: [8L]
Binary Number System [1L]; BCD, ASCII, EBDIC, Gray codes and their conversions [1L], Introduction and laws of Boolean algebra [1L], Boolean functions, Min term and maxterm, Prime implicants, Representation in SOP and POS forms[2L], Minimization of logic expressions by Karnaugh Map and algebraic method [3L]

Module – 2: [8L]
Combinational circuits:
Adder and Subtractor (half-full adder & subtractor) [2L], Serial & Parallel Adder, Carry look ahead adder and
Parity Generator[2L], Encoder, Decoder, Multiplexer [2L], Demultiplexer, Comparator, Code Converters [2L]

Module – 3: [12L]
Sequential Circuits:
Flip-Flops, SR, JK, Master slave JK, D, T, characteristic Tables, Excitation tables [5L]. Basic concept of Synchronous and Asynchronous counters, Up/Down Counters, Ring counter, Johnson counter, Design of Modulo-N Counter, Counter applications [5L]. Registers (SISO, SIPO, PIPO, PISO) [2L].

Module – 4: [8L]
A/D and D/A conversion techniques – Basic concepts (D/A: R-2-R only [2L], A/D: successive approximation [2L]) Logic families- TTL, ECL, MOS and CMOS - basic concepts [2L], Programmable logic Array, programmable Array logic, Sequential Programmable Devices [2L].

Text Book:
1. Saliva Hanan S, Digital Circuits and Design, Oxford
2. Morries Mano- Digital Logic Design- PHI

Reference Book:
1. R.P. Jain—Modern Digital Electronics, 2/e, Mc Graw Hill
2. Digital Fundamentals – A Systems Approach – Thomas L. Floyd, Pearson

CO-PO Mapping:

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

Course Name: Computer Organization and Architecture Lab
Course Code: AM391
Contact: 0:0:3
Credits: 1.5

Prerequisites:
Knowledge of designing different circuits in Computer Organization Lab

Course Outcomes (COs):
After attending the course students should be able to

CO1	Illustrate and use proper syntax in appropriate platforms for developing programs to solve problems related to Mathematics and Engineering fields leading to lifelong learning.
CO2	Apply the knowledge of algorithms in the computational area to efficient programming codes to design the problem using modern tools for solving complex engineering problems.
CO3	Outline different types of digital electronic circuits such as adder, subtract or, encoder decoder, multiplexer, demultiplexer, flip-flops, register, counter using various mapping and modern tools to prepare the most simplified circuit and optimize using various mapping and mathematical methods for solving the problem as a professional engineering practice as a team.
CO4	Apply the knowledge of digital electronic circuits to design memory and ALU and analyze the same to solve engineering-related computational problems as a team.
CO5	Interpret the result of the experiments, prepare laboratory reports based on observed output and analyze it to validate professional ethics and responsibilities and norms of the engineering practice.

List of Experiment:
1. Implement different types of Basic gates and simulate for truth table verification.
2. Implement half adder circuit and simulate for truth table verification.
3. Implement full adder circuit and simulate for truth table verification.
4. Implement half subtractor circuit and simulate for truth table verification.
5. Implement a full subtractor circuit and simulate for truth table verification.
6. Implement Multiplexer, De-Multiplexer circuit and simulate for truth table verification.
7. Implement Encoder, Decoder circuit and simulate for truth table verification.
8. Implement different types of flip flop and simulate for truth table verification.
9. Implement different types of parallel circuits (SISO, SIPO, PISO, PIPO) and simulate the result.
10. Implement ALU and simulate the result.
11. Implement a RAM chip and simulate the result.
12. Innovative Experiments.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	-	-	-	3	-	-	-
CO2	3	3	3	3	3	-	-	-	3	-	-	-
CO3	3	3	3	3	3	-	-	-	3	-	-	-
CO4	3	3	3	3	3	-	-	-	3	-	-	-
CO5	3	3	3	3	3	-	-	-	3	-	-	-

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Design & Analysis of Algorithm Lab
Course Code: AM392
Contact: 0:0:3
Credit: 1.5

Prerequisite:
Programming knowledge

Course Outcomes (COs):
After attending the course students should be able to

CO1	To identify and prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains.
CO2	To understand and illustrate methods for analyzing the efficiency and correctness of algorithms (such as exchange arguments, recurrence, induction, and average case analysis)
CO3	To analyze and design algorithms using the dynamic programming, greedy method, Backtracking, Branch and Bound strategy, and recite algorithms that employ this strategy.
CO4	To understand, compare, contrast, and choose appropriate implementation of the algorithmic design techniques to present an algorithm that solves a given problem.
CO5	To Identify and analyze criteria and specifications appropriate to new problems.

Course Content:

A. Implementation of various Divide & Conquer Methods; viz. Matrix Multiplication.
B. Implementations of various Dynamic Programming Methods, viz. Matrix Chain Multiplication Method, Travelling Salesman Problem etc.
C. Implementations of various Branch & Bound Techniques, viz.
D. Implementations of various Backtracking Methods, viz. n-Queen Problem.
E. Implementations of Greedy Method, viz. Fractional Knapsack Problem, Job Sequencing Problem etc.
F. Implementations of String-matching Algorithm viz. Naïve Algorithm, String Matching with Finite Automata etc.
G. Implementations of Various Graph Algorithms, viz. Dijkstra ‘s Algorithm, Floyd Algorithm etc.
H. Implementation of some Real-Life Trendy Problems

CO-PO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**2**	**2**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**3**
CO2	**3**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**3**
CO3	**3**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**3**
CO4	**3**	**3**	**2**	**2**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**3**
CO5	**3**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**3**

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Digital Logic and Electronics Lab
Course Code: EC(AM)391
Contact: 0:0:3
Credit: 1.5

Prerequisite:
Basic concepts of Logic gates, Truth Tables, function realization –minimization of Logic expressions by K-map, Concept of basic components of a digital computer, Binary Arithmetic

Course Outcomes (COs):
After attending the course students should be able to

CO1	Knowledge of Electronic components such as Resistors, Capacitors, Diodes, Transistors measuring equipment like DC power supply, Multimeter, CRO, Signal generator, DC power supply.
CO2	Analyze the characteristics of Junction Diode, Zener Diode, BJT & FET and different types of Rectifier Circuits.
CO3	Determination of input-offset voltage, input bias current and Slew rate, Common- mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
CO4	Able to know the application of Diode, BJT &OPAMP.
CO5	Familiarization and basic knowledge of Integrated Circuits

Course Content:

1. A) Realization of basic gates and universal gates.
B) Realization of basic gates using universal gates.
2. Design a Half adder and Full Adder circuit using basic gates and verify its output.
3. Design a Half subtractor and Full Subtractor circuit using basic gates and verify its output
4. Design an Adder/Subtractor composite unit.
5. Design of a _Carry-Look-Ahead Adder circuit.
6. Realization of a) Encoder, b) Decoder c) Multiplexer, d) De-mux, e) Comparator and their Truth Table verification.
7. Realization of RS / JK / D flip flops using logic gates.
8. Design of Shift Register using J-K / D Flip Flop.
9. Realization of Synchronous Up/Down counters.
10. Design of MOD- N Counter
11. Study of DAC
12. Study of logic families and PLDs

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	-	-	-	-
CO2	3	3	3	3	3	-	-	-	-	-	-	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-
CO4	3	3	3	3	3	-	-	-	-	-	-	-
CO5	3	3	3	3	3	-	-	-	-	-	-	-

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	2		2
CO4	2	2	2
CO5	2	2	2

Course Name: IT Workshop Lab (Sci Lab/MATLAB/C++
Course Code: AM393
Contact: 0:1:3
Credits: 2.5

Prerequisite
Computer Fundamentals and principles of computer programming

Course Outcomes (COs):
After attending the course students should be able to

CO1	Demonstrate a thorough understanding of modular programming by designing programs that require the use of programmer-defined functions.
CO2	Demonstrate a thorough understanding of arrays by designing and implementing programs that search and sort arrays.
CO3	Demonstrate a thorough understanding of the object-oriented programming concepts of encapsulation, data abstraction and composition by designing and implementing classes including the use of overloaded functions and constructors.
CO4	Demonstrate a thorough understanding of the concept of pointers and dynamic memory allocation the implementation of programmer-defined functions and classes by writing code, performing unit testing and debugging of multiple complex programs.
CO5	Demonstrate an understanding of the differences between C and C++ in the areas of strings, pass by reference/passing pointers, and structs by designing and implementing programs that use C strings, C++

Course Content:

1. Introduction of UNIX/Linux Operating System which includes preliminary commands, start-up & shutdown
methodology, file.
2. Handling as well as introduction to editors like Vi editor, introduction to GNU C & C++ compiler, as well as introduction to GNU & GDB script.
3. Introduction to C++, basic loop control, executing programs.
4. Writing functions, selection statements, review of functions and parameters, command line arguments, recursion, I/O streams, arrays and string manipulation, pointers, structures & unions.
5. Object-Oriented Programming in C++, fundamentals of classes, constructors-destructors.
6. Dealing with member functions, operator overloading and polymorphism (both static & dynamic).
7. Dealing with inheritance, derived class handling.
8. Abstract class, virtual class, overriding, template class, name-space & exception handling.
9. Dynamic memory allocation, implementation of Linked Lists, using C++.
10.MATLAB Environment, variable, constant, operators, loop, function.
11.MATLAB Toolbox, MATLAB Graphic function.
12.Reading and Writing to file, Numerical simulation.
13. Innovative experiments/Projects

Text Books

1. The C++ Programming Language by Bjarne Stroustrup Addison-Wesley publisher
2. Object-Oriented Programming in C++ b by Robert Lafore Publisher: Sams

Reference Books

1. Object Oriented Programming with C++ by Balaguru swamy McGraw Hill Education; Sixth edition Addison-
Wesley publisher
2. Object-Oriented Programming in C++ b by Robert Lafore Publisher: Sams
3. MATLAB Getting Started Guidehttps://www.mathworks.com/help/pdf_doc/matlab/getstart.pdf

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	-	-	-	3	-	-	-
CO2	3	2	2	2	2	-	-	-	3	-	-	-
CO3	3	3	3	2	2	-	-	-	3	-	-	-
CO4	3	3	3	2	2	-	-	-	3	-	-	-
CO5	3	3	3	2	2	-	-	-	3	-	-	-

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

2nd Year 4th Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	AM401	Operating Systems	3	0	0	3	3
2	ENGG	Major	AM402	Formal Language and Automata Theory	3	0	0	3	3
3	ENGG	Major	AM403	Object Oriented Programming using Java	3	1	0	3	4
4	SCI	Minor	M(AM)401	Probability and Statistics	3	0	0	3	3
5	HUM	Ability Enhancement Course	HU(AM)401	Principles of Management	2	0	0	2	2
B. PRACTICAL									
1	ENGG	Major	AM491	Operating Systems Lab	0	0	3	3	1.5
2	ENGG	Minor	M(AM)492	Numerical Methods Lab	0	0	3	3	1.5
3	ENGG	Major	AM493	Object Oriented Programming Lab using Java	0	0	3	3	1.5
4	ENGG	Major	AM494	Programming Using Python	0	0	3	3	1.5
5	HUM	Ability Enhancement Course	HU(AM)491	Soft Skill & Aptitude	2	0	0	2	1
Total of Theory and Practical								27	22

Paper Name: Operating System
Paper Code: AM401
Contact Hours/Week: 3
Credit: 3
Total Contact Hours: 36L

Prerequisites:
1. Computer organization
2. Computer Architecture
3. Data Structures
4. Algorithms & Programming Concept

Course Outcomes (COs):
After attending the course students should be able to

CO1	Understand the fundamental concepts of Operating System, Protection & Security and differentiate different types of Operating System.
CO2	Understand and implement process & thread; understand, apply, compare different process synchronization algorithm and inter process communication to solve engineering problems
CO3	Understand/explain/analyze different synchronization techniques, critical section problems and deadlock and apply them to solve engineering problems.
CO4	Understand/explain different memory management techniques including virtual memory management; also able to apply, compare, and implement different page replacement algorithms to solve engineering problems.
CO5	Understand/explain different I/O mechanisms, File structures and disk management techniques and solving engineering problems applying different disk scheduling algorithms.

Course Content:

Module – 1: [3L]
Functionalities of Operating System, Evolution of Operating System.
Types of Operating System: batch, multi-programmed, time-sharing, real-time, distributed, parallel, Structural overview, Protection & Security. [3L]

Module – 2: [11L]
Processes: Concept of processes, process states, PCB, process scheduling, co-operating processes, independent process, suspended process, Interaction between processes and OS, Inter-process communication: Message passing. [3L]
Threads: overview, benefits of threads, user and kernel level threads, Thread models. [2L]
CPU scheduling: Scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, SRTF, RR, priority, multilevel queue, multilevel feedback queue scheduling). [6L]

Module – 3: [11L]
Process Synchronization: background, critical section problem, synchronization hardware, classical problems of synchronization (producer-consumer, readers-writer, dining philosophers, etc), semaphores, monitors.[6L]
Deadlocks: deadlock characterization, methods for handling deadlocks, deadlock prevention,

deadlock avoidance, deadlock detection, recovery from deadlock.[5L]

Module 4: [6L]

Background, logical vs. physical address space, swapping, contiguous memory allocation, paging, Segmentation, TLB. [3L]

Virtual Memory: background, demand paging, page replacement algorithms (FCFS, LRU, Optimal), thrashing, Working set model. [3L]

Module 5: [5L]

Disk structure, disk scheduling (FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK etc), disk reliability, disk formatting, boot block, bad blocks. [2L]

File: File concept, access methods, directory structure, file system structure, UNIX file structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector). [2L]

I/O: I/O hardware, polling, interrupts, DMA, caching, buffering, blocking-non blocking I/O. [1L]

Text Book:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts.
2. Operating Systems & Systems Programming by P Balakrishna Prasad

Reference Book:

1. Dietel H. N., ―An Introduction to Operating Systems‖, Addison Wesley.
2. Andrew Tanenbaum, Modern Operating Systems, Prentice Hall.
3. William Stallings, Operating Systems, Prentice Hall.

CO-PO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3								3
CO2	3	3	3	3								3
CO3	3	3	3	3								3
CO4	3	3	3	3								3
CO5	3	3	3	3								3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Formal Language and Automata Theory
Course Code: AM402
Contacts: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

1. Digital Logic
2. Computer organization
3. Computer Fundamentals

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand the fundamental concepts of Finite State Automata to Explain or Illustrate andIdentify problems where students can Apply the concept appropriately to Solve them.
CO2	Understand the fundamental concepts of Regular Expressions and its relation with DFA so thatthey can Develop regular expression for a specified language and Validate it.
CO3	Understand the fundamental concepts of Context Free Grammar so that they can Design grammafor a specified language and Validate it.
CO4	Explain or Illustrate the fundamental operating principles of Push Down Automata andUse it appropriately to Solve problems.
CO5	Understand the operating principles of Turing Machine and Design Turing Machines to Propose solutions to the related problems appropriately and validate the effectiveness as well as limitationsof computations making the students aware of its utilitarian importance for further explorations leading towards lifelong learning.

Course Contents:

Module-1: [9L]

Fundamentals: Basic definition of sequential circuit, block diagram, mathematical representation, concept of transition table and transition diagram, [1L]

Introduction to Finite State Model (FSM), Design of sequence detector, Finite State Machine, Finite Automata, Deterministic Finite Automation (DFA) and Non-deterministic Finite Automation (NFA), Transition diagrams, Transition tables and Language recognizers.[3L]

NFA with empty transitions, Equivalence between NFA with and without empty transitions. NFA to DFA conversion. [2L]

Minimization of FSM: Minimization Algorithm for DFA, Introduction to Myhill-NerodeTheorem [2L] Limitations of FSM, Application of Finite Automata[1L]

Module-2: [7L]

Finite Automata with output − Moore & Mealy machine. Representation of Moore & Mealy Machine, Processing of the String through Moore & Mealy Machine, Equivalence of Moore & Mealy Machine – Inter- conversion. [2L]

Equivalent states and Distinguishable States, Equivalence and k-equivalence, Minimization of Mealy Machine[1L]

Minimization of incompletely specified machine−Merger Graph, Merger Table, Compatibility Graph [2L]

Lossless and Lossy Machine – Testing Table, Testing Graph [2L]

Module-3: [5L]

Regular Languages, Regular Sets, Regular Expressions, Algebraic Rules for Regular Expressions,Arden'sTheorem statement and proof[1L]
Constructing Finite Automata (FA) for given regular expressions, Regular string accepted by FA[2L]
Constructing Regular Expression for a given Finite Automata[1L]
Pumping Lemma of Regular Sets. Closure properties of regular sets[1L]

Module-4: [9L]
Grammar Formalism-Context Free Grammars, Derivation trees, sentential forms. Rightmost and leftmost derivation of strings, Parse Tree, Ambiguity in context free grammars. [1L]
Minimization of Context Free Grammars. [1L], Removal of null and unit production[1L]Chomsky normal form and Greibach normal form. [1L]
Pumping Lemma for Context Free Languages. [1L]

Enumeration of properties of CFL, Closure property of CFL, Ogden's lemma & its applications [1L], Regular grammars−right linear and left linear grammars[1L]
Pushdown Automata: Pushdown automata, definition. Introduction to DCFL, DPDA, NCFL, NPDA[1L] Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. [1L] Equivalence of CFL and PDA, inter-conversion.1L]

Module-5: [5L]
Turing Machine: Turing Machine, definition, model[1L]
Design of TM, Computable functions [1L], Church 's hypothesis, counter machine [1L] Types ofTuring machines [1L]
Universal Turing Machine, Halting problem[1L]

Textbook:
1. Introduction to Automata Theory Languages and Computation‖, Hopcroft.E. and Ullman J.D.,Pearson Education.

Reference Books:
1. Formal Languages and Automata Theory‖,C. K. Nagpal, Oxford
2. ‒Switching and Finite Automata Theory‖, Zvi Kohavi, 2nd Edition, Tata McGraw Hill

CO-PO Mapping

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

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Object Oriented Programming using Java

Course Code: AM403

Contact: 3:1:0

Total Contact Hours: 48

Credits: 4

Prerequisite: Partial Object-Oriented Programming using C++

Course Outcomes (COs):

After attending the course students should be able to

CO1	Design the process of interaction between Objects, classes & methods w.r.t. Object Oriented Programming.
CO2	Acquire a basic knowledge of Object Orientation with different properties as well as different features of Java.
CO3	Analyze various activities of different string handling functions with various I/O
CO4	Discuss basic code reusability feature w.r.t. Inheritance, Package and Interface.
CO5	Implement Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

Course Contents:

Module 1: [2L]Introduction:

Object Oriented Analysis (OOA) & Object Oriented Design (OOD) - Concepts of object oriented programming language, Relationships among objects and classes-Generalization, Specialization, Aggregation, Association, Composition, links, Meta-class. [1L]; Object Oriented Programming concepts - Difference between Java and C++; Different features of Java [1L];

Module 2[10L]Java

Basics:

Basic concepts of java programming - Advantages of java, Byte-code & JVM, Data types, Different types of Variables.[1L] ;Java Operators & Control statements [1L]; Java loops. [1L]; Array.[1L] ;Creation of class, object, method. [1L]; Constructor- Definition, Usage of Constructor, Different types of Constructor.[1L]; finalize method and garbage collection, Method & Constructor overloading. [1L]; this keyword, use of objects as parameter & methods returning objects.[1L]; Call by value & call by reference. [1L]; Static variables & methods.Nested & inner classes.[1L].

Module 3: [5L]

Basic String handling & I/O:

Basic string handling concepts- Concept of mutable and immutable string, Methods of String class- charAt(), compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(). [1L]; toCharArray(),toLowerCase(), toString(), toUpperCase() , trim() , valueOf() methods, Methods of String buffer class- append(), capacity(), charAt(), delete(), deleteCharAt(). [1L];ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString(). [1L] ;Command line arguments, basics of I/O operations – keyboard input using BufferedReader [1L] ; Scanner class in Java I/O operation [1L];

Module 4: [8L]
Inheritance and Java Packages:

Inheritance - Definition, Advantages, Different types of inheritance and their implementation. [1L] ;Super and final keywords, super() method. [1L]; Method overriding, Dynamic method dispatch.[1L]; Abstract classes & methods.[1L]; Interface - Definition, Use of Interface.[1L]; Multiple inheritance by using Interface.[1L] ;Java Packages -Definition, Creation of packages. [1L]; Java Access Modifiers - public, private, default and protected, Importing packages, member access for packages. [1L]

Module 5: [11L]
Exception handling, Multithreading and Applet Programming :
Exception handling - Basics, different types of exception classes.Difference between Checked & Unchecked Exception.[1L]; Try & catch related case studies.[1L]; Throw, throws & finally. [1L]; Creation of user defined exception. [1L]; Multithreading - Basics, main thread [1L]; Thread life cycle.[1L]; Creation of multiple threads-yield(), suspend(), sleep(n), resume(), wait(), notify(), join(), isAlive().[1L] ;Thread priorities, thread synchronization.[1L];Interthread communication, deadlocks for threads[1L]; Applet Programming - Basics, applet life cycle, difference between application & applet programming[1L]; Parameter passing in applets. [1L]

Textbooks:
1. Herbert Schildt – "Java: The Complete Reference " – 9th Ed. – TMH
2. E. Balagurusamy – " Programming With Java: A Primer " – 3rd Ed. – TMH.

Reference Books:
1. R.K Das – " Core Java for Beginners " – VIKAS PUBLISHING.
2. Rambaugh, James Michael, Blaha – " Object Oriented Modelling and Design " – Prentice Hall, India.

CO-PO Mapping

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

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Probability and Statistics
Course Code: M(AM)401
Contacts: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite:

The students to whom this course will be offered must have the concept of (10+2) standard algebra andcalculus.

Course Outcome(s):

After completion of the course students will be able to
CO1: Recall the distinctive principles of probability and statistics.
CO2: Understand the theoretical workings of theory of probability and tests of hypotheses.
CO3: Apply statistical methods to compute and explain point estimators and interval estimators for mean,variance and proportion.
CO4: Analyze statistical data from engineering experiments.

Course Content

Module 1 (Probability and Random Variables) (15 Hours)
The axioms of probability , Conditional probability, Baye_s theorem, Discrete and continuous random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, Moments, Moment generating functions, Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

Module 2 (Two dimensional random variables) (5 Hours)
Joint distributions, Marginal and conditional distributions, Covariance , Correlation and linear regression , Transformation of random variables , Central limit theorem (for independent and identically distributed randomvariables).

Module 3 (Sampling Distribution) (3 Hours)
Distributions of the sample mean and the sample variance for a normal population, Chi-Square, t and F distributions, problems

Module 4 (Estimation) (4 Hours)
Unbiasedness, consistency, the method of moments and the method of maximum likelihood estimation, confidence intervals for parameters in one sample and two sample problems of normal populations, confidence intervals for proportions, problems.

Module 5 (Testing of Hypotheses) (9 Hours)
Null and alternative hypotheses, the critical and acceptance regions, two types of error, power of the test, the most powerful test and Neyman-Pearson Fundamental Lemma, tests for one sample and two sample problems for normal populations, tests for proportions, Chi square goodness of fit test and its applications, problems.

Project Domains:

1. Construction of Univariate and Bivariate frequency tables
2. Diagrammatic and Graphical representation of data.
3. Fitting of discrete and Continuous distributions

4. Regression Analysis
5. Curve Fitting
6. Tests of significance with regard to Single Mean, Two Means
7. Construction of Confidence intervals for Mean, Variance and Proportion

Text and Reference Books:

1. Sheldon M. Ross, ‐Introduction to Probability and Statistics for Engineers and Scientists‖, Academic Press, (2009).
2. D. C. Montgomery and G.C. Runger, ‐Applied Statistics and Probability for Engineers‖, 5th edition, John Wiley & Sons, (2009)..
3. Robert H. Shumway and David S. Stoffer, ‐Time Series Analysis and Its Applications with R Examples‖, Third edition, Springer Texts in Statistics, (2006).
4. N. G. Das: Statistical Methods, TMH.
5. Sancheti , *D. S. &*Kapoor *,V.K. : Statistics Theory , Method & Application,* Sultan chand & sons , NewDelhi
6. N.K.Dutta (2004). Fundamentals of Biostatistics, Kanishka Publishers.

CO-PO Mapping:

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

Course Name: Principles of Management
Course Code: HU(AM)401
Contacts: 2:0:0
Total Contact Hours: 24
Credits: 2

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand the basic concepts and technologies used in the field of management information System.
CO2	Have the knowledge of the different types of management information systems
CO3	Understand the processes of developing and implementing information systems.
CO4	Be aware of the ethical, social, and security issues of information systems.
CO5	An ability to effectively integrate IT-based solutions into the user environment

Course Content:

Module-1: Management Concepts: Definition, roles, functions and importance of Management, Evolution of Management thought-contribution made by Taylor,Fayol,Gilbreth,Elton Mayo,McGregor,Maslow(4L)

Module - 2: Planning and Control: Planning: Nature and importance of planning, -types of planning, Levelsof planning - The Planning Process. –MBO, SWOT analysis, McKinsey‘s7S Approach.
Organizing for decision making: Nature of organizing, span of control, Organizational structure – line and staffauthority.
Basic control process -control as a feedback system – Feed Forward Control –Requirements for effectivecontrol – control (4L)

Module - 3: Group dynamics: Types of groups, characteristics, objectives of Group Dynamics.
Leadership: Definition, styles & functions of leadership, qualities for good leadership, Theories of leadership(4L)

Module – 4: Work Study and work measurement: Definition of work study, Method Study Steps, Tools and Techniques used in the Method Study and Work Measurement Time Study: Aim & Objectives, Use of stopwatch procedure in making Time Study. Performance rating, allowances and its types. Calculation of Standard Time. Work sampling(4L)

Module - 5: Marketing Management: Functions of Marketing, Product Planning and development, Promotional Strategy (2L)

Module - 6: Quality management: Quality definition, Statistical quality control, acceptance sampling ,Control Charts –Mean chart, range chart,c chart,p chart,np chart, Zero Defects, Quality circles,, Kaizen & Six Sigma,ISO -9000 Implementation steps, Total quality management (6L)

Text Books:

1. Essentials of Management, by Harold Koontz & Heinz Weihrich Tata McGraw
2. Production and Operations Management-K.Aswathapa,K .Shridhara Bhat,Himalayan Publishing House

References:

1. Organizational Behavior, by Stephen Robbins Pearson Education, New Delhi
2. New era Management, Daft, 11th Edition, Cengage Learning
3. Principles of Marketing, Kotlar Philip and Armstrong Gary, Pearson publication

CO-PO Mapping

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

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	2	2	2
CO4	2	2	2
CO5	2	2	2

Course Name: Operating Systems Lab
Course Code: AM491
Credit :1.5
Allotted Hours: 36L
Prerequisites:

1. Computer organization
2. Computer Architecture
3. Data Structures
4. Algorithms & Programming Concept

Course Outcomes (COs):

After attending the course students should be able to

CO1	Analyze and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF,and Priority.
CO2	Understand the concepts of deadlock in operating systems.
CO3	Implement them in Multiprogramming system.
CO4	Create process creation and implement inter process communication
CO5	Analyze the performance of the various page replacement schemes

Course Content:

1. **Essential Linux Commands[9P]:** Commands for files and directories cd, cp, mv, rm, mkdir, more, less, creating and viewing files, using cat, file comparisons, View files, kill, ps, who, sleep, grep, fgrep, find,sort, cal, banner, touch, file related commands – ws, sat, cut, grep etc. Mathematical commands –expr,factor, units, Pipes(use functions pipe, popen, pclose), named Pipes (FIFOs, accessing FIFO)

2. **Shell Programming [6P]:** Creating a script, making a script executable, shell syntax (variables, conditions,control structures, functions, and commands).
3. **Process [3P]**: Starting new process, replacing a process image, duplicating a process image.

4. **Semaphore [3P]:** Programming with semaphores (use functions semget, semop, semaphore_p,semaphore_v).
5. **POSIX Threads[6P]:** Programming with pthread functions(viz. pthread_create, pthread_join, pthread_exit,pthread_attr_init, pthread_cancel) .
6. **Shared Memory [9P]:**Create the shared memory , Attach the shared memory segment to the address spaceof the calling process , Read information from the standard input and write to the shared memory,
   Read the content of the shared memory and write on to the standard output , Delete the shared memory

Books:

1. Yashavant P. Kanetkar, UNIX Shell Programming, 1st edition, BPB Publications
2. Beej's Guide to Unix IPC
3. W. Richard Stevens, UNIX Network Programming, 2nd edition, Prentice Hall

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3				3			
CO2	3	3	3	3	3				3			
CO3	3	3	3	3	3				3			
CO4	3	3	3	3	3				3			
CO5	3	3	3	3	3				3			

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Course Name: Numerical Methods Lab
Course Code: M(AM)492
Credit 1.5
Allotted Hours: 30L

Prerequisite: Any introductory course on programming language (example. C/ Matlab).

Course Outcomes (COs):

After attending the course students should be able to

CO1	Describe and explain the theoretical workings of numerical techniques with the help of C
CO2	Compute basic command and scripts in a mathematical programming language
CO3	Apply the programming skills to solve the problems using multiple numerical approaches.
CO4	Analyze if the results are reasonable, and then interpret and clearly communicate the
CO5	Apply the distinctive principles of numerical analysis and the associated error measures.

Course Content:

1. Assignments on Newton forward /backward, Lagrange‘s interpolation.

2. Assignments on numerical integration using Trapezoidal rule, Simpson‘s 1/3 rule, Weddle‘s rule.

3. Assignments on numerical solution of a system of linear equations using Gauss elimination, Tridiagonal matrix algorithm, Gauss-Seidel iterations. LU Factorization method.

4. Assignments on numerical solution of Algebraic Equation by Bisection method, Regula-Falsi method,Secant Method, Newton-Raphson method

5. Assignments on ordinary differential equation: Euler‘s method, Euler‘s modified method, Runge-Kutta methods, Taylor series method and Predictor-Corrector method.

Implementation of numerical methods on computer through C/C++ and commercial Software Packages: Matlab / Scilab / Labview / Mathematica/NAG (Numerical Algorithms Group)/Python.

CO-PO Mapping

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

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	2	2	2
CO4	2	2	2
CO5	2	2	2

Course Name: Object Oriented Programming using Java Lab

Course Code: AM493
Contact: 0:0:3
Credits: 1.5

Prerequisites:

1. Computer Fundamentals
2. Basic understanding of Computer Programming and related Programming Paradigms
3. Problem Solving Techniques with proper logic Implementation.

Course Outcomes (COs):

After attending the course students should be able to

CO1	Create the procedure of communication between Objects, classes & methods.
CO2	Understand the elementary facts of Object Orientation with various characteristics as well as several aspects of Java.
CO3	Analyze distinct features of different string handling functions with various I/O
CO4	Discuss simple Code Reusability notion w.r.t. Inheritance, Package and Interface.
CO5	Apply Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

Course Contents:

Module 1:Java Basics:

1. Simple Java programming using operators, control statements & loops, array.
2. Programming on class, object, and method, access specifier.
3. Programming on constructor, method/constructor overloading.
4. Programming on this keyword, call by value & call by reference, static variables & methods, inner classes.

Module 2: Basic String handling & I/O:

1. Programming to show the use of String class methods - charAt(), compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(), toCharArray(), toLowerCase(), toString(), toUpperCase(), trim(), valueOf() methods.
2. Programming to show the use of StringBuffer class methods - append(), capacity(), charAt(), delete(), deleteCharAt(),ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString() methods.
3. Programming on Command line arguments.
4. Programming using keyboard input by implementing BufferedReader& Scanner classes.

Module 3: Inheritance, Interface and Java Packages:

1. Programming on Simple Inheritance, super and final keywords, super() method.
2. Programming on method overriding, dynamic method dispatch,abstract classes & methods, multiple inheritance by using interface.
3. Programming on importing system package, creating user-defined package, importing user-defined package, using protected access specifier, subclassing an imported class of a package, using same

names forclasses of different packages, adding multiple public classes to a package.

Module 4: Exception handling, Multithreading and Applet Programming:

1. Programming on exception handling using try-catch block, implementing throw and throws keywords,using finally block, creating user-defined exception.
2. Programming on creating child threads i) by extending thread class ii) by implementing runnable interface,creating child threads by assigning thread priorities.
3. Programming on creating simple applet to display some message, creating applet two add 2 integers,creating applet to do GUI based programming.

Textbooks:

1. Herbert Schildt – "Java: The Complete Reference " – 9th Ed. – TMH

2. E. Balagurusamy – " Programming With Java: A Primer " – 3rd Ed. – TMH.

Reference Books:

1. R.K Das – " Core Java for Beginners " – VIKAS PUBLISHING.
2. Rambaugh, James Michael, Blaha – " Object Oriented Modelling and Design " – Prentice Hall, India

CO-PO Mapping

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

CO-PSO Mapping

Cos	PSO1	PSO2	PSO3
CO1	3	2	2
CO2	3	2	2
CO3	3	2	3
CO4	3	2	3
	3	3	3

Course Name: Programming using Python
Course Code: AM494
Credit :1.5
Allotted Hours: 36L

Prerequisites:
Knowledge of Mathematics and basic concepts of Programming

Course Outcome(s):
After completion of the course students will be able to
CO1: Understand basic of Python Programming Language
CO2: Understand the use of Conditional statement and Loops
CO3: Learn functions in python and represent collection type data using List and Dictionary
CO4: Read and write data from & to files in Python
CO5: Understand Numpy array and numerical operations on Numpy array.

Course Contents:

1. **Basics of Python:** Python Installation, python variables, data types and Operator.
2. **Loops:** While and For loops, Python Syntax, Colon & Indentation, ConditionalStatements: if, elif and else.
3. **Functions:** Defining Functions in python; passing arguments.
4. **String:** Python Programming to explore string functions
5. **Lists**: Python programs using Lists; understand the use of List methods, Slicing on List.
6. **Sets**: Working with Sets; Write programs to show different set operations.
7. **Dictionary**: Demonstrate the use of Dictionaries
8. **File handling:** Reading & Writing data from a file, Redirecting output streams to files.
9. **Numpy**: Numerical operations using Numpy array; slicing numpy array; stacking numpy arrays; Writeprograms to show different numerical operations on numpy array;.

CO-PO Mapping:

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

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Paper Name: Soft Skill and Aptitude Training

Paper Code: HU(AM)491

Contact: 2:0:0

Total Contact Hours: 12

Credit: 1

Course Objective: To train the students in acquiring workplace-specific interpersonal communication skills.

Course Outcome: By the end of the course the students will be enabled

CO1: to identify, define, apply workplace interpersonal communication modalities in an effective manner.

CO2: to employ, infer, relate group behavioral and personal interview skills.

CO3: to organize, differentiate, employ reading proficiency skills.

CO4: to identify, classify, organize and relate question types and aptitude test patterns in placement tests.

Course Content:

Module 1 – Introduction to Soft Skills

1.The Skills of Interpersonal Communication. 2. Team Behavior. 3. Time Management Skills

Module 2- Verbal Ability: Reading

Enhancing reading speed and vocabulary enhancement through intensive practice of placement test-based reading passages.

Module 3 – Verbal Ability Test Patterns

Introducing Verbal Ability tests—Test Question Types: Synonyms and Antonyms, Error Spotting/Sentence Improvement, Analogies and Para Jumbles.

Module 4 – Group Discussion and Personal Interview

Basics of Group Discussion—Intensive practice on answering interview-based questions common in placement interviews.

CO-PO Mapping

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

3rd Year 5th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	AM501	Artificial Intelligence	3	0	0	3	3
2	ENGG	Major	AM502	Database Management Systems	3	0	0	3	3
3	ENGG	Major	AM503	Computer Networks	3	0	0	3	3
4	ENGG	Major	AM504A	Compiler Design	3	0	0	3	3
			AM504B	Cryptography and Network Security					
			AM504C	Computer Graphics					
5	HUM	Minor	HU(AM)501	Economics for Engineers	2	0	0	2	2
B. PRACTICAL									
1	ENGG	Major	AM591	Artificial Intelligence Lab	0	0	3	3	1.5
2	ENGG	Major	AM592	Database Management Systems Lab	0	0	3	3	1.5
3	ENGG	Major	AM593	Computer Networks Lab	0	0	3	3	1.5
4		Internship	AM581	Internship/Industrial Training	0	0	2	2	2
Total of Theory and Practical								25	20.5

SYLLABUS	
Semester – 5th	
Course Code	**AM501**
Course Name	**Artificial Intelligence**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites: Data Structure, Design and Analysis of Algorithms, Statistics

Course Objectives:

The objectives of this course are to enable students to

1. Comprehend the fundamental concepts of Knowledge Representation and Inferencing in Artificial Intelligence and its utilitarian importance in current technological context.
2. Formulate a problem as State-Space Exploration Framework or an Inferencing Framework of Artificial Intelligence.
3. Use the strategies of AI-Heuristics to find acceptable solutions avoiding brute-force techniques.
4. Design AI-Frameworks for Inferencing based on knowledge base.
5. Analyze the effectiveness of AI-Inferencing Model in offering solutions to the respective problem.

Course Outcome:

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

CO1	**Understand and explain** the fundamental concepts of Knowledge Representation and Inferencing in Artificial Intelligence and its utilitarian importance in current technological context for further exploration leading towards lifelong learning.
CO2	**Identify** and **formulate** an engineering problem primarily to fit a State-Space Exploration Framework or an Inferencing Model/Agent Design Framework within the scope of Artificial Intelligence paradigm.
CO3	**Explore** relevant literature and **apply** the concept of Heuristic Techniques of Artificial Intelligence to **solve** problems.
CO4	**Develop** Inferencing Models for **proposing** solutions to the problems of Artificial Intelligence.

CO5	**Implement** Inferencing Models of Artificial Intelligence through **developing** feasible algorithms and **investigate** their effectiveness by **analyzing** their performances in solving the relevant problems.

MODULE NUMBER	COURSE CONTENT
1	**Introduction to Artificial Intelligence [1L]** Basic Concepts, History of Artificial Intelligence, Architecture of an Artificial Intelligent Agent, Applications of Artificial Intelligence
2	**Artificial Intelligence Problem Formulation as State-Space Exploration Problem for Goal Searching [5L]** Basic Concepts, State-Space Exploration Formulation for Water Jug Problem, Missionaries and Cannibals Problems, Farmer-Wolf-Goat-Cabbage Problem, 8-Puzzle Problem, Constraint Satisfaction Problem and Production System for Goal Searching. Blind Search Techniques for Goal Searching: Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Search, Uniform Cost Search, Bi-directional Search.
3	**Heuristic Techniques for Goal Searching [8L]** Basic Concepts of Heuristic Techniques and Properties of Heuristic Functions, Hill Climbing Search. Best First Search, A* Search, Memory-bounded heuristic search: Iterative-deepening A* Search, Recursive Best First Search, Simplified Memory Bounded A* Search. Simulated Annealing Based Stochastic Search, Genetic Algorithm Based Evolutionary Search, Ant Colony Optimization, Particle Swarm Optimization.
4	**Adversarial Search for Game Playing [2L]** Basic Concepts, Minimax Search, Alpha-Beta Pruning.
5	**Knowledge Representation and Inference using Propositional Logic and Predicate Logic[5L]** Propositional Logic: Knowledge Representation and Inference using Propositional Logic

	Predicate Logic: Knowledge Representation, Inference and Answer Extraction using First Order Predicate Logic
6	**Slot-and-Filler Structure for Knowledge Representation[2L]** Weak Slot-and-Filler Structure for Knowledge Representation: Semantic Nets and Frames. Strong Slot-and-Filler Structure for Knowledge Representation: Conceptual Dependency and Script.
7	**Reasoning under Uncertainty [5L]** Bayesian Inferencing and Bayesian Belief Network, Dempster-Shafer Theory, Overview of Fuzzy Logic and Inferencing, Overview of Hidden Markov Model.
8	**Planning [5L]** Basic Concepts, Problem of Blocks World, Components of a Planning System, Algorithms for Planning: Goal Stack, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Algorithms for Planning as State-Space Search, Heuristics for planning, Planning Graphs and GRAPHPLAN Algorithm.
9	**Introduction to Natural Language Processing [1L]** Basic Concepts, Steps of Natural Language Processing, Morphological, Syntactic and Semantic Analysis, Discourse Integration and Pragmatic Analysis, Applications of Natural Language Processing.
10	**Introduction to Machine Learning [2L]** Basic concepts of Machine Learning Model, Supervised Learning, Unsupervised Learning, and Reinforced Learning, Overview of Artificial Neural Network

Textbook:

1. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall.
2. Rich, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGraw Hill.

Reference Books:

1. Padhy, N.P. 2009. Artificial Intelligence and Intelligent Systems, Oxford University Press.
2. Deepak Khemani, “A First Course in Artificial Intelligence”, McGraw Hill.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	2	2	-	2
CO5	2	2	3	3	2				-	-	-	2	2	2	3

SYLLABUS	
Semester – 5th	
Course Code	**AM502**
Course Name	**Database Management Systems**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Objectives:

1. To Understand and Describe the basic concepts and utility of Database management system, different data models of Database management system.
2. To Design an Entity Relationship (E-R) Diagram and relational model for any kind of real-life application and able to Apply relational algebra operations, SQL, Neo4j for solving query.
3. To Analyze and Create the relational database for any real-life applications based on normalization.
4. To Apply the query optimization techniques, different file organization techniques and determine whether the transaction satisfies the ACID properties.

Course Outcome:

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

CO1	To Understand and Describe the basic concepts and utility of Database management system, different data models of Database management system.
CO2	To Design an Entity Relationship (E-R) Diagram and relational model for any kind of real-life application and able to Apply relational algebra operations, SQL, Neo4j for solving query.
CO3	To Analyze and Create the relational database for any real-life applications based on normalization.
CO4	To Apply the query optimization techniques, different file organization techniques and determine whether the transaction satisfies the ACID properties.

CO5	**Explore** DBMS based ideas through **developing** software programs with adequate documentation in collaborative environment for successfully carrying out projects on DBMS Problems and **investigate** their effectiveness by **analyzing** the performances using proper techniques and tools and **assess** the limitations of solutions underscoring utilitarian importance for further explorations leading towards lifelong learning.

MODULE NUMBER	COURSE CONTENT
1	**Introduction [3L]** Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.
2	**Entity-Relationship and Relational Database Model [11L]** Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features, case study on E-R Model. Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications of the Database.
3	**Graph Based Model [4L]** Concept of graph-based model, difference between relational model and graph-based model, application, overview of Neo4j CQL.
4	**SQL and Integrity Constraints [6L]** Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.
5	**Relational Database Design [8L]** Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF, Case Study**.**
6	**Internals of RDBMS [8L]** Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols; two phase locking, Dead Lock handling.
7	**File Organization & Index Structures [3L]** File & Record Concepts, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes**.**

Textbook:

1. Henry F. Korth and Silberschatz Abraham, “Database System Concepts”, Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, “Fundamentals of Database Systems”, Benjamin Cummings Publishing. Company.

Reference Books:

1.“Fundamentals of Database Systems”, Ramez Elmasri, Shamkant B. Navathe, Addison Wesley Publishing.
2. Ramakrishnan: Database Management System, McGraw-Hill.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	2	2	-	2
CO5	2	2	3	3	2				-	-	-	2	2	2	3

SYLLABUS	
Semester – 5th	
Course Code	**AM503**
Course Name	**Computer Networks**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:

1. Familiarity and knowledge of Operating Systems and Computer Architecture.

2. Also require little bit programming languages concepts like C, Java.

Course Objectives:

The objectives of this course are to enable students to

1. To be familiar with the basics of data communication

2. To be familiar with various types of computer networks

3. To have experience in designing communication protocols

4. To be exposed to the TCP/IP protocol suite

Course Outcome:

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

CO1	Understand OSI and TCP/IP models
CO2	Analyze MAC layer protocols and LAN technologies.
CO3	Design applications using internet protocols.
CO4	Implement routing and congestion control algorithms.
CO5	Develop application layer protocols and understand socket programming.

MODULE NUMBER	COURSE CONTENT
1	Introduction [6L] Introduction (3L): Introduction: Computer Network, data communication, topology, OSI & TCP/IP Reference Models, layers and characteristics, Wireless Network, comparison to wired and wireless network. Physical Layer: [3L] Overview of data (analog & digital), signal (analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network.
2	Data Link Layer [10L] Framing, Error Control, Error Detection and Correction, Flow Control, Data Link Protocols, Simple Stop- andWait Protocol, ARQ mechanism, Sliding Window Protocols, One-Bit Sliding Window Protocol, Go- Back-N and Selective Repeat, HDLC, PPP Medium Access Control Sub-layer, The Channel Allocation. [5L] Multiple Access Protocols: ALOHA, Carrier Sense Multiple Access Protocols, IEEE 802.x Ethernet, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet, Wireless LANs - IEEE 802.xx, Bluetooth, RFID, Bridges, Virtual LANs, Switching. [5L]
3	Network Layer [10L] IP Addressing, IPv4and IPv6. Difference IPv4and IPv6, Conversion ofIPv4and IPv6, Subnetting, Supernetting, Design Issues, Store-and-Forward Packet Switching, Virtual-Circuit and Datagram Networks, ARP, IP, ICMP, IPV6, BOOTP and DHCP– Delivery protocols Other Protocols such as mobile IP in wireless Network. [5L] Routing: Shortest Path Algorithms, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Anycast Routing: RIP, OSPF, BGP; Routing forMobile Hosts. [5L]
4	Transport layer: [6L] Process to Process delivery; UDP; TCP, SCTP, TCP RENO, TCP/IP in Wireless environment, Congestion control in TCP: Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm. [5L] Advanced topic such as Remote Procedure Call, Delay Tolerant Networks. [1L]
5	Application Layer [3L] Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW: Cryptography (Public, Private Key based), Digital Signature, Firewalls
6	Socket Programming [1L] Introduction to Socket Programming, UDP socket and TCP Socket.

Textbook:

1. B. A. Forouzan – "Data Communications and Networking (3rd Ed.) "– TMH

2. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI

3. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education

4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP

Reference Books:

1. Kurose and Rose – "Computer Networking -A top-down approach featuring the internet" – Pearson Education 2. Leon, Garica,Widjaja – "Communication Networks" – TMH

3. Walrand – "Communication Networks" – TMH.

4. Comer – "Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.)" – Pearson Education/PHI

CO-PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO1**	**PO1**	**PO1**	**PSO**	**PSO2**	**PSO3**
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	2	2	-	2
CO5	2	2	3	3	2				-	-	-	2	2	2	3

SYLLABUS	
Semester – 5th	
Course Code	**AM504A**
Course Name	**Compiler Design**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:

- Mathematics
- Concept of programming languages
- Data structures
- Computer architecture
- Formal languages and automata theory
- Some advanced math might be required if you adventure in code optimization

Course Objectives:

The objectives of this course are to enable students to

1. Make the student understand the process involved in a compiler.
2. Create an overall view of various types of translators, linkers, loaders, and phases of a compiler.
3. Understand the concepts of syntax analysis, various types of parsers especially the top down approach.
4. Create awareness among students the various types of bottom-up parsers,
5. Understand the syntax analysis and, intermediate code generation, type checking, the role of symbol table and its organization, Code generation, machine independent code optimization and instruction scheduling.

Course Outcome:

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

CO1	**I**llustrate the basic concept of compilers and discuss on the components as well as the strengths and weaknesses of various phases of designing a compiler.
CO2	Design and analyze algorithms for syntactic or parsing techniques and semantic analysis of the process of designing compilers.
CO3	Develop the parsers and experiment the knowledge of activation tree, activation record and dynamic storage allocation techniques

CO4	Construct the intermediate code representations and generation.
CO5	Apply for various optimization techniques for dataflow analysis.

MODULE NUMBER	COURSE CONTENT
1	**Module I [7L]** Compilers, Cousins of the Compiler, Analysis-synthesis model, The phases of the compiler. The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of tokens, Finite automata, From a regular expression to an NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).
2	**Module II [10L]** The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR, Canonical LR), Parser generators (YACC), Error Recovery strategies for different parsing techniques. Syntax directed translation: Syntax directed definitions, Construction of syntax trees, Bottom-up evaluation of S-attributed definitions, L-attributed definitions, Bottom-up evaluation of inherited attributes.
3	**Module III [7L]** Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Symbol tables, dynamic storage allocation techniques.
4	**Module IV [4L]** Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).
5	**Module V [8L]** Consideration for Optimization, scope of optimization, local optimization, loop optimization, folding, DAG representation, Flow Graph, Data flow equation, global optimization, redundant sub expression elimination, induction variable elimination, copy propagation, basic blocks & flow graphs, transformation of basic blocks, DAG representation of basic blocks, peephole optimization Object code forms, machine dependent code optimization, register allocation and assignment, generic code generation algorithms, DAG for register allocation.

Textbook:

1. Alfred Aho, V. Ravi Sethi, D. Jeffery Ullman, “Compilers Principles, Techniques and Tools”, Addison Wesley, 2nd edition
2. Holub Allen. Compiler Design in C, PHI, 1993.

Reference Books:

1. Chattopadhyay, Santanu. Compiler Design. PHI Learning Pvt. Ltd., 2005
2. Tremblay and Sorenson Compiler Writing-McGraw Hill International

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	3	2
CO2	-	3	3	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	2	3	2	-	-	-	-	-	-	-	-	3	2	-
CO4	-	-	3	2	3	-	-	-	-	-	-	-	2	3	-
CO5	3	-	2	-	3	3	-	-	-	-	-	-	-	3	3

SYLLABUS	
Semester – 5th	
Course Code	**AM504B**
Course Name	**Cryptography and Network Security**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:

The student must have basic knowledge about Computer Network and mathematics.

Course Objectives:

1. To provide introduction to the concept of Network Security Model and Cryptography systems.
2. To give the knowledge of Digital Signature and other Security Measures available.
3. To familiarize with the various techniques like PGP and S/MIME.
4. To showcase IP Security Architecture & Transport Layer Security to identify the vulnerability of the Internet systems and recognize the mechanisms of the attacks.
5. To explain the firewall design principles and various intrusion detection system.

Course Outcome:

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

CO1	Understand cryptography and network security concepts and application.
CO2	Apply security principles to system design.
CO3	Identify and investigate network security threat
CO4	Analyze and design network security protocols.
CO5	Develop ideas to Propose solutions to the problems of network security and Identify problems where students can Apply the concept appropriately and analyze the effectiveness as well as limitations of solutions making the students aware of its utilitarian importance for further explorations leading towards lifelong.

MODULE NUMBER	COURSE CONTENT
1	[7L] Introduction - Services, Mechanisms, and Attacks, OSI security architecture, Network security model[1L], Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques steganography) [3L] Finite Fields

	and Number Theory: Groups, Rings, Fields, Modular arithmetic, Euclid's algorithm[1L]
2	[9L] Data Encryption Standard- Block cipher principles, block cipher modes of operation[2L] Advanced Encryption Standard (AES), Triple DES, Blowfish, RC5 algorithm[3L] Public key cryptography: Principles of public key cryptosystems, The RSA algorithm[2L] Key management - Diffie Hellman Key exchange, Elliptic curve arithmetic, Elliptic curve cryptography [2L]
3	[6L] Authentication requirement, Authentication function, MAC, Hash function [2L] Security of hash function and MAC, MD5, SHA, HMAC, CMAC [2L] Digital signature and authentication protocols, DSS, ElGamal, Schnorr [2L]
4	[7L] Authentication applications, Kerberos, X.509 [1L] Internet Firewalls for Trusted System: Roles of Firewalls, Firewall related terminology- Types of Firewalls, Firewall designs principles [1L] SET for E-Commerce Transactions [1L] Intruder, Intrusion detection system [1L] Virus and related threats, Countermeasures [1L] Trusted systems, Practical implementation of cryptography and security [2L]
5	[7L] E-mail Security: Security Services for E-mail-attacks possible through E-mail, Establishing keys privacy, authentication of the source [1L] Message Integrity, Non-repudiation, Pretty Good Privacy, S/MIME [2L] IP Security: Overview of IPSec, IPv4 and IPv6-Authentication Header, Encapsulation Security Payload (ESP) [1L] Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding) [1L] Web Security: SSL/TLS Basic Protocol, computing the keys, client authentication [1L] PKI as deployed by SSL Attacks fixed in v3, Exportability, Encoding, Secure Electronic Transaction [1L]

Textbook:

[1] Kahate, A. (2013). Cryptography and network security. Tata McGraw-Hill Education.

[2] Forouzan, B. A., & Mukhopadhyay, D. (2015). Cryptography and network security. New York, NY: Mc Graw Hill Education (India) Private Limited.

Reference Books:

[1] Stallings, W. (2006). Cryptography and network security, 4/E. Pearson Education India.

[2] Daras, N. J., & Rassias, M. T. (Eds.). (2015). Computation, cryptography, and network security (pp. 253- 287). Springer.

[3] Kumar, A., & Bose, S. (2017). Cryptography and network security. Pearson Education India.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	3	2
CO2	-	3	3	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	2	3	2	-	-	-	-	-	-	-	-	3	2	-
CO4	-	-	3	2	3	-	-	-	-	-	-	-	2	3	-
CO5	3	-	2	-	3	3	-	-	-	-	-	-	-	3	3

SYLLABUS	
Semester – 5th	
Course Code	**AM504C**
Course Name	**Computer Graphics**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:

Mathematics, Computer Fundamentals & Principle of Computer Programming.

Course Objectives:

1. The objectives of this course are to enable students to Use of the component so fa graphics system and become familiar with building approach of graphics system components and algorithms related with them.
2. Understand the basic principles of 2D and 3D computer graphics.
3. Understand of how to scan convert the basic geometrical primitives, how to transform the shapes to fit the master the picture definition.
4. Understand the mapping from a world co-ordinate to device co-ordinates, clipping, and projections.
5. Discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications.

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

CO1	**Understand t**he fundamental concept of Computer graphics and mathematical knowledge and explain the foundations of computer graphics and different display technology and devices.
CO2	**Demonstrate** different scan conversion algorithms, drawing algorithms, polygon filling algorithms, curves and surface drawing algorithms, clipping algorithms, surface removal algorithms using graphics tools.
CO3	**Understand** the basic concept of graphics programming and implement clipping with the comprehension of windows, view-port scene relation to images display on screen.
CO4	**Analyze** and compare different drawing algorithms, polygon filling algorithms, curves and surface drawing algorithms hidden surface illumination methods.

CO5	**Develop** the concept of geometric models, mathematical and algorithmic approach necessary for programming computer graphics leading to lifelong learning.

MODULE NUMBER	COURSE CONTENT
1	**Introduction [4L]** Introduction: Objective, applications, GKS/PHIGS, normalized co-ordinate system, aspect ratio.
2	**Computer Graphics System [4L]** Graphics System: Vector and raster graphics, various graphics display devices, graphics interactive devices, segmented graphics, attribute table.
3	**Computer Graphics System [4L]** Raster Scan Graphics: Line drawing algorithms, circle/ellipse drawing algorithms, polygon filling algorithms.
4	**Geometric Transformation [4L]** Geometric Transformation: Homogeneous co-ordinate system, 2D and 3D transformations, projection— orthographic and perspective.
5	**Curves and Surfaces [4L]** Curves and Surfaces: Curve approximation and interpolation, Lagrange, Hermite, Bezier and B Spline curves/surfaces and their properties, curves and surface drawing algorithms.
6	**Curves and Surfaces 2 [4L]** Geometric modelling: 3D object representation and its criteria, edge/vertex list, constructive solid geometry, wire-frame model, generalized cylinder, finite element methods.
7	**Viewing and Clipping [4L]** Clipping: Window and viewport, 2D and 3D clipping algorithms.
8	**Hidden Surfaces [4L]** Hidden Lines and Hidden Surfaces: Concept of object- and image-space methods, lines and surface removal algorithms.
9	**Illumination and Color models [4L]** Intensify, Coloring and Rendering: RGB, YIQ, HLS and HSV models and their conversions, gamma correction, half toning. Illumination models, polygon mesh shading, transparency, shadow, texture.

Textbook:

1. D. Hearn and P. M. Baker: Computer Graphics, 2nd ed. Prentice Hall of India, New Delhi, 1997.
2. W. M. Newman and R. F. Sproull: Principles of Interactive Computer Graphics, McGraw Hill, New Delhi, 1979.

Reference Books:

1. F. S. Hill: Computer Graphics, McMillan, New York, 1990.
2. D. P. Mukherjee: Fundamentals of Computer Graphics and Multimedia, Prentice Hall of India, New Delhi, 1999.
3. J. D. Foley et al.: Computer Graphics, 2nd ed., Addison-Wesley, Reading, Mass., 1993.
4. W. K. Giloi: Interactive Computer Graphics: Data Structure, Algorithms, Languages, Prentice Hall, Englewood Cliffs, 1978.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	3	2
CO2	-	3	3	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	2	3	2	-	-	-	-	-	-	-	-	3	2	-
CO4	-	-	3	2	3	-	-	-	-	-	-	-	2	3	-
CO5	3	-	2	-	3	3	-	-	-	-	-	-	-	3	3

SYLLABUS	
Semester – 5th A. THEORY	
Course Code	**HU(AM)501**
Course Name	**Economics for Engineers**
Lecture [per week]	**2**
Tutorial [per week]	**0**
Contact Hours [per week]	**2**
Total Contact Hours	**24**
Credit	**2**
Pre-requisites: MATH – College Algebra, Pre-Calculus Algebra and Trigonometry.	
Course Outcome[s]: On completion of the course students will be able to	
CO1	Apply the appropriate engineering economics analysis method[s] for problem solving present worth, annual cost, rate-of-return, payback, break-even, benefit-cost ratio.
CO2	Evaluate the cost effectiveness of individual engineering projects using the methods learned and drawing references for the investment decisions.
CO3	Compare the life cycle cost of multiple projects using the methods learned and make a quantitative decision between alternate facilities and/or systems.
CO4	Evaluate the profit of a firm, carry out the break-even analysis and employ this tool to make production decision.
CO5	Discuss and solve advanced economic engineering analysis problems including taxation and inflation.
MODULE NUMBER	**COURSE CONTENT**
1	**Introduction[3L]** Managerial Economics-Relationship with other disciplines-Firms: Types, Objectives and goals-Managerial Decisions-Decision Analysis
2	**Demand and Supply Analysis[5L]** Demand-Types of demand-determinants of demand-Demand function-Demand Elasticity-Demand forecasting-Supply-Determinants of supply-Supply function-Supply Elasticity.
3	**Cost Analysis[5 L]** Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis– PV ratio.
4	**Elementary economic Analysis [4 L]** Inflation-Meaning of inflation, types, causes, measures to control inflation. National Income-Definition, Concepts of national income, Method of measuring national income.

5	**Financial Accounting [5 L]** Concepts and Definition of Accounting, Journal, Ledger, Trial Balance. Trading A/C, Profit & amp; Loss A/C and Balance Sheet.
6	**Investment Decision[2L]** Time value of money- Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence. Evaluation of engineering projects-Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for public projects.

Textbooks:

1. Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India.
2. Principles of Economics, Deviga Vengedasalam, Karunagaran Madhavan, Oxford University Press.

Reference Books:

1. Engineering Economy by William G. Sullivan, Elin M. Wicks, C. Patric Koelling, Pearson
2. R. Paneer Seelvan, "Engineering Economics", PHI
3. Ahuja, H. L., "Principles of Microeconomics", S. Chand & Company Ltd
4. Jhingan, M. L., "Macro Economic Theory"
5. Macro Economics by S. P Gupta, TMH
6. Haniff and Mukherjee, Modern Accounting, Vol-1, TMG
7. Modern Economic Theory – K.K. Dewett [S. Chand]

Reference Books:

1. Engineering Economy by William G. Sullivan, Elin M. Wicks, C. Patric Koelling, Pearson
2. R. Paneer Seelvan, "Engineering Economics", PHI
3. Ahuja, H.L., "Principles of Microeconomics", S. Chand & Company Ltd
4. Jhingan, M. L., "Macro Economic Theory"
5. Macro Economics by S.P. Gupta, TMH
6. Haniff and Mukherjee, Modern Accounting, Vol-1, TMG
7. Modern Economic Theory – K.K. Dewett [S. Chand]

CO-PO MAPPING:

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

SYLLABUS	
Semester – 5th	
Course Code	**AM591**
Course Name	**Artificial Intelligence Lab**
Practical (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Prerequisites: Data Structure, Design and Analysis of Algorithms, Statistics

Course Objectives:

The objectives of this course are to enable students to

1. Gain foundational knowledge of PROLOG to implement an Artificial Intelligent Agent as an executable computer program for Knowledge Representation and Inferencing
2. Formulate a problem by analyzing its characteristics to fit a State-Space Exploration Framework or an Inferencing Framework of Artificial Intelligence.
3. Apply the concepts of Artificial Intelligence to solve a problem by implementing well-known Artificial Intelligence strategies using proper techniques and tools of PROLOG.
4. Build expert systems offering solutions to the challenging problems of Artificial Intelligence.
5. Implement Artificial Intelligence based ideas as executable PROLOG programs through developing intelligent heuristic strategies

Course Outcome:

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

CO1	**Acquire** foundational knowledge of PROLOG to **implement** an Artificial Intelligent Agent as an executable computer program for Knowledge Representation and Inferencing and **understand** the working principle of the agent and **assess** its utilitarian importance in current technological context leading towards lifelong learning.
CO2	**Identify** and **formulate** an engineering problem by analyzing its characteristics to fit a State-Space Exploration Framework or an Inferencing Agent Formulation Framework of Artificial Intelligence.
CO3	**Explore** relevant literature and **apply** the concepts of Artificial Intelligence to **solve** a problem by **implementing** well-known Artificial Intelligence strategies using proper techniques and tools of PROLOG.
CO4	**Develop** ideas and **propose an** expert system offering solutions to the challenging problems of Artificial Intelligence.

CO5	**Plan and Implement** Artificial Intelligence based ideas as executable PROLOG programs through **developing** intelligent heuristic strategies or expert systems with adequate documentation in collaborative environment for successfully carrying out projects on Artificial Intelligence Problems and **investigate** their effectiveness by **analyzing** the performances using proper techniques and tools.

MODULE NUMBER	COURSE CONTENT
1	**Introduction to PROLOG Programming along with the IDE and its Basic Components** Assignments for understanding the Basic Components of Knowledge Representation and Inferencing in Artificial Intelligence using PROLOG Programming and its working strategy.
2	**Arithmetic, Boolean Expression, Decision Making Strategies** Assignments for understanding implementation of Arithmetic Expression, Boolean Expression, and Decision-Making Strategies.
3	**Recursion and Looping through Recursion** Assignments for understanding implementation of Recursion and Looping through Recursion.
4	**List of Data Items in PROLOG** Assignments for understanding the utility of List in solving various problems.
5	**Blind Search Techniques – BFS, DFS** Implementation of BFS and DFS Algorithms for Goal Searching to solve Puzzles (8-Puzzle, Water Jug Puzzle)
6	**Heuristic Search Techniques – A* Search** Implementation of A* Search Algorithm for Goal Searching to solve Puzzles (8-Puzzle, Route Finding Puzzle)
7	**Constraint Satisfaction Problem Solving** Implementation of Backtracking Strategies to solve Constraint Satisfaction Problems (Graph Coloring Problem, 8-Queens Problem)
8	**Game Playing**

	Implementation of Adversarial Search Algorithm with alpha-beta pruning strategy for Game Playing (Tic-Tac-Toe)
9	**Discussion on Project Problems and Allocation (Problem Description Report Submission)**
10	**Designing Solution Model and Proposal Report Submission**
11	**Project Implementation, Verification and Documentation**
12	**Project Demonstration and Project Report Review**

Textbook:

1. Ivan Bratko, Prolog Programming for Artificial Intelligence, 4th Edition, Addison-Wesley
2. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall.
3. Rich, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGraw Hill.

Reference Books:

1. Padhy, N.P. 2009. Artificial Intelligence and Intelligent Systems, Oxford University Press.
2. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill.

CO–PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO1**	**PO1**	**PO1**	**PSO**	**PSO**	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	2	2	-	2
CO5	2	2	3	3	2	2	2	2	2	2	2	2	2	2	3

SYLLABUS	
Semester – 5th	
Course Code	**AM592**
Course Name	**Database Management System Lab**
Practical (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Prerequisites:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

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

CO1	Demonstrate and explain the database management system and different database languages.
CO2	Understand and apply the SQL queries related to management of data and transaction processing for solving real life problems.
CO3	Explain and analyze query processing techniques involved in query optimization.
CO4	Demonstrate and apply the PL/SQL programming, the concept of Cursor Management, Error Handling, Package and Triggers for solving real life complex problems.
CO5	Design and assess the commercial database systems.

MODULE NUMBER	COURSE CONTENT
1	Conceptual Designing using ER Diagrams (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.)

2	Converting ER Model to Relational Model (Represent entities and relationships in Tabular form, Represent attributes as columns, identifying keys) and apply the normalization techniques.
3	Creation of Tables using SQL- Overview of using SQL tool, Data types in SQL, Creating Tables (along with Primary and Foreign keys), Altering Tables and Dropping Tables
4	Practicing DML commands- Insert, Select, Update, Delete
5	Practicing Queries using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, CONSTRAINTS etc., Practicing Sub queries (Nested, Correlated) and Joins (Inner, Outer and Equi).
6	Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, VIEWS Creation and Dropping, Practicing on Triggers - creation of trigger, Insertion using trigger, Deletion using trigger, Updating using trigger.
7	Procedures- Creation of Stored Procedures, Execution of Procedure, and Modification of Procedure, PL/SQL, Cursors- Declaring Cursor, Opening Cursor, Fetching the data, closing the cursor.

CO-PO Mapping:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	P O9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	2	2	-	-	-	-	-	-	3	3	2
CO2	3	3	3	3	3	1	1	-	-	-	1	1	3	3	3
CO3	3	3	3	3	3	2	1	-	-	1	1	1	2	3	2
CO4	3	3	3	3	3	2	1	-	-	1	1	-	3	3	3
CO5	3	3	3	3	3	2	1	1	-		2	1	3	3	3

SYLLABUS	
Semester – 5th	
Course Code	**AM593**
Course Name	**Computer Network Lab**
Practical (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Prerequisites:

Knowledge of Computer Organization and Architecture, Operating System, C language/ JAVA are required.

Course Outcome:

1. To design and implement small size network and to understand various networking commands.
2. To provide the knowledge of various networking tools and their related concepts.
3. To understand various application layer protocols for its implementation in client/server environment 4. Understand the TCP/IP configuration for Windows and Linux
5. Learn the major software and hardware technologies used on computer networks

CO1	To design and implement small size network and to understand various networking commands.
CO2	To provide the knowledge of various networking tools and their related concepts.
CO3	To understand various application layer protocols for its implementation in client/server environment
CO4	Understand the TCP/IP configuration for Windows and Linux.
CO5	Apply the concepts of networking basics through programs with adequate documentation in collaborative environment for successfully carrying out projects on Problems of networking and investigate their effectiveness by analyzing the outputs using proper techniques and tools and assess the limitations of solutions underscoring utilitarian importance for further explorations leading towards lifelong learning.

MODULE NUMBER	COURSE CONTENT
1	Familiarization of UNIX or Linux environment, UNIX or Linux general Commands specially Network Commands. Familiarization of Internetworking - Network Cables - Color coding - Crimping. Internetworking Operating Systems - Configurations.
2	Implementation of flow control mechanisms.
3	Socket Programming using TCP and UDP.
4	Implementing routing protocols such as RIP, OSPF.
5	Familiarization of advanced simulators like Packet Tracer, NS2/NS3, OMNET++, Tiny OS. Server Configuration: only web server
6	List of A Few Experiments as Sample Assignments 1. Implement the following forms of IPC. a) Pipes b) FIFO 2. Implement file transfer using Message Queue form of IPC. 3. Write a Program to create an integer variable using Shared Memory concept and increment the variable simultaneously by two processes. Use Semaphores to avoid Race conditions. 4. Design TCP iterative Client and Server application to reverse the given input sentence. 5. Design TCP concurrent Client and Server application to reverse the given input sentence. 6. Design TCP Client and Server application to transfer file. 7. Design a TCP concurrent Server to convert a given text into upper case using multiplexing system call "select". 8. Design a TCP concurrent Server to echo given set of sentences using Poll functions. 9. Design UDP Client and Server application to reverse the given input sentence. 10. Design UDP Client Server to transfer a file. 11. Design using Poll Client Server application to multiplex TCP and UDP requests for converting a given text into upper case. 12. Design RPC application to add and subtract a given pair of integers.
7.	Mini Project

Textbooks:

1. B. A. Forouzan – "Data Communications and Networking (3rd Ed.) " – TMH

2. S. Tanenbaum – “Computer Networks (4th Ed.)” – Pearson Education/PHI
Recommended Books: 1. TCP sockets in C Programs-Practical guide for Programmers By Micheal J Donahoo and Kenneth Calvert. 2. Socket Programming by Rajkumar Buyaa.

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**P O9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	2	2	2	-	-	-	-	-	-	3	3	2
CO2	3	3	3	3	3	1	1	-	-	-	1	1	3	3	3
CO3	3	3	3	3	3	2	1	-	-	1	1	1	2	3	2
CO4	3	3	3	3	3	2	1	-	-	1	1	-	3	3	3
CO5	3	3	3	3	3	2	1	1	-		2	1	3	3	3

3rd Year 6th Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	AM601	Machine Learning	3	1	0	4	4
2	ENGG	Major	AM602	Digital Image Processing	3	0	0	3	3
3	ENGG	Major	AM603	Natural Language Processing	3	0	0	3	3
4	ENGG	Major	AM604A	Mobile Computing	3	0	0	3	3
			AM604B	Quantum Computing					
			AM604C	Cloud Computing					
5	HUM	Minor	HU(AM)605	Cyber Law and Ethics	3	0	0	3	3
B. PRACTICAL									
1	ENGG	Major	AM691	Machine Learning Lab	0	0	3	3	1.5
2	ENGG	Major	AM692	Digital Image Processing Lab	0	0	3	3	1.5
3	ENGG	Major	AM693	Natural Language Processing Lab	0	0	3	3	1.5
Total of Theory and Practical								25	20.5

SYLLABUS	
Semester – 6th	
Course Code	**AM601**
Course Name	**Machine Learning**
Lecture [per week]	**3**
Tutorial [per week]	**1**
Contact Hours [per week]	**4**
Total Contact Hours	**48**
Credit	**4**

Pre-requisites:

Data Structure, Design and Analysis of Algorithms, Statistics, Artificial Intelligence

Course Objectives:

1. Comprehend the fundamental concepts of the evolving technologies in machine learning such as Supervised and Unsupervised Learning
2. Formulate an engineering problem within the scope of machine learning paradigm.
3. Apply the concepts of machine learning to solve problems of making automated decisions dealing with large scale data.
4. Develop and Implement ideas for proposing solutions to the challenging problems of machine learning.
5. Analyze the effectiveness of various machine learning Frameworks.

Course Outcomes:

After completion of the course students will be able to

CO1	**Understand** the basic concepts of machine learning to **explain or illustrate** and **Identify** problems where students can **apply** the concept appropriately to **Solve** them.
CO2	**Understand** the fundamental concepts of regression analysis so that they can **propose models** for predicting values based on exemplary data and **analyze** their performances.
CO3	**Explain or illustrate** the fundamental strategies of unsupervised machine learning paradigm to solve clustering problems and **analyze** their performances.
CO4	**Explain or illustrate** the concepts of Mining Frequent Patterns, Associations and Data Streams and Apply them to solve the relevant problems and **analyze** their performances.
CO5	**Develop** ideas to **propose** solutions to the problems of supervised learning and **Identify** problems where students can **Apply** the concept appropriately and **Analyze** the effectiveness as well as limitations of solutions making the students aware of its utilitarian importance for further explorations leading towards lifelong learning.

MODULE NUMBER	COURSE CONTENT
1	**Introduction to Machine Learning[4L]** Basic Concepts, Various types of Machine Learning Techniques and related applications, Issues in Machine Learning Strategies, Data Exploration for Machine Learning: Data Types, Data Attributes, Statistical Description of Data, Data Visualization, Data Similarity Measures; Data Pre-processing: Data Cleaning, Data Integration, Data Reduction, Data Transformation & Discretization.
2	**Classification and Regression[14L]** Basic Concepts, assessing and visualizing performance of classification, k-Nearest-Neighbor Classifier, Decision Tree Classifier, Naïve Bayes Classifier; Ensemble Classification, Random Forest Strategy, Linear and Nonlinear Regression Methods and their performance analysis.
3	**Clustering, Association and Outlier Analysis[10L]** Basic Concepts, Partitioning Methods: k-Means and k-Medoids, Hierarchical Methods: Agglomerative and Divisive Hierarchical Clustering, Density-Based Methods: DBSCAN: Density-Based Clustering Based on Connected Regions with High Density; Outlier Analysis.
4	**Mining Frequent Patterns, Associations and Data Streams[3L]** Basic Concepts, Association analysis and Frequent Itemset Mining Methods: The Apriori Algorithm, Mining Time Series Data.
5	**Advanced Concepts[5L]** Introduction to advanced concepts of machine learning like Support Vector Machines and Artificial Neural Network and their applications in solving machine learning problems.

Textbook:

1. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007
2. Dr. Rajiv Chopra, Machine Learning, Khanna Publishing House, 2018
3. Machine Learning by Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Pearson.

Reference Books:

1. Machine Learning using Python, Manaranjan Pradhan and U Dinesh Kumar, Wiley
2. Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow, AurélienGéron, O'Reilly
3. Han J &Kamber M, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, Third Edition.

CO–PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	-	2	-	2
CO5	2	2	3	3	-	-	-	-	-	-	-	2	2	2	3

SYLLABUS	
Semester – 6th	
Course Code	**AM602**
Course Name	**Digital Image Processing**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:

Design and Analysis of Algorithms, UG Level Mathematics

Course Objectives:

The objectives of this course are to enable students to

1. Understand the basic concepts of digital image processing and identify problems where students can apply the concept appropriately.
2. Understand the fundamental concepts of image enhancement strategies and identify the scope of enhancement where students can apply the appropriate strategy and analyze the performance.
3. Illustrate the fundamental image restoration strategies and apply them appropriately to eliminate noise in the image.
4. Illustrate various Image Compression Techniques and Analyze their performances.
   Understand the ideas of Morphological Image Processing and Image Segmentation to propose solutions to the related problems and analyze the effectiveness as well as limitations of solutions underscoring its utilitarian importance for further explorations leading towards lifelong learning.

Course Outcome:

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

CO1	**Understand** the basic concepts of digital image processing to **Explain or Illustrate** and **Identify** problems where students can **apply** the concept appropriately to **solve.** them.
CO2	**Understand** the fundamental concepts of image enhancement strategies and **identify** the scope of enhancement where students can **apply** the appropriate strategy and **analyse** the performance.
CO3	**Illustrate** the fundamental image restoration strategies and **apply** them appropriately to eliminate noise in the image.
CO4	**Illustrate** various Image Compression Techniques and **apply** them to compress the images and **analyze** their performances.
CO5	**Understand** and **develop** ideas to **propose** solutions to the problems of Morphological Image Processing and Image Segmentation and **analyze** the effectiveness as well as limitations of solutions under scoring its utilitarian importance for further explorations. leading towards lifelong learning.

MODULE NUMBER	COURSE CONTENT
1	**Introduction to Digital Image Processing [3L]** Applications of digital image processing, fundamental steps in digital image processing, components of image processing system. Digital Image Fundamentals: A simple image formation model, image sampling and quantization, Some Basic Relationships Between Pixels- Neighbours and Connectivity of pixels in image, Colour Image Models.
2	**Image Enhancement [10L]** Image Enhancement in The Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters. Image Enhancement in Frequency Domain: Introduction, Fourier Transform, Discrete Fourier Transform (DFT) and its relation with image characterization, fundamental steps of image enhancement in Frequency Domain, Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.
3	**[8L]** Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Loss and gain of degree of freedom, Statics of serial and parallel manipulators, Statics and force transformation matrix of a Gough-Stewart platform, Singularity analysis and statics. Mass and inertia of links, Lagrangian formulation for equations of motion for serial and parallel manipulators.
4	**[9L]** Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes, Simulation and experimental case studies on serial and parallel manipulators, Control of constrained manipulators, Cartesian control, Force control and hybrid position/force control, Advanced topics in non-linear control of manipulators.
5	**[5L]** Introduction and some well known wheeled mobile robots (WMR), two and three-wheeled WMR on flat surfaces, Slip and its modeling, WMR on uneven terrain, Design of slip-free motion on uneven terrain, Kinematics, dynamics and static stability of a three-wheeled WMR‘s on uneven terrain, Simulations using MATLAB and ADAMS. Introduction to chaos, Non-linear dynamics and chaos in robot equations, Simulations of planar 2 DOF manipulators, Analytical criterion for unforced motion. Gough-Stewart platform and its singularities, use of near singularity for fine motion for sensing, design of Gough-Stewart platform-based sensors. Over-constrained mechanisms and deployable structures, Algorithm to obtain redundant links and joints, Kinematics and statics of deployable structures with pantographs or scissor-like elements (SLE‘s).

Textbook:

1. Digital Image Processing, Rafael C. Gonzales, Richard E. Woods, Third Edition, Pearson Education, 2010.
2. Digital Image Processing, S. Sridhar, Oxford University Press, 2nd Ed, 2016.

Reference Books:

1. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India.
2. Image Processing, analysis and Machine Vision, Milan Sonka, Thomson Press India Ltd, Fourth Edition.

CO–PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	1
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	2	3
CO5	3	3	3	3	-	-	-	-	3	2	-	-	3	2	3

SYLLABUS	
Semester – 6th	
Course Code	**AM603**
Course Name	**Natural Language Processing**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:
Statistics, Automata, Compiler Design.

Course Objectives:
The objectives of this course are to enable students.

1. To learn the basics and details of NLP algorithms, principles & application, different NLP techniques and different tools and their uses.
2. To familiarize the concepts and techniques of Natural language Processing for analyzing words based on Morphology and CORPUS.
3. To learn the fundamental strategies of Language Modelling and Word Sense Disambiguation acquiring enough knowledge to Propose models for Word Prediction & Disambiguation.
4. To learn the concepts of Markov Model for POS Tagging and Probabilistic Context Free Grammars and Probabilistic parsing.
5. To learn the techniques of Syntax & Semantics Analysis for Machine Translation and Identify problems where students can Apply the concept appropriately**.**

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

CO1	Understand the basic concepts of NLP to Explain or Illustrate and Identify problems where students can Apply the concept appropriately to Solve them.
CO2	Understand the fundamental concepts of Text Pre-processing and Morphology so that they can Apply the concept to Analyze their CORPUS.
CO3	Explain or illustrate the fundamental strategies of Language Modelling and Word Sense Disambiguation acquiring enough knowledge to Propose models for Word Prediction & Disambiguation and Evaluate their performances.
CO4	Explain or illustrate the concepts of Markov Model for POS Tagging and Probabilistic Context Free Grammars and Probabilistic parsing so that they can Apply them to solve the relevant problems and analyze their performances.
CO5	Develop ideas to Propose solutions to the problems of Syntax & Semantics Analysis for Machine Translation and Identify problems where students can Apply the concept appropriately and analyze the effectiveness as well as limitations of solutions underscoring the utilitarian importance for further exploration of NLP issues leading towards lifelong learning.

MODULE NUMBER	COURSE CONTENT
1	**Introduction to NLP [4L]** Introduction to NLP - Various stages of NLP –The Ambiguity of Language: Why NLP Is Difficult Parts of Speech: Nouns and Pronouns, Words: Determiners and adjectives, verbs, Phrase Structure. Statistics Essential Information Theory: Entropy, perplexity, The relation
2	**Text Pre-processing and Morphology [5L]** Character Encoding, Word Segmentation, Sentence Segmentation, Introduction to Corpora, Corpora Analysis. Inflectional and Derivation Morphology, Morphological analysis and generation using Finite State Automata and Finite State transducer.
3	**Language Modeling [4L]** Introduction to N-grams, Chain Rule, Smoothing – Add-One Smoothing, Witten-Bell Discounting; Backoff, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models.
4	**Word Sense Disambiguation [5L]** Methodological Preliminaries, Supervised Disambiguation: Bayesian classification, An in-formation theoretic approach, Dictionary-Based Disambiguation: Disambiguation based on sense, Thesaurus based disambiguation, Disambiguation based on translations in a second-language corpus.
5	**Markov Model and POS Tagging [5L]** Markov Model: Hidden Markov model, Fundamentals, Probability of properties, Parameter estimation, Variants, Multiple input observation. The Information Sources in Tagging: Markov model taggers, Viterbi algorithm, Applying HMMs to POS tagging, Applications of Tagging.
6	**Probabilistic Context Free Grammars and Probabilistic parsing [5L]** The Probability of a String, Problems with the Inside-Outside Algorithm, Parsing for disambiguation, Treebanks, Parsing models vs. language models, Phrase structure grammars and dependency, Lexicalized models using derivational histories, Dependency-based models.
7	**Syntax &Semantics Analysis and Machine Translation [8L]** Shallow Parsing and Chunking, Shallow Parsing with Conditional Random Fields (CRF), Lexical Semantics, WordNet, Thematic Roles, Semantic Role Labelling with CRFs. Statistical Alignment and Machine Translation, Text alignment, Word alignment, Information extraction, Text mining, Information Retrieval, NL interfaces, Sentimental Analysis, Question Answering Systems, Social network analysis.

Textbook:

1. Speech and Language Processing, Jurafsky and Martin, Pearson Education
2. Foundation of Statistical Natural Language Processing, Manning and Schutze, MIT Press
3. Multilingual Natural Language Processing Applications from Theory to Practice: Bikel, Pearson.
4. Ela Kumar, "Natural Language Processing', Wiley

Reference Books:

1. Allen, James. 1995. – "Natural Language Understanding". Benjamin/Cummings, 2ed. 2.
2. Bharathi, A., Vineet Chaitanya and Rajeev Sangal. 1995. Natural Language Processing- "A Paninian Perspective". Prentice Hll India, Eastern Economy Edition.
3. Hobson lane, Cole Howard, Hannes Hapke, "Natural language processing in action" MANNING Publications, 2019

CO–PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	1
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	2	3
CO5	3	3	3	3	-	-	-	-	3	2	-	-	3	2	3

SYLLABUS	
Semester – 6th	
Course Code	**AM604A**
Course Name	**Mobile Computing**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisite:

1. Basic concept of computer network and communication engineering
2. Basic programming knowledge

Course Objective(s)

The objective of the course is to make the students able to –

1. Understand and illustrate the basic concepts and principles in mobile computing.
2. Understand and demonstrate the various routing algorithms for both infrastructures based and ad hoc networks.
3. Identify and develop mobility and bandwidth management in cellular network.
4. Design and build an energy efficient and secure mobile computing environment using heterogeneous wireless technologies.
5. Predict and explain the technical issues related to recent mobile computing environment.

Course Outcome(s)

After completion of the course students will be able to

CO1	**Illustrate** the concepts and working of modern communication technologies.
CO2	**Demonstrate** the various routing algorithms for both infrastructure based and ad hoc networks.
CO3	**Develop** mobility and bandwidth management in cellular network
CO4	**Design** and build an energy efficient and secure mobile computing environment using heterogeneous wireless technologies
CO5	**Predict** the technical issues related to recent mobile computing environment.
MODULE NUMBER	**COURSE CONTENT**
1.	**Introduction [6L]** Evolution of different types of wireless communication devices; Effects of mobility of devices; Cellular mobile networks – mobility management (call setup, handoff, interoperability and internetworking), bandwidth management, energy management, security; Brief introduction about different generations of wireless communication technology – 1G, 2G, 3G, 4G, 5G.
2.	**Mobile Data Communication [5L]** Mobile Data Communication, WLANs (Wireless LANs) IEEE 802.11 standard, Bluetooth technology, Bluetooth Protocols, Ad hoc networks initialization, leader election, location identification, communication protocols, energy and security.
3.	**Mobility Management in Cellular Networks [4L]**

	Call setup in PLMN (location update, paging), GPRS, Call setup in mobile IP networks; Handoff management; Mobility models- random walk, random waypoint, Brownian, map-based, group-based.
4.	**Bandwidth Management in Cellular Mobile networks [3L]** Mathematical formulation of the channel assignment problem (CAP); CAP and generalized graph coloring; Benchmark instances; Lower bound on bandwidth, Genetic algorithms for channel assignment- concept of critical block in a hexagonal cellular network, coalesced CAP, fast near-minimal channel assignment algorithm.
5.	**Localization of Nodes in a Mobile Network [4L]** Different approaches, Indoor and outdoor localizations, LOS and NLOS signals, Outdoor localization techniques – triangulation (TOA-based, AOA- based), errors due to inaccuracies in coordinates of beacon nodes and in measurements, selection of beacon nodes; Location region identification- computational geometric technique.
6.	**Message Communication in Ad Hoc Networks [6L]** Collision avoidance mechanism (different schemes for a deterministic transmission schedule), collision resolution mechanism – successive partitioning approach; Time slot assignment based on location information, Point-to-point routing in ad hoc networks – proactive, reactive and hybrid approaches, different protocols - DSDV, DSR, AODV, TORA, ZRP
7.	**Energy-efficient Communication [3L]** Energy efficiency at various layers - Physical layer, MAC layer, Network layer, Application layer, performance analysis in noisy channel environment.
8.	**Secure Wireless Communication [4L]** Introduction-different types of attacks, internal attacks, external attacks; measures against attacks (authentication, intrusion detection, encryption); RC4 algorithm, Lightweight cryptographic algorithms; antijamming techniques.

Text books:

1) K. Sinha, S. Ghosh and B. P. Sinha, Wireless Networks and Mobile Computing. CRC Press : New York, 2015.
2) J. Schiller, Mobile Communication, Pearson
3) Yi-Bing Lin & Imrich Chlamtac, Wireless and Mobile Networks Architectures, John Wiley & Sons, 2001
4) Raj Pandya, Mobile and Personal Communication systems and services, Prentice Hall of India, 2001
5) 5. Xiang Yang Li, Wireless, Adhoc and Sensor Networks, Cambridge University Press.

Recommended books:

1) Research articles published on secure wireless communication (authentication, mitigation of DoS, DDoS, eavesdropping) published in leading journals.
2) Mark Ciampa, Guide to Designing and Implementing wireless LANs, Thomson learning, Vikas Publishing House, 2001.
3) P. Stavronlakis, Third Generation Mobile Telecommunication systems, Springer Publishers.

CO-PO Mapping

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	2	1	1	-	-	3	2	3	2	2	2
CO2	3	3	3	3	2	1	1	-	-	3	2	3	2	2	2
CO3	3	3	2	3	2	1	1	-	-	3	2	3	2	2	2
CO4	3	3	2	2	2	1	1	-	-	3	2	3	2	2	2
CO5	3	3	3	3	2	1	1	-	-	3	2	3	2	2	2

SYLLABUS	
Semester – 6th	
Course Code	**AM604B**
Course Name	**Quantum Computing**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisite:

Discrete Structures

Course Objective(s)

The objective of the course is to make the students able to –

1. **Understand** the basic idea of quantum computing including background of mathematics and physics.
2. **Understand** and explain the concept of quantum circuits using single and multiple qubit gates and designing quantum circuits.
3. **Compare** classical and quantum information theory and explain and apply Bell states, Quantum teleportation, Quantum Cryptography, and no cloning theorem.
4. **Understand**, **explain**, and **apply** different quantum algorithms including classical computation on quantum computers like Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search and also relate between quantum and classical complexity classes.
5. **Understand** noise and error correction including graph states and codes, quantum error correction, fault tolerant.

Course Outcome(s)

After completion of the course students will be able to

CO1	Understand the basic idea of quantum computing including background of mathematics and physics required for developing and solving complex engineering problem in the domain of quantum computing possibly using modern engineering tools.
CO2	Understand and explain the concept of quantum circuits using single and multiple qubit gates and designing of quantum circuits for solving engineering problem including societal and environmental issues.
CO3	Compare between classical and quantum information theory and explain and apply Bell states, Quantum teleportation, Quantum Cryptography and no cloning theorem in solving engineering problem possibly in a team maintain proper ethics of professional collaboration.
CO4	Understand, explain and apply different quantum algorithms including classical computation on quantum computers like Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search and also relate between quantum and classical complexity classes for solving engineering problem.
CO5	Understand noise and error correction including graph states and codes, quantum error correction, fault tolerant computation and apply it in designing and solving complex engineering problems leading to their lifelong learning.

MODULE NUMBER	COURSE CONTENT
1.	Introduction to Quantum Computation: 8L Quantum bits, Bloch sphere representation of a qubit, multiple qubits. Background Mathematics and Physics: Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.
2.	Quantum Circuits: 6L Single qubit gates, multiple qubit gates, design of quantum circuits.
3.	Quantum Information and Cryptography: 6L Comparison between classical and quantum information theory. Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem.
4.	Quantum Algorithms: 8L Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search.
5.	Noise and error correction: 8L Graph states and codes, Quantum error correction, fault-tolerant computation.

Text books:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press.
2. 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.
3. Pittenger A. O., An Introduction to Quantum Computing Algorithms

Recommended books:

1. P Kaye, R Laflamme and M Mosca, An Introduction to Quantum Computing.

2. Eleanor G. Rieffel , Wolfgang H. Polak , "Quantum Computing - A Gentle Introduction" (Scientific and Engineering Computation)

3. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists.

4. Riley Tipton Perry, "Quantum Computing from the Ground Up", World Scientific Publishing Ltd.

5. Scott Aaronson, "Quantum Computing since Democritus", Cambridge.

6. P. Kok, B. Lovett, "Introduction to Optical Quantum Information Processing", Cambridge

CO-PO Mapping

CO #	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	2	1	1	-	-	3	2	3	2	2	2
CO2	3	3	3	3	2	1	1	-	-	3	2	3	2	2	2
CO3	3	3	2	3	2	1	1	-	-	3	2	3	2	2	2
CO4	3	3	2	2	2	1	1	-	-	3	2	3	2	2	2
CO5	3	3	3	3	2	1	1	-	-	3	2	3	2	2	2

SYLLABUS	
Semester – 6th	
Course Code	**AM604C**
Course Name	**Cloud Computing**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Pre-requisite:

1. The student must have basic knowledge in Computer Network and Distributed System

Course Objectives(s):

1. To provide students with the fundamentals and essentials of Cloud Computing.
2. Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing.
3. Understand the importance of protocols and standards in computing

Course Outcome(s)

After competition of the course the student able to do

CO1	Identify the appropriate cloud services for a given application
CO2	Assess the comparative advantages and disadvantages of Virtualization technology
CO3	Analyze authentication, confidentiality and privacy issues in cloud computing
CO4	Identify security implications in cloud computing.
CO5	Understand the importance of protocols and standards in management for cloud services.
MODULE NUMBER	**COURSE CONTENT**
1.	**Definition of Cloud Computing and its Basics [8L]** Definition of Cloud Computing: Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public, Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers, Cloud Reference model, Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing [3] Cloud Architecture: Cloud Infrastructure, Architecture of each components, Virtualization versus Traditional Approach, Virtualization Model for Cloud Computing. [2] Services and Applications by Type [3] IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos. PaaS – Basic concept, tools and development environment with examples

	SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service (CaaS)
2.	**Use of Platforms in Cloud Computing [6L]** Concepts of Abstraction and Virtualization [2L] Virtualization technologies: Types of virtualization, Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing; Classification of Virtualization Environment: Scheduling-based Environment, Load-Distribution-Based Environment, Energy Aware-Based Environment, Operational-Based Environment, Distributed Pattern-Based Environment, Transactional-Based Environment Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine imaging (including mention of Open Virtualization Format – OVF) [2L] Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance Concepts of Platform as a Service [2L] Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development.Use of PaaS Application frameworks.
3.	**Cloud Service Models [6L]** Use of Google Web Services [2L] Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service. Use of Amazon Web Services [2L] Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon SimpleDB and Relational Database Service Use of Microsoft Cloud Services [2L] Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services
4.	**Cloud Infrastructure [10L]** Types of services required in implementation – Consulting, Configuration, Customization and Support **Cloud Management [3L]** An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle)

	Live Migration of Virtual Machines [2L] Need of Live Migration of Virtual Machine, A Designing Process of Live Migration, and Security Issues during live migration. **Concepts of Cloud Security [3L]** Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security, Identity and Access Management. **Auditing and Compliance in Cloud Environment [2L]** Data Security in Cloud Computing Environment, Need for Auditing in Cloud Computing Environment, Third Party Service Provider, Cloud Auditing Outsourcing Lifecycle Phases, Auditing Classification.
5.	**Concepts of Services and Applications [6L]** Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs [6] Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs [2] Cloud-based Storage: Cloud storage definition – Manned and Unmanned. [1] Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services [1]

Textbook

1. Kai Hwang, Geoffrey C Fox, Jack J Dongarra: Distributed and Cloud Computing – From Parallel Processing to the Internet of Things, Morgan Kaufmann Publishers – 2012.
2. Barrie Sosinsky, “Cloud Computing Bible”, Wiley India Edition.

Reference books

1. Anthony Velte, Toby Velte, Robert Elsenpeter, “Cloud Computing – A Practical Approach”, Tata McGraw-Hill Edition.
2. Alex Amies, Harm Suliman, Qiang Guo Tong and Guo Ning Liu: Developing and Hosting Applications on the cloud, IBM Press, 2012.
3. George Reese: Cloud Application Architectures: Building Applications and Infrastructure in the Cloud (Theory in Practice), O’Reilly Publications, 2009
4. Haley Beard: Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing – applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008
5. Michael Miller: Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Pearson Education, 2009.
6. Richard N. Katz: The Tower and The Cloud, Higher Education in the Age of Cloud Computing, 2008.

CO-PO mapping

CO #	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	-	3	3	1	-	-	-	1	-	-	-	-	3	-	2
CO2	3	-	-	2	-	-	1	-	-	-	-	-	-	1	3
CO3	2	2	-	-	3	-	-	-	1	-	-	-	-	-	3
CO4	-	1	3	3	-	-	-	-	-	1	-	-		1	3
CO5	1		-	-	-	-	-	-	-	-	-	-	3	-	-

SYLLABUS	
Semester – 6th	
Course Code	**HU(AM)605**
Course Name	**Cyber Law and Ethics**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisite:

1. Familiarity in computer Networking.
2. Basic concepts about network security.

Course Objective(s) :

1. To understand, explore and acquire acritical understanding of Cyber Law.
2. To learn the basics of a Cyber security

Course Outcome(s):

After completion of the course students will be able to

CO1	To understand the importance of professional practice, Law and Ethics in their personal lives and professional careers.
CO2	To acquire in depth knowledge of information technology act, security policies, and legal framework of right to privacy, data security and data protection
CO3	To develop the understanding of relationship between commerce and cyberspace
CO4	To be familiar with network security threats and countermeasures
CO5	To develop competencies for dealing with frauds and deceptions (Confidence Tricks, Scams
MODULE NUMBER	**COURSE CONTENT**
1.	**Introduction of Cybercrime** [7L] Cybercrime, Forgery, Hacking, Software Piracy, Computer Network intrusion Jurisdiction to prescribe/Legislative Jurisdiction; Jurisdiction to adjudicate to enforce; Cyber Jurisdiction in Civil, Criminal & International Cases. Criminals plan attacks, passive attack, Active attacks, cyberstalking.
2.	**Cybercrime Mobile & Wireless Devices [8L]** Security challenges in mobile devices, cryptographic security for mobile devices, Attacks on mobile/cell phones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop.
3.	**Tools and Methods used in Cyber-Crime [7L]** Proxy servers, Password checking, Random checking, Trojan Horses and Backdoors; DOS & DDOS attacks; SQL injection: Buffer overflow Attacks, Scripts Kiddies and Packaged Defense.

4.	**Cybercrime & Cyber Security[4L]** Phishing methods, ID Theft; Online identity method Legal aspects, Indian laws, IT act, Public Key Certificate, Design of Cyber Security Policy of an Organization, UNCITRAL Model Law.
5.	**Cyber Ethics[5L]** The Importance of Cyber Law, Significance of Cyber-Ethics, Need for Cyber regulations, and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.

Text Books:

1. Cyber security by Nina Godbole, Sunit Belapune; Pub: Wiley India.
2. Chris Reed & John Angel, Computer Law, OUP, New York, (2007).
3. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi, (2012).
4. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute, New Delhi, (2004)

Recommended Books:

1**.** Kenneth J. Knapp, "Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions", IGI Global, 2009.
2. Jonathan Rosenoer, "Cyber law: the Law of the Internet", Springer Verlag, 1997
3. Sudhir Naib, The Information Technology Act, 2005: A Handbook, OUP, New York,
4. Vasu Deva, Cyber Crimes and Law Enforcement, Commonwealth Publishers, New Delhi, (2003).

CO-PO mapping

CO #	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	2	1	1	-	-	3	2	3	2	2	2
CO2	3	3	3	3	2	1	1	-	-	3	2	3	2	2	2
CO3	3	3	2	3	2	1	1	-	-	3	2	3	2	2	2
CO4	3	3	2	2	2	1	1	-	-	3	2	3	2	2	2
CO5	3	3	3	3	2	1	1	-	-	3	2	3	2	2	2

SYLLABUS	
Semester – 6th	
Course Code	**AM691**
Course Name	**Machine Learning Lab**
Practical (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Pre-requisites:
Data Structure, Design and Analysis of Algorithms, Statistics, Artificial Intelligence, Python Programming

Course Objectives:

1. Comprehend and implement the fundamental concepts of the evolving technologies in machine learning such as Supervised and Unsupervised Learning
2. Formulate an engineering problem within the scope of machine learning paradigm.
3. Implement the concepts of machine learning to solve problems of making automated decisions dealing with large scale data.
4. Develop and Implement ideas for proposing solutions to the challenging problems of machine learning.
5. Analyze the effectiveness of various machine learning frameworks using appropriate tools.

Course Outcomes:

After completion of the course students will be able to

CO1	**Understand** and **implemen**t the basics concepts of machine learning to **explain or illustrate** and **identify** problems where students can **apply** the concept appropriately to **solve** them.
CO2	**Understand** and **implemen**t the fundamental concepts of regression analysis so that they can **propose models** for predicting values based on exemplary data and **analyze** their performances.
CO3	**Understand** and **implemen**t the fundamental strategies of unsupervised machine learning paradigm to solve clustering problems and **analyze** their performances.
CO4	**Understand** and **implemen**t the concepts of Mining Frequent Patterns, Associations and Data Streams and Apply them to solve the relevant problems and **analyze** their performances.
CO5	**Develop** ideas to **propose** solutions to the problems of supervised learning and **identify** problems where students can **apply** and **implement** the concept appropriately with adequate documentation in collaborative environment for successfully carrying out projects on machine learning problems and **investigate** their effectiveness by **analyzing** the performances using proper techniques and tools and **assess** the limitations of solutions underscoring utilitarian importance for further explorations leading towards lifelong learning.

MODULE NUMBER	COURSE CONTENT
1	**WEEK-1: Introduction to Machine Learning Programming Platform& Python Programming Basics** Introduction to Machine Learning Programming Platform and Python Programming Basics
2	**WEEK-2: Data Exploration** Data Exploration: Data Types, Data Attributes, Statistical Description of Data, Data Visualization, Data Feature Vectors, Data Preprocessing: Data Cleaning, Data Transformation
3	**WEEK -3: Regression** Implementation and Analysis of Linear and Nonlinear Regression Methods
4	**WEEK -4: Classification** Implementation and Analysis of k-Nearest-Neighbor Classifier, Decision Tree Classifier, Naïve Bayes Classifier
5	**WEEK -5: Classification** Implementation and Analysis of ANN-Backpropagation and SVM Based Classifier
6	**WEEK-6: Clustering** Implementation and Analysis of k-Means and k-Medoids
7	**WEEK -7: Association Analysis** Implementation and Analysis of Apriori Algorithm
8	**WEEK -8: Mining Time-Series Data** Implementation and Analysis of Time-Series Data Mining Models
9	**WEEK -9:** Discussion on Project Problems and Allocation (Problem Description Report Submission)
10	**WEEK -10:** Designing Solution Model and Proposal Report Submission
11	**WEEK -11:** Project Implementation, Verification and Documentation
12	**WEEK -12:** Project Demonstration and Project Report Review

Textbook:

1. Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron, O'Reilly
2. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007
3. Dr. Rajiv Chopra, Machine Learning, Khanna Publishing House, 2018

Reference Books:

1. Machine Learning by SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson.
2. Machine Learning using Python, Manaranjan Pradhan and U Dinesh Kumar, Wiley.

CO–PO Mapping:

CO #	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	2	2	-	2
CO5	2	2	3	3	2	2	2	2	2	2	2	2	2	2	3

SYLLABUS	
Semester – 6th B. PRACTICAL	
Course Code	**AM692**
Course Name	**Digital Image Processing Lab**
Practical (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Pre-requisites:
Knowledge of C programming and MATLAB: Design and Analysis of Algorithms, UG Level Mathematics, Python/MATLAB Programming.

Course Objective:
The objective of the course is to make the students able to -
1. Understand the practical aspects of digital image processing and identify problems where students can implement the concept appropriately.
2. Understand the practical aspects of image enhancement strategies and identify the scope of enhancement where students can apply the appropriate strategy and analyze the performance.
3. Implement the fundamental image restoration strategies and apply them appropriately to eliminate noise in the image.
4. Implement various Image Compression Techniques and Analyze their performances.
5. Understand the ideas of Morphological Image Processing and Image Segmentation and implement them to solve related problems and analyze the effectiveness as well as limitations of the solutions underscoring its utilitarian importance for further explorations leading towards lifelong learning.

Course Outcomes:

After completion of the course students will be able to

CO1	Understand the practical aspects of digital image processing and identify problems where students can implement the concept appropriately.
CO2	Understand the practical aspects of image enhancement strategies and identify the scope of enhancement where students can apply the appropriate strategy and analyze the performance.
CO3	Implement the fundamental image restoration strategies and apply them appropriately to eliminate noise in the image.
CO4	Implement various Image Compression Techniques and Analyze their performances.
CO5	Understand the ideas of Morphological Image Processing and Image Segmentation and implement them to solve related problems with adequate documentation in collaborative environment demonstrating the ability to carry out projects and investigate their effectiveness by analyzing the performances using proper techniques and tools and assess the limitations of the solutions underscoring utilitarian importance for further explorations leading towards lifelong learning.
MODULE NUMBER	**COURSE CONTENT**
1.	WEEK-1: Introduction to Digital Image Processing Basics & Python/MATLAB Programming Basics Introduction to Digital Image Processing Basics and Python/MATLAB Programming Basics.

2.	WEEK-2: Image Enhancement in Spatial Domain Implementation of various image enhancement strategies in Spatial Domain.
3.	WEEK -3: Image Enhancement in Frequency Domain Implementation of various image enhancement strategies in Frequency Domain.
4.	WEEK -4: Image Restoration Implementation of various Image Restoration strategies
5.	WEEK -5: Morphological Image Processing Implementation of various Morphological Image Processing strategies
6.	WEEK-6: Image Compression Implementation of various Image Compression strategies.
7.	WEEK -7: Image Segmentation: Detection of Points, lines and Edges (Sobel and Canny); Edge Linking Implementation of various techniques for Detection of Points, lines and Edges (Sobel and Canny); Edge Linking
8.	WEEK-8: Image Segmentation: Image Thresholding (Otsu's method), Region based segmentation, colour feature based segmentation in color images Implementation of various techniques for Image Thresholding (Otsu's method), Region based segmentation, color-feature based segmentation in color images.
9.	WEEK -9: Discussion on Project Problems and Allocation (Problem Description Report Submission).
10.	WEEK -10: Designing Solution Model and Proposal Report Submission
11.	WEEK -11: Project Implementation, Verification and Documentation
12.	WEEK -12: Project Demonstration and Project Report Review

Textbook:

1 Digital Image Processing using MATLAB, Rafael C. Gonzales, Richard E. Woods, Steven L. Eddins, Pearson Education.

2 OpenCV with Python By Example, Prateek Joshi, Oreilly.

Reference Books:

1. Practical Python and OpenCV: An Introductory, Example Driven Guide to Image Processing and Computer Vision, Adrian Rosebrock, PyImage Search.
2. Image Processing, analysis and Machine Vision, Milan Sonka , Thomson Press India Ltd, Fourth Edition.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	-	-	-	3	-	-	-	-	3	3	3
CO4	3	3	3	3	-	-	-	3	3	-	-	-	3	3	3
CO5	-	-	-	-	-	-	-	3	-	3	-	-	3	2	3
CO	3	3	3	3	3	-	-	3	3	3	-	3	3	3	3

SYLLABUS	
Semester – 6th B. PRACTICAL	
Course Code	**AM693**
Course Name	**Natural Language Processing Lab**
Practical (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Pre-requisites:
Statistics, Automata, Compiler Design, Python Programming

Course Objective:
1. To learn the principles of NLP through implementation.
2. To build an application using different algorithms and natural language processing techniques.
3. To learn techniques of Machine translations.
4. To implement the NLP algorithms for extracting meaning of sentences
5. To understand and evaluate expert systems for various NLP problems with moderate complexity

Course Outcomes:

After completion of the course students will be able to

CO1	Analyze text corpora and lexical resources and pre-process of raw text.
CO2	Apply the concepts of Markov Model for POS Tagging to write structured programs for categorizing and tagging of words, segmentation of sentences.
CO3	Classify text and extract information from it.
CO4	Implement the relevant algorithms to analyze meaning of sentences for translating linguistic data.
CO5	Design and Implement expert systems for various NLP problems with adequate documentation in collaborative environment for successfully carrying out projects on NLP Problems and investigate their effectiveness by analyzing the performances using proper techniques and tools and assess the limitations of solutions underscoring utilitarian importance for further explorations leading towards lifelong learning.

MODULE NUMBER	COURSE CONTENT
1.	WEEK-1: Introduction to NLP Programming Platform & Python Programming Basics Introduction to NLP Programming Platform and Python Programming Basics
2.	WEEK-2: Word Analysis and Morphological Processing Implementation of concepts for Word Analysis and Morphological Processing
3.	WEEK -3: N-Gram Modelling for Spelling and Word Prediction Implementation of concepts for Spelling and Word Prediction
4.	WEEK -4: POS Tagging: Hidden Markov Model Implementation and Analysis of Hidden Markov Model
5.	WEEK -5: POS Tagging: Viterbi Decoding Implementation and Analysis of Viterbi Decoding for POS Tagging.

6.	WEEK-6: Semantic Processing & Sentiment Analysis Implementation and Analysis of Semantic Processing and Sentiment Analysis strategies.
7.	WEEK -7: Automatic Query Processing System Implementation and Analysis of automatic query processing system.
8.	WEEK -8: NLP based information retrieval Implementation and Analysis of NLP based information retrieval models.
9.	WEEK -9: Discussion on Project Problems and Allocation (Problem Description Report Submission)
10.	WEEK -10: Designing Solution Model and Proposal Report Submission
11.	WEEK -11: Project Implementation, Verification and Documentation
12.	WEEK -12: Project Demonstration and Project Report Review

Textbook:

1. Steven Bird, Ewan Klein, and Edward Loper. Natural Language Processing with Python", O'Reilly.
2. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana, "Practical Natural Language Processing", O'Reilly.

Reference Books:

1. Sri Mathangi, "Practical Natural Language Processing with Python', Apress. 2.
2. Rajesh Arumugam, Rajalingappaa Shanmugamani, "Hands-On Natural Language Processing with Python", O'Reilly.
3. Natural Language Toolkit documentation (https://www.nltk.org/), Natural Language Processing Lab (https://nlp-iiith.vlabs.ac.in/)

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	-	-	-	3	-	-	-	-	3	3	3
CO4	3	3	3	3	-	-	-	3	3	-	-	-	3	3	3
CO5	-	-	-	-	-	-	-	3	-	3	-	-	3	2	3
CO	3	3	3	3	3	-	-	3	3	3	-	3	3	3	3

4th Year 7th Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	AM701	Neural Networks and Deep Learning	3	0	0	3	3
2	ENGG	Major	AM702A	Computer Vision	3	0	0	3	3
			AM702B	Parallel Computing					
			AM702C	Web Technology					
3	ENGG	Major	AM703A	Information Retrieval and Data Mining	3	0	0	3	3
			AM703B	Soft Computing					
			AM703C	Software Engineering					
4	HUM	Minor	HU(AM)701	Human Resource Development and Organizational Behavior	2	0	0	2	2
B. PRACTICAL									
1	ENGG	Major	AM791	Neural Networks and Deep Learning Lab	0	0	3	3	1.5
2	ENGG	Major	AM792A	Computer Vision Lab	0	0	3	3	1.5
			AM792B	Parallel Computing Lab					
			AM792C	Web Technology Lab					
3	ENGG	PRJ	AM781	Major Project-I	0	0	12	12	6
Total of Theory and Practical								29	20

SYLLABUS	
Semester – 7th	
Course Code	**AM701**
Course Name	**Artificial Neural Networks & Deep Learning**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites: Knowledge of Linear Algebra, DSP, PDE will be helpful

Course Objectives:

The objectives of this course are to enable students to

6. This course gives and understanding of the theoretical basis underlying neural networks and deep learning.
7. Furthermore, the course includes implementation of neural components and as well as applying deep learning on real-world data sets using modern deep learning packages.
8. Understand how to evaluate models generated from data.
9. Apply the algorithms to a real problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Course Outcome:

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

CO1	**Understand** the main fundamentals that drive Deep Learning.
CO2	**Understand** the key features in a neural network's architecture.
CO3	**Understand and acquire** the knowledge of applying Deep Learning techniques to solve various real life problems.
CO4	**Be able to build, train** and **apply** fully connected deep neural networks.
CO5	**Develop** Inferencing Models for **proposing** solutions to the problems of neural network's architecture.

MODULE NUMBER	COURSE CONTENT
1	**Introduction to Neural Network**:**[8L]** Introduction, basic models, Hebb's learning, Adeline, Perception, Multilayer feed forward network.

	Back Propagation Learning, Different issues regarding convergence of Multilayer Perceptron, Competitive learning, Self-Organizing Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.
2	**Learning Models**:[**6L]** Unsupervised Learning with Deep Network, Autoencoders, Convolutional Neural Network, Building blocks of CNN, Transfer Learning.
3	**Introduction to Deep Learning: [4L]** Bayesian Learning, Decision Surfaces, Linear Classifiers, Linear Machines with Hinge Loss
4	**Learning Models**: [**8L]** Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam, Classical Supervised Tasks with Deep Learning, Image Denoising, Semanticd Segmentation, Object Detection etc. LSTM Networks.
5	**Optimization Problem [10L]** Optimization Techniques, Gradient Descent, Batch Optimization, Generative Modeling with DL, Variational Autoencoder, Generative Adversarial Network Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam

Textbook:

4. "Neural Networks, Fuzzy logic, and Genetic Algorithms", S. Rajasekaran& G. A. V. Pai , PHI.

Reference Books:

4. Deep Learning- Ian Goodfelllow, Yoshua Benjio, Aaron Courville, The MIT Press
5. Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.

CO–PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	1
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	2	3
CO5	3	3	3	3	-	-	-	-	3	2	-	-	3	2	3

SYLLABUS	
Semester – 7th	
Course Code	**AM702A**
Course Name	**Computer Vision**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites: Digital Image Processing, Machine Learning

Course Objectives:

The objectives of this course are to enable students to

1. Understand the basic concepts of Computer Vision to Explain or Illustrate and Identify problems where students can Apply the concept appropriately to Solve them.
2. Understand the fundamental concepts of Image Analysis and Image Feature Descriptors, and Etraction Techniques and Analyze their performances.
3. Illustrate the fundamental strategies of Image Registration to solve related problems and analyze their performances.
4. Illustrate the concepts of Shape Matching, Video Processing and Apply them to solve the relevant problems

Course Outcome:

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

CO1	Understand the basic concepts of Computer Vision to Explain or Illustrate and Identify problems where students can Apply the concept appropriately to Solve them
CO2	Understand the fundamental concepts of Image Analysis and Image Feature Descriptors, and Etraction Techniques and Analyze their performances.
CO3	Explain or illustrate the fundamental strategies of Image Registration to solve related problems and analyze their performances.
CO4	Explain or illustrate the concepts of Shape Matching, Video Processing and Apply them to solve the relevant problems and analyze their performances.
CO5	Develop ideas to Propose solutions to the problems of Computer Vision and Identify problems where students can Apply the concept appropriately and Analyze the effectiveness as well as limitations of solutions making the students aware of its utilitarian importance for further explorations leading towards lifelong learning.

MODULE NUMBER	COURSE CONTENT
1	Introduction to Computer Vision [2L]: Basics of Computer Vision Systems, Computer Vision Problems, Computer Vision Solution Models

2	Image Analysis and Image Feature Descriptors [10L]: Image Analysis Basics, Edge Detection and Hough Transform – Definition Edges, Edges in real image, Gradient, Steps in Edge Detection, Different Edge Detectors, Second Derivative Operators, Laplacian Operator, Laplacian of Gaussian, Canny Edge Detector, Hough Transform, Hough space, Finding Circles by Hough Transform, Generalized Hough Transform. Image Feature Descriptors and Extraction Techniques – Image Object Shape Descriptors, HOG, Harris Corner Detector, Scale Invariant Feature Transform (SIFT), SIFT-PCA, Speeded Up Robust Features (SURF).
3	Texture Analysis [6L]: Definition and Applications, Texture Definition - Statistical Approach, Edge Density and Direction, Local Binary Pattern, Gray Level Co-occurance Matrix, Co-occurrence Features, Laws' Texture Energy Features, Law's texture masks, LBP: Applications to Medical Images.
4	Image Registration [3L]: Transformation, Registration algorithms - Point-based Method, Landmark based Method, Intensity based Method, Surface-based Method, Similarity Measures
5	Shape Descriptor & Shape Matching [3L]: Geometric Transformation, Shape Contexts, Shape Matching, Thin-Plate Spline Model, Hierarchical Matching of Deformable Shapes, The Shape Tree, Deformation Model, Elastic Matching.
6	Video Processing Basics [4L]: Digital Video Formation basics, Background subtraction in video, Object Tracking in video, Video Surveillance Applications.
7	Advanced Computer Vision Applications [8L]: Image Object Detection and Recognition: Face Detection and Recognition, Image Object Segmentation, Image Retrieval, Document Image Processing.

Textbook:

1) David A. Forsyth and Jean Ponce, Computer Vision: A Modern Approach, Pearson Education, 2003

2) Anil K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, 1989 - Technology & Engineering 3) Simon J.D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.

Reference Books:

1. Insight into Images: Principles and Practice for Segmentation, Registration, and Image Analysis, By: T. S. Yoo, 2004 (Hardcopy)

2. Biomedical Images Analysis, by: R. M. Rangayya, 2004, eBook.

CO–PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	1
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	2	3
CO5	3	3	3	3	-	-	-	-	3	2	-	-	3	2	3

SYLLABUS	
Semester – 7th	
Course Code	**AM702B**
Course Name	**Parallel Computing**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites: Computer Organization and Architecture

Course Objectives:

The objectives of this course are to enable students to

1. Illustrate the basic concept of computer architecture and its performance measurement, parallel processing, Flynn's classification and Amdahl's law to design real life engineering problems.
2. Summarize the basic concept of pipeline, instruction pipeline, arithmetic pipeline, hazards detection and prevention to design and implement mathematical and engineering problems.
3. Identify the concept of Instruction-Level Parallelism to solve engineering problems.
4. Illustrate and Compare concepts of Multiprocessor architecture and parallel architecture.
5. Understand the concept of message-passing architecture and interconnection network and design an optimized model

Course Outcome:

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

CO1	**Illustrate** the basic concept of computer architecture and its performance measurement, parallel processing, Flynn's classification and Amdahl's law and **apply** this knowledge in **designing** solutions for real life engineering problems.
CO2	**Summarize** the basic concept of pipeline, instruction pipeline, arithmetic pipeline, hazards detection and prevention and **use** this knowledge for **designing** and **implementing** mathematical and engineering problem leading to lifelong learning.
CO3	**Identify** the concept of Instruction-Level Parallelism to **solve** engineering problem.
CO4	**Illustrate and Compare** concept of Multiprocessor architecture and parallel architecture and **apply** this knowledge for **developing** an approach by means of existing and new methods as a team work.
CO5	**Understand** the concept of message passing architecture and interconnection network and **design** an optimized model for **building** a new solution as a professional engineering practice as a team.

MODULE NUMBER	COURSE CONTENT
1	**Introduction [3L]** Review of basic computer architecture [1], Measuring, reporting and summarizing performance [1], quantitative principles of Computer design [1] **Parallel processing [4L]** Parallel processing - concept, architecture [1], Flynn's classification-SISD, SIMD, MISD, MIMD [1], SIMD architecture, MIMD architecture, loosely coupled and tightly coupled computers [1], Amdahl' law [1].
2	**Pipelining[8L]** Introduction of pipelining, classification of pipeline [1], Instruction pipeline [1], Arithmetic pipeline [1], hazard detection and resolution in pipeline [3], dynamic pipeline [1], reservation table and case study [2].
3	**Instruction-Level Parallelism[6L]** Instruction-Level Parallelism: Basic Concepts [2L], Techniques for Increasing ILP, Superscalar, Super Pipelined and VLIW Processor Architectures [2L], Array Processor [1], Vector Processors [1L]
4	**Multiprocessor architecture[8L]** Shared memory architecture - classification, bus based symmetric multiprocessors [1], cache coherence methods, snooping protocols, directory-based protocols [1], Centralized and Shared- memory architecture: synchronization[1L] Introduction to Parallel Architecture-Different Classification scheme, Performance of Parallel Computers, PRAM model (EREW, CREW, CRCW) [3L], Program flow mechanisms –Control flow, data-driven and demand driven [2]
5	**Message passing architecture [4]** Basic concept, Routing in message passing network [1], switching mechanisms in message passing [1], Examples of message passing architecture [1], Message passing vs Shared memory architectures [1] **Interconnection Network [3]** Interconnection Network- taxonomy, bus based dynamic interconnection networks [1], switch-based interconnection networks [1], static interconnection networks [1], performance analysis [1L]

Textbook:

J. L. Hennessey and D. A. Patterson: Computer Architecture: A Quantitative Approach, 5th edition, Morgan Kaufmann, 2012.
2. K. Hwang and F. A. Briggs: Computer Architecture and Parallel Processing, Tata McGraw Hill, New Delhi.

Reference Books:

Tse-yun Feng, A Survey of Interconnection Networks, IEEE, 1981.
2. Selim G. Akl, The Design and Analysis of Parallel Algorithms, Prentice-Hall, 1989.

CO–PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	1
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	2	3
CO5	3	3	3	3	-	-	-	-	3	2	-	-	3	2	3

SYLLABUS	
Semester – 7th	
Course Code	**AM702C**
Course Name	**Web Technology**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites: Computer Organization and Architecture, Operating System, Network, programming concepts of JAVA

Course Objectives:

The objectives of this course are to enable students to

1. To impart the design, development, and implementation of Static and Dynamic Web Pages.
2. To develop programs for Web using Scripting Languages and .net framework.
3. To give an overview of Server-Side Programming in Web.

Course Outcome:

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

CO1	Understand networks, IP, DNS, routing and other related technologies used in internet and execute and solve problems related to them leading to engineering problems solutions
CO2	Understand different web based technologies like HTML, DHTML, CSS, XML and demonstrate their use in design of web based solutions leading to engineering problems
CO3	Comprehend and analyze different client and server side technologies like JavaScript, Servlet, CGI and design appropriate engineering solutions leading to life long learning.
CO4	Understand and implement different types of technologies like JSP, JavaBean, JDBC and ODBC and evaluate their performances.
CO5	Understand different web based applications and network security techniques and apply them to protect the network against different attacks and solve related problems preferably as a team.

MODULE NUMBER	COURSE CONTENT
1	Introduction (1L): Overview, Network of Networks, Intranet, Extranet, and Internet. World Wide Web (1L): Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. Review of TCP/IP (1L): Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. IP Subnetting and addressing (1L): Classful and Classless Addressing, Subnetting. NAT, IP masquerading, IP tables.

	Internet Routing Protocol (1L): Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. Electronic Mail (1L): POP3, SMTP, Clients - Servers Communication.
2	[9L] HTML, DHTML & CSS: Introduction, Elements, Attributes, Heading, Paragraph. Formatting[1L]; Link, Table, List, Block, Layout, Html Forms, and input [1L]; Iframe, Colors[1L], Image Maps and attributes of image area [1L]; Introduction to CSS, basic syntax and structure of CSS, different types internal, external and inline CSS [1L]; Basic Introduction of DHTML, Difference between HTML and DHTML, Documentary
3	[15L] Java Scripts: Basic Introduction, Statements, comments, variable, operators, data types [1L]; condition,switch, loop, break [1L]; Java script functions, objects, and events[1L]. CGI Scripts: Introduction, Environment Variable, GET and POST Methods [1L]. Java Servlet: Servlet environment and role, Servlet life cycle [1L]; Servlet methods- Request, Response, Get and post [1L]; Cookies and Session [1L]. Java Server Page (JSP): JSP Architecture [1L]; JSP Servers, JSP Life Cycle [1L]; Understanding the layout of JSP, JSP Scriptlet Tag [1L]; JSP implicit object (request and response) [1L]; Variable declaration, methods in JSP [1L]; JSPdirective (Taglib and Include), JavaBean- inserting JavaBean in JSP [1L]; JSP Action tags (Forward & Include) [1L]; Creating ODBC data source name, Introduction to JDBC, prepared statement and callable statement [1L].
4	[6L] Threats[1L]: Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks. Network security techniques: Password and Authentication; VPN, IP Security [1L], security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH)[1L]. Firewall (1L): Introduction, Packet filtering, Stateful, Application layer, Proxy. Search Engine and Web Crawler: Definition, Meta data, Web Crawler [1L], Indexing, Page rank, overview of SEO[1L].

Textbook:

1. “Web Technology: A Developer's Perspective”, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013. (Topics covered: html, CSS, imagemap, xml)
2. “Learning PHP, MySQL & JavaScript”, Robin Nixon, O’Reilly Publication. (Topics covered: Java Script) 3. “Head First Servlet’s & JSP”, Bryan Basham, Kathy Sterra, Bert Bates, O’Reilly Publication. (Topics covered: Servlet, JSP)
4.Cryptography and Network Security by William Stallings Publisher: Pearson Education India(Topics covered: Threats, Security techniques, Firewall)

Reference Books:

1. "Programming the World Wide Web", Robert. W. Sebesta, Fourth Edition, Pearson Education, 2007.
2. “Core Web Programming”- Second Edition-Volume I and II, Marty Hall and Larry Brown, Pearson Education, 2001

CO–PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	1
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	2	3
CO5	3	3	3	3	-	-	-	-	3	2	-	-	3	2	3

SYLLABUS	
Semester – 7th	
Course Code	**AM703A**
Course Name	**Information Retrieval and Data Mining**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:

1. Prior knowledge of elementary linear algebra, Machine Learning, NLP
2. Basic concept of statistical analysis

Course Objectives:

The objectives of this course are to enable students to

1. Understand the role of social media data and analytics.
2. Draw meaningful insights and provide actionable and strategic recommendations based on thorough social media data analysis.
3. Develop social media measurement plans and analytics reports and communicate findings and recommendations effectively.
4. Examine the ethical and legal implications of leveraging social media data.

Course Outcome:

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

CO1	Understand the basic concepts of Information Retrieval & Text Mining to Explain or Illustrate and Identify problems where students can Apply the concept appropriately to Solve them.
CO2	Understand the fundamental concepts of Query Processing Models so that they can propose models for predicting values based on exemplary data and Analyze their performances.
CO3	Explain or Illustrate the fundamental strategies of Text Mining to solve clustering problems and Analyze their performances.
CO4	Explain or Illustrate the concepts of Text Categorization and Clustering and Apply them to solve the relevant problems and Analyse their performances.
CO5	Develop ideas to Propose solutions to the problems of Text Mining and Identify problems where students can Apply the concept appropriately and Analyze the effectiveness as well as limitations of solutions making the students aware of its utilitarian importance for further explorations leading towards lifelong learning.

MODULE NUMBER	COURSE CONTENT
1	[6L] Introduction to Information Retrieval Goals and history of IR. Basic IR Model, Boolean and vector-space retrieval models; ranked retrieval; textsimilarity metrics; TF-IDF (term frequency/inverse document frequency) weighting; cosine similarity. Basic Tokenizing, Indexing, and Implementation of Vector-Space Retrieval Simple

	tokenizing, stop-word removal, and stemming; inverted indices; efficient processing with sparse vectors.
2	[6L] Experimental Evaluation of IR Performance metrics: recall, precision, F-measure, and NDCG; Evaluations on benchmark text collections. Query Operations and Languages Relevance feedback; Query expansion; Query languages.
3	[4L] Introduction to Text Mining Basic concept of Text Mining, Representation of Structured and unstructured data, Analysis of Structured and Unstructured Data, Conversion Technique from unstructured to structured data, visualizations forexploring and presenting data.
4	[10L] Text Categorization and Clustering: Categorization algorithms: naive Bayes; decision trees; and nearest neighbor. Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM). Applications to information filtering; organization; and relevance feedback.
5	[10L] Topic modeling: Probabilistic Latent Semantic Indexing (pLSI) and Latent Dirichlet Allocation (LDA), and their variants for different application scenarios, including classification, imagine annotation, collaborative filtering, and hierarchical topical structure modeling.

Textbook:

1. Mining Text Data. Charu C. Aggarwal and Cheng Xiang Zhai, Springer, 2012.
2. Speech & Language Processing. Dan Jurafsky and James H Martin, Pearson Education India, 2000.

Reference Books:

1. Introduction to Information Retrieval. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schuetze, Cambridge University Press, 2007

CO–PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	1
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	2	3
CO5	3	3	3	3	-	-	-	-	3	2	-	-	3	2	3

SYLLABUS	
Semester – 7th	
Course Code	**AM703B**
Course Name	**Soft computing**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:
Discrete Mathematics, Probability and Statistics

Course Outcome(s):
After completion of the course students will be able to

CO1	**Understand and explain** the basic concept of soft computing and hard computing and apply them in designing solution to engineering problem.
CO2	**Identify** and **formulate** learning rules for each of the architectures and learn several neural network paradigms and its applications to solving engineering and other problems
CO3	**Explore** relevant literature and apply fuzzy logic and reasoning to handle uncertainty and solving interdisciplinary engineering problems
CO4	Use genetic algorithms to combinatorial optimization problems and recognize the feasibility of applying a soft computing methodology for a particular problem
CO5	**Implement** the concept and techniques of designing of soft computing methods in real world problem.

MODULE NUMBER	COURSE CONTENT
1	Introduction to Soft Computing: **[8L]** An Overview of Artificial Intelligence, Evolution of Computing - Soft Computing Constituents – From Conventional Artificial Intelligence to Computational Intelligence - Machine Learning Basics. Soft Computing: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing
2	Fuzzy sets and Fuzzy logic :[**7L]** Introduction, Fuzzy sets versus crisp sets, operations on fuzzy sets, Extension principle, Fuzzy relations and relation equations, Fuzzy numbers, Linguistic variables, Fuzzy logic, Linguistic hedges, Applications, fuzzy controllers, fuzzy pattern recognition, fuzzy image processing, fuzzy database.
3	Artificial Neural Networks:[**9L]** Artificial Neural Network: Introduction, basic models, Hebb's learning, Adeline, Perception, Multilayer feed forward network.

	Back propagation, Different issues regarding convergence of Multilayer Perceptron, Competitive learning, Self-Organizing Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.
4	Genetic Algorithms:[**7L]** Evolutionary and Stochastic techniques: Genetic Algorithm (GA), different operators of Genetic Algorithm, Analysis of selection operations, Hypothesis of building Blocks, Schema theorem and convergence of Genetic Algorithm, Simulated annealing and Stochastic models, Boltzmann Machine, Applications. Rough Set: Introduction, Imprecise Categories Approximations and Rough Sets, Reduction of Knowledge, Decision Tables, and Applications.
5	Hybrid Systems: **[5L]** Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design and Learning, Fuzzy Logic controlled Genetic Algorithm. Fuzzy Logic and Genetic Algorithm for Optimization, Applications.
Textbook: 1.“Neural Networks, Fuzzy logic, and Genetic Algorithms”, S. Rajasekaran& G. A. V. Pai , PHI. 2.“Principles of Soft Computing”, S.N.Sivanandam, S.N Deepa, wiley publications.	
Reference Books: 1. “Genetic Algorithms in Search, Optimization and Machine Learning”, David E. Goldberg, Addison Wesley, 1997. 2.“Intelligent Hybrid Systems”, D. Ruan, Kluwer Academic Publisher, 1997. 3.“Neural Networks”, S. Haykin, Pearson Education, 2ed, 2001. 4.“An Introduction to Genetic Algorithm”, Mitchell Melanie, Prentice Hall, 1998.	

CO–PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	1
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	2	3
CO5	3	3	3	3	-	-	-	-	3	2	-	-	3	2	3

SYLLABUS	
Semester – 7th	
Course Code	**AM703C**
Course Name	**Software Engineering**
Lecture [per week]	**3**
Tutorial [per week]	**0**
Contact Hours [per week]	**3**
Total Contact Hours	**36**
Credit	**3**

Pre-requisites:
Programming for Problem Solving

1. To understand the working environment in industry and aware of cultural diversity, who conduct themselves ethically and professionally.
2. Graduates use effective communication skills and technical skills to assure production of quality software, on time and within budget.
3. Graduates build upon and adapt knowledge of science, mathematics, and engineering to take on more expansive tasks that require an increased level of self-reliance, technical expertise, and leadership.

Course Outcomes:

After completion of the course students will be able to

CO1	**Understand** the basic concept of Software Engineering and mathematical knowledge and **apply** them in designing solution to engineering problem including he specification, **design**, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements
CO2	**Analyze,** elicit and specify software requirements through a productive working relationship with various stakeholders of the project
CO3	**Design** applicable solutions in one or more application domains using software engineering approaches that integrates ethical, social, legal and economic concerns.
CO4	**Develop** the code from the design and effectively apply relevant standards and perform testing, and quality management and practice team work.
CO5	**Identify** and **Use** modern engineering tools necessary for software project management time management and software reuse, and an ability to engage in life-long learning.

MODULE NUMBER	COURSE CONTENT
1	**Introduction[6L]** Software Engineering, Characteristics, Components, Application ,Definitions. Software Project Planning-Feasibility Analysis, Technical Feasibility, Cost-Benefit Analysis, Basics of estimation : COCOMO[Basic, intermediate, Complete] model.
2	**Software life cycle models[6L]** Evolution and impact of Software engineering, software life cycle models Waterfall, prototyping, Evolutionary, and Spiral models. Feasibility study, Functional and Non-functional requirements, Requirements gathering, Requirements analysis and specification.
3	**Software design[8L]** Basic issues in software design, modularity, cohesion, coupling and layering, function-oriented software design: DFD and Structure chart, object modeling using UML, Object-oriented software development, user interface design. Coding standards and Code review techniques.
4	**Software Testing[7L]** Fundamentals of testing, White-box, and black-box testing, Test coverage analysis and test case design techniques, mutation testing, Static and dynamic analysis, Software reliability metrics, reliability growth modeling.
5	**Software project management[9L]** Software project management, Project planning and control, cost estimation, project scheduling using PERT and GANTT charts, cost-time relations: Rayleigh-Norden results, quality management, ISO and SEI CMMI, PSP and Six Sigma. Computer aided software engineering, software maintenance, software reuse, Component-based software development.

Text Books:

1. Fundamentals of Software Engineering by Rajib Mall, –PHI-3rd Edition, 2009.
2.SoftwareEngineering-PankajJalote[Wiley-India]

Reference Books:

1.SoftwareEngineering–Agarwal and Agarwal [PHI]
2.Software Engineering, by Ian Sommerville, Pearson Education Inc., New Delhi, [2009].
3. Software Engineering: A Practitioner‟s Approach", by Roger S. Pressman, McGraw-Hill.[2005]

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	3	-	-	-	3	-	-	-	3	3	3	2
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	3	3
CO5	3	2	3	2	3	-	-	-	3	2	3	3	3	2	2

SYLLABUS	
Semester – 7th	
Course Code	**HU(AM)701**
Course Name	**Human Resource Development and Organizational Behaviour**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Course Objective(s):

1. To develop an understanding of the nature, functioning and design of organisation as social collectivises.
2. The basic concepts and theories underlying individual behaviour besides developing better insights into one's own self.
3. To gain insight into the organisational learning processes, how they can be fostered and enhanced.
4. Individual behaviour in groups, dynamics of groups and team building besides developing a better awareness of how they can be better facilitators for building effective teams as leaders themselves.

Course Outcome(s):

At the end of the course students are able to:

CO1	To understand key functions in management as applied in practice.
CO2	To identify and analyze major practices associated with HRD in modern work and organization
CO3	To evaluate the connections between the HRD process and the contemporary performance management concerns of organisations
CO4	To assess the potential effects of organisational-level factors (such as structure, culture and change) on organisational behaviour.
CO5	To evaluate the potential effects of important developments in the externalenvironment (such as globalisation and advances in technology) on organisationalbehaviour
MODULE NUMBER	**COURSE CONTENT**
1	HRD-Macro Perspective: HRD Concept, Origin and Need, HRD as a Total System; Approaches to HRD; Human Development and HRD; HRD at Macro and Micro Climate. **3L**
2	HRD–Micro Perspective: Areas of HRD; HRD Interventions Performance Appraisal, Potential Appraisal, Feedback and Performance Coaching, Training, Career Planning,

	OD or Systems Development, Rewards, Employee Welfare and Quality of Work Life and Human Resource Information; Staffing for HRD: Roles of HR Developer; Physical and Financial Resources for HRD; HR Accounting; HRD Audit, Strategic HRD **6L**
3	Instructional Technology for HRD: Learning and HRD; Models and Curriculum; Principles of Learning; Group and Individual Learning; Transactional Analysis; Assessment Centre; Behaviour Modeling and Self Directed Learning; Evaluating the HRD.**5L**
4	Human Resource Training and Development: Concept and Importance; Assessing Training Needs; Designing and Evaluating T&D Programmes; Role, Responsibilities and challenges to Training Managers.**4L**
5	Organisational Effectiveness (OE): Concept; Approaches to O E; Adoptive Coping Cycle for Effectiveness; Achieving OE; Organisational Climate: Concept, Determinants of Organisational Climate.**3L**
6	Organization Theory: Classical Theory; Neo-Classical Theory, Modern Behavioural Theories, contingency theory, system theory, modern structural models; Organizational Culture; Creating and Sustaining Culture; Work Culture.**6L**
7	Motivation: Types of Motives; Theories of Maslow; Herzberg, McGregor, Alderfers, Porter and Lawler's Model; Job Enlargement, Job Enrichment, Behaviour Modification. **3L**
8	(a)Group & Group Dynamics - concept, importance, classification of groups, reason for group, formation, group cohesiveness. (b) Team work: meaning, concept, types, creating, and an effective team. (c) Leadership: Concept, Leader vs. Manager; Classical Studies on Leadership; Trait Theories; Behavioral Theories; Group and Exchange Theories; Contingency Theory of Leadership; Leadership Styles.**6L**

References:

1) Rao, T.V and Pareek, Udai: Designing and Managing Human Resource Systems, Oxford IBH Pub. Pvt.Ltd., New Delhi , 2005
2) Viramani, B.R and Seth, Parmila: Evaluating Management Development, Vision Books, New Delhi.
3) Rao, T.V: Human Resource Development, Sage Publications, New Delhi.
4) Luthans, Fred: OrganisationalBehaviour, Tata McGraw-Hill Co. New Delhi, 2004.
5) Stephen, P. Robins: OrganisationalBehaviour, Prentice-Hall of India Pvt., Ltd., 2004.
6) John, W. Mewstrom& Davis, Keith :Organisational Behavior (Human Behavior at Work), Tata McGraw-Hill, New Delhi , 2002

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	3	-	-	-	3	-	-	-	3	3	3	2
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	3	3
CO5	3	2	3	2	3	-	-	-	3	2	3	3	3	2	2

SYLLABUS	
Semester – 7th	
Course Code	**AM791**
Course Name	**Neural Networks and Deep Learning Lab**
Practical (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Pre-requisites:

1. Basics of probability theory, linear algebra and calculus at university level.
2. Programming skills (Python will be used throughout the course).

Course Objectives:

The objective of the course is to make the students able to -

1. Understand generic machine learning terminology
2. Understand motivation and functioning of the most common types of deep neural networks
3. Understand the choices and limitations of a model for a given setting
4. Apply deep learning techniques to practical problems
5. Critically evaluate model performance and interpret results
6. Write reports in which results are assessed and summarized in relation to aims, methods and available data.

Course Outcomes:

After completion of the course students will be able to

CO1	Understand to design and implement various types of neural networks, including feedforward neural networks, convolutional neural networks (CNNs), and recurrent neural networks (RNNs), for solving real-world problems.
CO2	**Analyze** the optimizing neural network architectures by fine-tuning hyperparameters and selecting appropriate activation functions.
CO3	**Analyze** and apply deep learning techniques to solve complex tasks such as image classification, natural language processing, and time-series analysis.
CO4	**Implement** the neural network models, interpret their results, and make informed decisions about model improvements and adjustments to data-driven decision-making processes.
CO5	**Understand** selecting appropriate activation functions and employing regularization techniques to improve model performance and prevent overfitting.

MODULE NUMBER	COURSE CONTENT
1	Intro to Machine Learning and Neural Networks: [4P] supervised learning, linear models for regression, basic neural network structure, simple examples and motivation for deep networks.
2	Lab 1: Introduction of TensorFlow: [4P] Intro to TensorFlow, simple ML examples.
3	Lab 2: Neural Networks: [8P] Forward propagation, cost functions, error backpropagation, training by gradient descent, bias/variance and under/overfitting, regularization. Exercises on NNs, solving a problem with NNs on TensorFlow.
4	Lab 3- Convolutional Neural Networks: [8P] Convolutional networks. Exercises on CNNs, solving a problem with CNNs on TensorFlow.
5	Lab 3- Recurrent Neural Networks.: [8P] Recurrent networks. Exercises on RNNs, solving a problem with RNNs on TensorFlow.
Textbook: 1. Bishop, Pattern Recognition and Machine Learning. Chapters 1, 3, 5. **2.** Goodfellow et al., Deep Learning. Chapters 5, 6, 7, 9, 10	

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	3	-	-	-	3	-	-	-	3	3	3	2
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	3	3
CO5	3	2	3	2	3	-	-	-	3	2	3	3	3	2	2

SYLLABUS	
Semester – 7th	
Course Code	**AM792A**
Course Name	**Computer Vision Lab**
Practical (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Pre-requisites: Digital Image Processing

Course Objectives:

The objective of the course is to make the students able to -

Course Outcomes:

After completion of the course students will be able to

CO1	Implement the basic concepts of Computer Vision to Explain or Illustrate and Identify problems where students can Apply the concept appropriately to Solve them.
CO2	Implement the fundamental concepts of Image Analysis and Image Feature Descriptors, and Etraction Techniques and Analyze their performances.
CO3	Implement the fundamental strategies of Image Registration to solve related problems and analyze their performances.
CO4	Implement the concepts of Shape Matching, Video Processing and Apply them to solve the relevant problems and analyze their performances.
CO5	Develop ideas to Propose solutions to the problems of Computer Vision and Identify problems where students can apply the concept appropriately and Analyze the effectiveness as well as limitations of solutions making the students aware of its utilitarian importance for further explorations leading towards lifelong.
MODULE NUMBER	**COURSE CONTENT**
1	Week - 1: Introduction to Computer Vision & Python-OpenCV
2	Week - 2: Image Analysis Basics Image Analysis Basics, Edge Detection and Hough Transform – Definition Edges, Edges in real image, Gradient, Steps in Edge Detection, Different Edge Detectors, Second Derivative Operators, Laplacian Operator, Laplacian of Gaussian, Canny Edge Detector, Hough Transform, Hough space, Finding Circles by Hough Transform, Generalized Hough Transform.
3	Week - 3: Image Feature Descriptors Image Feature Descriptors and Extraction Techniques – Image Object Shape Descriptors, HOG, Harris Corner Detector, Scale Invariant Feature Transform (SIFT), SIFT-PCA, Speeded Up Robust Features (SURF), Texture

4	Week - 4: Shape Matching
5	Week - 5: Video Processing Basics
6	Week -6: Advanced Computer Vision Applications Image Object Detection and Recognition: Face Detection and Recognition
7	Week -7: Advanced Computer Vision Applications Image Object Segmentation
8	Week -8: Advanced Computer Vision Applications Image Retrieval
9	WEEK -9: Discussion on Project Problems and Allocation (Problem Description Report Submission)
10	WEEK -10: Designing Solution Model and Proposal Report Submission
11	WEEK -11: Project Implementation, Verification and Documentation
12	WEEK -12: Project Demonstration and Project Report Review

Textbook:

1) David A. Forsyth and Jean Ponce, Computer Vision: A Modern Approach, Pearson Education, 2003
2) Anil K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, 1989 - Technology & Engineering 3) Simon J.D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.

Reference Book:

1. OpenCV with Python By Example, Prateek Joshi, O'Reilly Reference(s): 1 Insight into Images: Principles and Practice for Segmentation, Registration, and Image Analysis, By: T. S. Yoo, 2004 (Hardcopy).
2. Biomedical Images Analysis, by: R. M. Rangayya, 2004, eBook.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	3	-	-	-	3	-	-	-	3	3	3	2
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	3	3
CO5	3	2	3	2	3	-	-	-	3	2	3	3	3	2	2

SYLLABUS	
Semester – 7th	
Course Code	**AM792B**
Course Name	**Parallel Computing Lab**
Practical (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Pre-requisites: The student has the basic knowledge of Computer Organization Architecture, Distributed System and Operating System and its related programming concepts.

Course Objectives:

The objective of the course is to make the students able to –

1. Analyze a given problem for possibilities of parallel computations.
2. Select algorithms and hardware for the solution of high-performance applications.
3. Select program computers with shared and distributed memory architectures.
4. Understand the Introduction of GPU- and concepts of related applications.

Course Outcomes:

After completion of the course students will be able to

CO1	Analyze a given problem for possibilities of parallel computations.
CO2	Select algorithms and hardware for the solution of high-performance applications.
CO3	Select program computers with shared and distributed memory architectures.
CO4	Understand the Introduction of GPU- and Concept of related Applications.
CO5	Develop ideas to for executing parallel programs on different hardware architectures and software environments and Identify problems where students can Apply and Implement the concept appropriately with adequate documentation in collaborative environment for successfully carrying out projects on machine learning problems and investigate their effectiveness by analyzing the performances using proper techniques and tools and Assess the limitations of solutions underscoring utilitarian importance for further explorations leading towards lifelong learning.
MODULE NUMBER	**COURSE CONTENT**
1	Basics of MPI (Message Passing Interface)
2	To learn Communication between MPI processes • To get familiarized with advance communication between MPI processes • Study of MPI collective operations using 'Synchronization'
3	Study of MPI collective operations using 'Data Movement' • Study of MPI collective operations using 'Collective Computation'
4	To understand MPI Non-Blocking operation • Basics of OpenMP API (Open Multi-

	Processor API)
5	To get familiarized with OpenMP Directives
6	Sharing of work among threads using Loop Construct in OpenMP •
7	Clauses in Loop Construct • Sharing of work among threads in an OpenMP program using 'Sections Construct' • Sharing of work among threads in an OpenMP program using 'Single Construct'
8	Use of Environment Variables in OpenMP API
9	Parallel Computing with NVIDIA CUDA
10	Parallel Computing with NVIDIA CUDA
11	Mini Project
12	Mini Project

Textbook:

Reference Book:

1. LECTURES: NOTES from COS 598A: Parallel Architecture and Programming Spring 2007, Princeton University Princeton notes.
2. LECTURE NOTES from CS258, Berkeley: Parallel Processors BERKELEY Notes.

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO1**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	3	-	-	-	3	-	-	-	3	3	3	2
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	3	3
CO5	3	2	3	2	3	-	-	-	3	2	3	3	3	2	2

SYLLABUS	
Semester – 7th	
Course Code	**AM792C**
Course Name	**Web Technology Lab**
Practical (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Course Objective(s):

1. To impart the design, development, and implementation of Static and Dynamic Web Pages.
2. To develop programs for Web using Scripting Languages and .net framework.
3. To give an overview of Server-Side Programming in Web.

Course Outcomes:

After completion of the course students will be able to:

CO1	**Understand** networks, IP, DNS, routing, and other related technologies used in internet and e**xecute** and **solve** problems related to them leading to engineering problems solutions.
CO2	**Understand** different web-based technologies like HTML, DHTML, CSS, XML and **demonstrate** their use in design of web-based solutions leading to engineering problems.
CO3	**Comprehend** and **analyze** different client and server-side technologies like JavaScript, Servlet, CGI, and **design** appropriate engineering solutions leading to lifelong learning.
CO4	**Understand** and **implement** different types of technologies like JSP, JavaBean, JDBC and ODBC and **evaluate** their performances.
CO5	**Understand** different web-based applications and network security techniques and **apply** them to protect the network against different attacks and **solve** related problems preferably as a team.
MODULE NUMBER	**COURSE CONTENT**
1	**[6L]** Introduction (1L): Overview, Network of Networks, Intranet, Extranet, and Internet. World Wide Web (1L): Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. Review of TCP/IP (1L): Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6.IP Subnetting and addressing (1L): Classful and Classless Addressing, Subnetting. NAT, IP masquerading, IP tables.Internet Routing Protocol (1L): Routing -Intra and Inter

	Domain Routing, Unicast and Multicast Routing, Broadcast.Electronic Mail (1L): POP3, SMTP, Clients - Servers Communication.
2	**[9L]** HTML, DHTML &CSS: Introduction, Elements, Attributes, Heading, Paragraph. Formatting[1L]; Link, Table, List, Block, Layout, Html Forms, and input [1L]; Iframe, Colors[1L], Image Maps andattributes of image area [1L];Introduction to CSS, basic syntax and structure of CSS, different typesinternal, external and inline CSS [1L];Basic Introduction of DHTML, Difference between HTMLand DHTML, Documentary Object Model (DOM) [1L].Extended Markup Language (XML) : Introduction, Difference between HTML & XML,XML-Tree [1L]; Syntax, Elements, Attributes, Validation and parsing, DTD [2L].
3	**[15L]** Java Scripts: Basic Introduction, Statements, comments, variable, operators, data types[1L];condition, switch, loop, break [1L]; Java script functions, objects, and events[1L].CGI Scripts: Introduction, Environment Variable, GET and POST Methods[1L].Java Servlet: Servlet environment and role, Servlet life cycle [1L]; Servlet methods- Request, Response, Get and post [1L]; Cookies and Session [1L]. Java Server Page (JSP): JSP Architecture [1L]; JSP Servers, JSP Life Cycle [1L]; Understanding the layout of JSP, JSP-Scriptlet Tag [1L]; JSP implicit object (request and response) [1L]; Variable declaration, methods in JSP [1L]; JSP directive (Tag-lib and Include), JavaBean-inserting JavaBean in JSP [1L]; JSP-Action tags (Forward & Include) [1L]; Creating ODBC data source name, Introduction to JDBC, prepared statement and callable statement [1L].
4	**[6L]** Threats[1L]: Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks. Network security techniques: Password and Authentication; VPN, IP Security[1L], security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH)[1L]. Firewall (1L): Introduction, Packet filtering, Stateful, Application layer, Proxy. Search Engine and Web Crawler: Definition, Meta data, Web Crawler [1L], Indexing, Page rank, overview of SEO[1L].

Textbooks:

1. “Web Technology: A Developer's Perspective”, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013. (Topics covered: html, CSS, imagemap, xml).
2. “Learning PHP, MySQL & JavaScript”, Robin Nixon, O’Reilly Publication. (Topics covered: Java Script).
3. “Head First Servlet’s & JSP”, Bryan Basham, Kathy Sterra, Bert Bates, O’Reilly Publication. (Topics covered: Servlet, JSP).
4.Cryptography and Network Security by William Stallings Publisher: Pearson Education India (Topics covered: Threats, Security techniques, Firewall).

Recommended books:

1. "Programming the World Wide Web", Robert. W. Sebesta, Fourth Edition, Pearson Education, 2007.
2. “Core Web Programming”- Second Edition-Volume I and II, Marty Hall and Larry Brown, Pearson Education, 2001

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	-	-	-	2	3	3
CO2	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	2	-	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	3	2	-	-	-	3	-	2	-	3	3	3

4th Year 8th Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	AM801A	Big Data Analytics	3	1	0	4	4
			AM801B	Block Chain and Crypto Currency Technologies					
			AM801C	Cyber Security					
2	ENGG	Major	AM802A	VLSI Design and Application	3	1	0	4	4
			AM802B	Bioinformatics					
			AM802C	Robotics					
3	ENGG	Minor	CS(AM)803A	Wireless Sensor Network and IoT	3	0	0	3	3
			CS(AM)803B	Information Theory and Coding					
			M(AM)803C	Optimization Techniques					
B. PRACTICAL									
1	ENGG	Minor	CS(AM)893A	Wireless Sensor Network and IoT Lab	0	0	3	3	1.5
			CS(AM)893B	Information Theory and Coding Lab					
			M(AM)893C	Optimization Techniques Lab					
2	ENGG	PRJ	PR(AM)881	Major Project-II	0	0	12	12	06
3			AM882	Grand Viva	0	0	0	0	1.5
Total of Theory and Practical								26	20

SYLLABUS	
Semester – 8th	
Course Code	**AM801A**
Course Name	**Big Data Analytics**
Lecture (per week)	**3**
Tutorial (per week)	**1**
Contact Hours (per week)	**4**
Total Contact Hours	**48**
Credit	**4**

Prerequisites:
Data Structure, Design and Analysis of Algorithms, Database Management Systems, Statistics, Artificial Intelligence, Programming skills of Python.

Course Objectives:

1. Comprehend the fundamental concepts of the Big Data Analytics exploring machine learning strategies such as Supervised and Unsupervised Learning etc. for analyzing various types of large scale structured as well as unstructured data distributed across multiple locations (Map Reduce, Hadoop and NoSQL Framework).
2. Formulate an engineering problem of analyzing large scale data distributed across multiple locations to make automated meaningful decisions.
3. Apply the concepts of Big Data Analytics to solve problems of making automated decisions dealing with large scale structured as well as unstructured data distributed across multiple locations.
4. Excogitate and Implement ideas to address the challenging issues of Big Data Analytics.
5. Analyze the effectiveness of various Big Data Analytics Frameworks.

Course Outcomes:

After completion of the course students will be able to

CO1	**Understand and explain** the fundamental concepts of the Big Data Analytics which are primarily explored for making automated decisions using machine learning strategies on analyzing large scale structured as well as unstructured data distributed across multiple locations (Map Reduce, Hadoop and NoSQL Framework) underscoring the utilitarian importance in current technological context for further exploration leading towards lifelong learning.
CO2	**Identify** and **formulate** an engineering problem of analyzing large scale data distributed across multiple locations to make automated meaningful decisions within the scope of Big Data Analytics Frameworks.
CO3	**Explore** relevant literature and **apply** the concepts of Big Data Analytics to **solve** problems of making automated decisions dealing with large scale structured as well as unstructured data using Map Reduce, Hadoop and advanced SQL Frameworks.
CO4	**Excogitate** ideas for **proposing** solutions to the challenging problems of Big Data Analytics.
CO5	**Implement** ideas of Big Data Analytics through **developing** feasible algorithms or frameworks and **investigate** their effectiveness in solving the relevant problems by **analyzing** the performances using proper techniques.

MODULE NUMBER	COURSE CONTENT
1.	**Introduction to Basic Analytics [10L]** Introduction: Big data overview, Analyst's perspective on data repositories, Current analytical architecture, Drivers of big data, Examples of big data analytics. Life Cycle of Data Analytics: Phase 1: Discovery, Phase 2: Data preparation, Phase 3: Model planning, Phase 4: Model building, Phase 5: Communication of results, Phase 6: Making operational. Basic Analytic Methods: Visualization, Dirty data, Data exploration versus presentation, Statistical methods for evaluation – hypothesis testing, difference of means, rank sum test, type I and type II errors, ANOVA.
2.	**Advanced Analytic Methods I [14L]** Clustering: Overview, K-means, Determining the number of clusters, Diagnostics. Association Rules: Overview, Apriori algorithm, Evaluation of candidate rules, Application of association rules, Validation and testing, Diagnostics. Regression: Linear regression - model description, Logistic regression – model description, Other regression models. Classification: Decision trees – overview, General algorithm, Decision tree algorithms, Evaluating a decision tree, Naïve Bayes – Bayes theorem, Naïve Bayes classifier, Diagnostics of classifiers.
3.	**Advanced Analytic Methods II [14L]** Time Series Analysis: Overview, Box-Jenkins methodology, Autocorrelation function (ACF), Autoregressive model, Moving average model, ARMA and ARIMA model, Building and evaluating an ARIMA model. Text Analysis: Steps in text analysis, Collecting raw text, Representing text, Term Frequency-Inverse Document Frequency (TFIDF), Categorizing documents by types, Determining sentiments. Map Reduce and Hadoop: Analytics for unstructured data – map reduce, Apache Hadoop, Hadoop Ecosystem – Pig, Hive, Hbase, Mahout.
4.	**Advanced Analytic Methods III [10L]** Technology and Tools: SQL essentials - Join, Set, Grouping extensions, Advanced SQL – Window functions, User-defined functions, Ordered aggregates, MADlib, NoSQL. Integration of Techniques: Communicating and operationalizing an analytic project. Creating final deliverables – Developing core materials, project goals, Main findings, Approach, Model description and model details, Recommendations, Providing technical specifications and code. Data visualization basics - Key points, evolution of a graph, common representation methods, how to clean up a graphic.

Textbook:

1. EMC Education Services (Editor), Data Science and Big Data Analytics. John Wiley & Sons, 2015.
2. Mike Barlow, Real-Time Big Data Analytics: Emerging Architecture. O'Reilly, 2013.

Reference Books:

1. Nathan Marz and James Warren, Big Data: Principles and Best Practices for Scalable Real-time Data Systems. Manning Publications, 2015.
2. Venkat Ankam, Big Data Analytics. Packt Publishing Ltd., UK, 2016.

CO–PO Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	2	2	-	2
CO5	2	2	3	3	2	2	2	-	-	-	-	2	2	2	3

SYLLABUS	
Semester – 8th	
Course Code	**AM801B**
Course Name	**Block Chain and Crypto Currency Technologies**
Lecture (per week)	**3**
Tutorial (per week)	**1**
Contact Hours (per week)	**4**
Total Contact Hours	**48**
Credit	**4**

Course Objective:

1. The students should be able to understand a broad overview of the essential concepts of blockchain technology.
2. To familiarize students with Bitcoin protocol followed by the Ethereum protocol – to lay the foundation necessary for developing applications and programming.
3. Students should be able to learn about different types of blockchain and consensus algorithms.

Course Outcome(s):

After completion of the course students will be able to

CO1	Understand blockchain terminologies and its properties and the emerging models for blockchain technology
CO2	Familiarize with the functional/operational aspects of crypto currency ecosystem
CO3	Design, code, deploy and execute a smart contract – the computational element of the blockchain technology using Solidity and Remix IDE
CO4	Build private - permissioned blockchain -based applications for enterprises and businesses
CO5	Explore the blockchain decentralization and cryptography concepts.

MODULE NUMBER	COURSE CONTENT
1.	**[6L]** **Basics:** The Double-Spend Problem, Byzantine Generals' Computing Problems, Public-Key Cryptography, Hashing, Distributed Systems, Distributed Consensus.
2.	**[10 L]** **Technology Stack:** Blockchain, Protocol, Currency. **Bitcoin Blockchain:** Structure, Operations, Features, Consensus Model, Incentive Model.
3.	**[10 L]** **Ethereum Blockchain:** Smart Contracts, Ethereum Structure, Operations, Consensus Model, Incentive Model.
4.	**[6 L]** **Tiers of Blockchain Technology**: Blockchain 1.0, Blockchain 2.0, Blockchain 3.0,

	Types of Blockchain: Public Blockchain, Private Blockchain, Semi-Private Block chain, Side chains.
5.	**[10 L]** **Types of Consensus Algorithms:** Proof of Stake, Proof of Work, Delegated Proof of Stake, Proof Elapsed Time, Deposite-Based Consensus, Proof of Importance, Federated Consensus or Federated Byzantine Consensus, Practical Byzantine Fault Tolerance. Blockchain Use Case: Supply Chain Management.

Textbooks/References:

1. Kiran Kalyan Kulkarni, Essentials of Bitcoin and Blockchain, Packt Publishing.
2. Anshul Kaushik, Block Chain & Crypto Currencies, Khanna Publishing House.
3. Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.
4. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Imran Bashir, Packt Publishing (2017).
5. Blockchain: Blueprint for a New Economy by Melanie Swan, Shroff Publisher O'Reilly Publisher Media; 1st edition (2015).
6. Mastering Bitcoin: Programming the Open Blockchain by Andreas Antonopoulos.

Corresponding Online Resources:

1. https://www.coursera.org/specializations/blockchain.
2. https://nptel.ac.in/courses/106105184/
3. Introduction to Blockchain Technology and Applications, https://swayam.gov.in/nd1_noc20_cs01/preview

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	-	-	-	-	-	-	-	3	3	2
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	2
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	3	2
CO4	2	2	2	3	-	-	-	-	-	-	-	-	2	3	2
CO5	2	2	3	3	-	-	-	-	-	-	-	2	2	2	3

SYLLABUS	
Semester – 8th	
Course Code	**AM801C**
Course Name	**Cyber Security**
Lecture (per week)	**3**
Tutorial (per week)	**1**
Contact Hours (per week)	**4**
Total Contact Hours	**48**
Credit	**4**

Prerequisite:
The student has the basic knowledge of Computer Network and Network Security.

Course Objective:

1. Understand the vulnerabilities in computer and network security.
2. Use the tools for vulnerability assessment and defense of the network.
3. Identify the software bugs that pose cyber security threats.
4. Articulate cyber-crime and cyber law.
5. Explain the investigation process of the cyber-crime and computer forensics.

Course Outcome(s):

After completion of the course students will be able to

CO1	Understand the vulnerabilities in the computer and network security.
CO2	Use the tools for vulnerability assessment and defense of the network.
CO3	Identify the software bugs that pose cyber security threats.
CO4	Articulate the cyber-crime and cyber law.
CO5	Explain the investigation process of the cyber-crime and computer forensics.

MODULE NUMBER	COURSE CONTENT
1.	**[8 L]** Systems Vulnerability Scanning Overview of vulnerability scanning, Open Port / Service Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning - Netcat, Socket, understanding Port and Services tools – Data pipe, Fpipe, WinRelay, Network Reconnaissance – Nmap, THC-A map and System tools. Network Sniffers and Injection tools – TCP dump and Win dump, Wireshark, Ettercap, Hping Kismet
2.	**[10 L]** Network Défense tools Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall. Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Introduction Detection System
3.	**[10 L]**

	Web Application Tools Scanning for web vulnerabilities tools: Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sqlmap. DVWA, Webgoat, Password Cracking and Brute-Force Tools – John the Ripper, L0htcrack, Pwdump, HTC-Hydra Machine Learning Techniques for Cyber Security.
4.	**[10 L]** Introduction to Cyber Crime and law Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world, A Brief History of the Internet, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000.
5.	**[10 L]** Introduction to Cyber Crime Investigation Firewalls and Packet Filters, password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks.
Text Books: 1. Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw Hill. 2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and Sunit Belpure, Publication Wiley	

CO–PO Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3							-	-	-	-		3		
CO2		2		3	1			-	-	-	-			2	3
CO3		3	2					-	-	-	-				
CO4	3						3	-	-	-	-				
CO5		2	3					-	-	-	-			2	

SYLLABUS	
Semester – 8th	
Course Code	**AM802A**
Course Name	**VLSI Design and Applications**
Lecture (per week)	**3**
Tutorial (per week)	**1**
Contact Hours (per week)	**4**
Total Contact Hours	**48**
Credit	**4**

Pre-requisite:
Concept of courses Solid State Devices; Analog Electronic Circuit; Digital Electronic and Circuit

Course Objective(s):
Objective of the course is:

1. To understand the basic concepts of designing combinational and sequential circuits and the design of VLSI ICs
2. To motivate students to design VLSI circuits in the area of digital and analog.
3. To encourage the design of IC with low power and high speed.
4. To study various programmable logic devices like PLDs and FPGA.

Course Outcome(s):

After completion of the course students will be able to

CO1	Understand basic CMOS circuits and properties of CMOS transistors and able to draw stick diagram and layout of CMOS circuits.
CO2	Apply CMOS realization for combinational logic design and analyze the delay models for combinational circuits and understand power dissipation and low power design principles in CMOS circuits.
CO3	Describe fabrication steps of IC and construct stick diagram & layout of CMOS inverter and basic gates based on Layout design rules
CO4	Understand different architectures for address and analyze the speed and area trade off and also understand accumulators, multipliers, dividers and barrel shifters.
CO5	Understandthe techniques of chip design using programmable devices like VHDL or Verilog Combinational & Sequential Logic circuit Design
MODULE NUMBER	**COURSE CONTENT**
1.	**Introduction to VLSI Design [9L]** Historical perspective development of VLSI from discrete electronic circuit to VLSI.IC, MSI, LSI, Microelectronics & VLSI Types of VLSI Chips (General purpose, ASIC, PLA, FPGA),photo-resist Basic CMOS Technology – (Steps in fabricating CMOS), Basic n-well CMOS procVLSI Design Concepts, Moor's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI – basic idea only), Types of VLSI Chips (Analog & Digital VLSI chips, General

	purpose, ASIC, PLA, FPGA), Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioural, Structural, Physical), Y-Chart, Digital VLSI Design Steps.
2.	**MOS structure [2L]** E-MOS & D-MOS, Charge inversion in E-MOS, Threshold voltage, Flat band voltage, Potential balance & Charge balance, Inversion, MOS capacitances. Three Terminal MOS Structure: Body effect. Four Terminal MOS Transistor: Drain current, I-V characteristics. Current-voltage equations (simple derivation). Scaleing in MOSFET, General scaling, Constant Voltage & Field scaling.] CMOS: CMOS inverter, Simple Combinational Gates - NAND gate and NOR Gate using CMOS.
3.	**Micro-electronic Processes for VLSI Fabrication [10L]** Silicon Semiconductor Technology- An Overview, Wafer processing, Oxidation, Epitaxial deposition, Ion-implantation & Diffusion, Cleaning, Etching, Photo-lithography – Positive & Negative-ness, p-well CMOS process, Twin tub process, Silicon on insulator Layout Design Rule: Stick diagram with examples, Layout rules.
4.	**Hardware Description Language [6L]** VHDL or Verilog Combinational & Sequential Logic circuit Design.
Text Books: 1. Digital Integrated Circuit, J.M. Rabaey, Chandrakasan, Nicolic, Pearson Education 2. CMOS Digital Integrated Circuits Analysis and Design, S.M. Kang & Y. Leblebici, TMH.	
Reference Books: 1. Microelectronic Circuits, Sedra & Smith, Oxford 2. Introduction to VLSI Circuits and System, Uyemura, Wiley	

CO-PO Mapping:

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

SYLLABUS	
Semester – 8th	
Course Code	**AM802B**
Course Name	**Bioinformatics**
Lecture (per week)	**3**
Tutorial (per week)	**1**
Contact Hours (per week)	**4**
Total Contact Hours	**48**
Credit	**4**

Course Objective(s):

The objective of the course is to make the student able to:

1. Familiar with the basic concept of the Bioinformatics and Molecular Biology and also familiar with a variety of currently available genomic and proteomic databases.
2. Search and retrieve information from genomic and proteomic databases (e.g., GenBank, Swiss-Prot), and to analyze their search results using software available on the internet (e.g. BLAST, ClustalW).
3. Familiar with the principles and applications of microarrays and locate consensus sequences, genes and open reading frames within biological sequences.
4. Learn how to compare and analyze biological sequences and how to interpret the results of their analyses and how to construct phylogenetic trees based on biological sequence data.
5. Perform elementary predictions of protein structure and function and use the scientific method of inquiry, through the acquisition of scientific knowledge.

Course Outcomes:

After completion of the course students will be able to

CO1	Acquire the knowledge of Bioinformatics technologies with the related concept of DNA, RNA and their implications
CO2	Develop idea in Molecular Biology
CO3	Understand the concept and techniques of different types of Data Organization and Sequence Databases with different types of Analysis Tools for Sequence Data Banks
CO4	Acquire the knowledge of the DNA Sequence Analysis
CO5	Analyze the performance of different types of Probabilistic models used in Computational Biology
MODULE NUMBER	**COURSE CONTENT**
1	**Introduction to Molecular Biology[7L]** Concepts of Cell, tissue, types of cells, components of cell, organelle, Functions of different organelles. Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept. Concepts of RNA: Basic structure, Difference between RNA and DNA. Types of

	RNA Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Translation, Introduction to Metabolic Pathways. Introduction to Bioinformatics, Recent challenges in Bioinformatics.
2	**Introduction to Genomic and MSDN [10L]** Introduction to Genomic data, Data Organization and Sequence Databases: Sequence Data Banks - Introduction to sequence data banks - protein sequence data bank. Signal peptide data bank, Nucleic acid sequence data bank - GenBank, AIDS virus sequence data bank. RRNA data bank, structural data banks - protein Data Bank (PDB), The Cambridge Structural Database (CSD): Genome data bank - Metabolic pathway data: Microbial and Cellular Data Banks. Introduction to MSDN (Microbial Strain Data Network): Numerical Coding Systems of Microbes, Hibridoma Data Bank Structure, Virus Information System Cell line information system; Protein Sequence Databases, DNA sequence databases, sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank; OMIM, Taxonomy browser, PubMed.
3	**DNA Sequence Analysis[8L]** DNA Mapping and Assembly: Size of Human DNA, Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing Secondary Structure predictions; Prediction algorithms; Chao-Fasman algorithm, Hidden-Markov model, Neural Networking Tertiary Structure predictions; Prediction algorithms; Chao-Fasman algorithm, Hidden-Markov model, Neural Networking
4	**Introduction Probabilistic models used in Computational Biology [10L]** Probabilistic Models; Gene Regulatory Method Application of HMM in Bioinformatics: Gene finding, profile searches, multiple sequence alignment and regulatory site identification. Applications in Biotechnology: Protein classifications, Fold libraries, Protein structure prediction: Fold recognition (threading), Protein structure predictions: Comparative modeling (Homology), Advanced topics: Protein folding, Protein-ligand interactions, Molecular Modeling& Dynamics, Drug Designing.

Textbook:

1. Yi-Ping Phoebe Chen (Ed), “Bioinformatics Technologies”, First Indian Reprint, Springer Verlag, 2007.

References Book:

1. Bryan Bergeron, “Bio Informatics Computing”, Second Edition, Pearson Education, 2003.
2. Arthur M Lesk, “Introduction to Bioinformatics”, Second Edition, Oxford University Press, 2005

CO-PO Mapping

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

SYLLABUS	
Semester – 8th	
Course Code	**AM802C**
Course Name	**Robotics**
Lecture (per week)	**3**
Tutorial (per week)	**1**
Contact Hours (per week)	**4**
Total Contact Hours	**48**
Credit	**4**

Pre-requisite:

1. Microprocessor & Microcontroller
2. Computer Organization & Architecture

Course Objective(s):

1. To study microcontroller operations for robotics.
2. To study how different interfaces are implemented in a microcontroller.
3. To learn how Microchip PIC micro PIC16F627 can be erased and reprogrammed.
4. To learn how different sensors, outputs, and peripherals can be wired to a microcontroller to work cooperatively and create a high-level control program.
5. To design robots in a real time environment.

Course Outcome(s):

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

CO1	**Understand** the basic concepts of robotics exploring the characteristics of its various components, motion control, actuator and drive system and the functions of various sensors in robotics, and robot programming.
CO2	**Apply** the concepts of robotics for machine loading and their kinematics and **analyze** the kinematics of serial and parallel robots, motion control systems.
CO3	**Illustrate** concepts of Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators.
CO4	**Understand** classical control concepts and **use** advanced topics in non-linear control of manipulators.
CO5	**Develop** algorithmic solutions and corresponding robot-programs for designing various robotic systems.
MODULE NUMBER	**COURSE CONTENT**
1	**[5L]** Brief history, types, classification and usage, Science and Technology of robots, Some useful websites, textbooks and research journals. Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D-H parameters, Examples of D-H parameters and link transforms, different kinds of actuators – stepper, DC servo and brushless motors, model of a DC servo motor, Types of transmissions, Purpose of

	sensors, internal and external sensors, common sensors – encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors, and vision.
2	**[8L]** Introduction, Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Tractrix based approach for fixed and free robots and multi-body systems, simulations and experiments, Solution procedures using theory of elimination, Inverse kinematics solution for the general 6R serial manipulator. Degrees-of-freedom of parallel mechanisms and manipulators, Active and passive joints, Constraint and loop-closure equations, Direct kinematics problem, Mobility of parallel manipulators, Closed-from and numerical solution, Inverse kinematics of parallel manipulators and mechanisms, Direct kinematics of Gough-Stewart platform.
3	**[8L]** Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Loss, and gain of degree of freedom, Statics of serial and parallel manipulators, Statics and force transformation matrix of a Gough-Stewart platform, Singularity analysis and statics. Mass and inertia of links, Lagrange formulation for equations of motion for serial and parallel manipulators
4	**[9L]** Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model-based control schemes, Simulation and experimental case studies on serial and parallel manipulators, Control of constrained manipulators, Cartesian control, Force control and hybrid position/force control, Advanced topics in non-linear control of manipulators.
5	**[5L]** Introduction and some well-known wheeled mobile robots (WMR), two and three-wheeled WMR on flat surfaces, Slip and its modeling, WMR on uneven terrain, Design of slip-free motion on uneven terrain, Kinematics, dynamics and static stability of a three-wheeled WMR‘s on uneven terrain, Simulations using Matlab and ADAMS. Introduction to chaos, Non-linear dynamics and chaos in robot equations, Simulations of planar 2 DOF manipulators, Analytical criterion for unforced motion. Gough-Stewart platform and its singularities, use of near singularity for fine motion for sensing, design of Gough-Stewart platform-based sensors. Over-constrained mechanisms and deployable structures, Algorithm to obtain redundant links and joints, Kinematics and statics of deployable structures with pantographs or scissor-like elements (SLE‘s).

Textbooks:

Myke Predko, Programming Robot Controllers‖ – McGraw Hill, 1st edition, 2003.

Reference books:

1. Michael slater, ―Microprocessor – based design: A comprehensive Guide to Effective Hardware Design, Prentice Hall, 1989.
2. Myke Predko, Programming and customizing the 8051- micro-controller‖, Tata McGraw-Hill, New Delhi, 2000.

CO-PO Mapping

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

SYLLABUS	
Semester – 8th	
Course Code	**CS(AM)803A**
Course Name	**Wireless Sensor Network and IoT**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Pre-requisite:

1. Basic concept of computer network and communication engineering.
2. Basic knowledge of Microcontroller fundamentals

Course Objective(s):

The objective of the course is to make the students able to –

1. understand and illustrate the principles of sensor networks and IOT and their impact on protocol design.
2. Design the networks for various application setups.
3. Develop appropriate data dissemination protocols and model links cost.
4. Evaluate the performance of the networks and identify bottlenecks

Course Outcome(s):

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

CO1	Understand and explain the Fundamental Concepts and applications of wireless sensor networks and Internet of Things.
CO2	Describe and analyze the basic protocols in wireless sensor network and IOT.
CO3	Design and develop the M2M communication protocols.
CO4	Explain the concepts of network architecture for WSN and IOT.
CO5	Develop IOT applications in different domain on embedded platforms and able to analyze their performance.
MODULE NUMBER	**COURSE CONTENT**
1	**Wireless Sensor Networks (WSNs) and MAC Protocols [7L]** Single node architecture: hardware and software components of a sensor node -WSN Network architecture: typical network architectures -data relaying and aggregation strategies -MAC layer protocols: self-organizing- Hybrid TDMA/FDMA and CSMA based MAC -IEEE 802.15.4. Schedule based protocols (LEACH, SMACS, TRAMA) Address and Name Management in WSNs, Assignment of MAC Addresses.
2	**WSN Routing, Localization & QOS [12L]** Issues in WSN routing –OLSR - Localization –Indoor and Sensor Network Localization - absolute and relative localization - triangulation - QOS in WSN - Energy Efficient Design – Synchronization. Routing Protocols- Energy-Efficient Routing, Geographic Routing, Hierarchical networks by clustering. Sensor deployment & Node discovery, data aggregation & dissemination.

3	**Fundamentals on IoT [6L]** Definition of IoT and Characteristics of IoT, Physical and logical design of IoT, Functional blocks of IoT, Communication models &APIs: Internet connectivity, Internet-based communication, IPv4, IPv6,6LoWPAN protocol, IP Addressing in the IoT, Application layer protocols: HTTP, HTTPS, FTP,TELNET and ports.
4	**Message to Message Communication and IoT [5L]** M2M communication and 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.
5	**IoT Prototyping and Security [6L]** Introduction to Prototyping Embedded device software [1L] Programming Embedded Device Arduino Platform using IDE [1L] Reading data from sensors and devices, Devices, Gateways [2L] Internet and Web/Cloud services software development [1L] Introduction to IoT privacy and security [2L] Vulnerabilities, security requirements and threat analysis.

Textbooks:

1. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", Wiley.
2. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”, Orient Black Swan.

Reference books:

1. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication.
2. Holger Karl and Andreas Willig “Protocols and Architectures for Wireless Sensor Networks”, Wiley, 2005.
3. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, Rowan Trollope, “IoT Fundamentals : Networking Technologies, Protocols and Use Cases for the Internet of Things”, Pearson.
4. C. Siva Ram Murthy, B. S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols”, Prentice Hall.
5. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks Technology, Protocols, and Applications”, John Wiley, 2007.
6. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.

CO-PO Mapping

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

SYLLABUS	
Semester – 8th	
Course Code	**CS(AM)803B**
Course Name	**Information Theory and Coding**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Pre-requisite:
Probability & Statistics

Course Objective(s):
The objective of the course is to make the students able to –
1. Understand the basic concept of information and apply this knowledge in designing solution.
2. Understand the basic concept of coding theory and use this knowledge for designing and implementing problem.
3. Understand the concept of channel models to determine the mutual information in the channels.
4. Outline the concept of error detection techniques and design a model for building a new solution.
5. Understand how convolutional theory works and develop a new approach.

Course Outcome(s):
After the successful completion of this course, the student will be able to:

CO1	Understand the basic concept of information and apply this knowledge in designing solution for real life engineering problem.
CO2	Understand the basic concept of coding theory and use this knowledge for designing and implementing mathematical and engineering problem leading to lifelong learning.
CO3	Understand the concept of channel models to determine the mutual information in the channels.
CO4	Outline the concept of error detection techniques and design a model for building a new solution as a professional engineering practice as a team.
CO5	Understand how convolutional theory works and develop an approach to solve it by means of existing and new methods as a teamwork.
MODULE NUMBER	**COURSE CONTENT**
1	**Information Theory [4L]** Introduction, Measure of Information, Average Information Content (Entropy) of a Zero Memory Source, Extension of Zero Memory Source, Entropy of a Source with Memory.
2	**Source Coding [9L]** Introduction, Types of Codes, Prefix Codes, Source Coding Theorem, Shannon's Encoding Theorem, Huffman Coding, Arithmetic Coding, Lempel-Ziv Algorithm, Run Length Encoding, An Overview on Speech and Image Compression.
3	**Information Channels [4L]** Introduction, Channel Models, System Entropies, Mutual Information (Trans

	information), Channel Capacity,Capacity of Channels, Continuous Channels.
4	**Error Control Coding [8L]** Introduction, need for Error Control Coding, Types of Codes, Coding Gain, Linear Block Codes, Hamming Codes, Probability of an Undetected Error Pattern for an LBC over a BSC, Equivalent Codes, Cyclic Codes, Golay Codes, Shortened Cyclic Codes.
5	**Burst Error Correcting Codes [6L]** Introduction, Burst Errors, Interleaved Codes, Product Codes, Fire Codes, BCH Codes, Non-Binary BCH Codes and Reed-Solomon Codes.
6	**Convolution Codes[5L]** Introduction, Convolution Encoder, Representation of Convolution Code, Transfer Function of a Convolution Code, Distance Properties of Convolution Codes, Decoding of Convolution Codes, Stack Algorithm, Known Good Convolution Codes.
Textbooks: 1. Information theory, coding and cryptography - Ranjan Bose; TMH. 2. Information and Coding - N Abramson; McGraw Hill.	
Reference books: 1.Introduction to Information Theory - M Mansurpur; McGraw Hill. 2. Information Theory - R B Ash; Prentice Hall. 3. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.	

CO-PO Mapping

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

SYLLABUS	
Semester – 8th	
Course Code	**M(AM)803C**
Course Name	**Optimization Techniques**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Pre-requisite:

2. Linear algebra
3. Probability

Course Objective(s):

1. To build an understanding on the basics of optimization techniques.
2. To introduce basics of linear programming and meta- heuristic search techniques)
3. To select appropriate objective function for the given problem.

Course Outcome(s):

After completion of the course students will be able to

CO1	Understand Decision making procedure and its applications - **Explain or illustrate** and **identify** queuing model and simulation in real life scenario.
CO2	Understand the essential features and scope of optimization techniques - Learn and **analyze** the properties of objective function and formalization of optimization problem.
CO3	Learn numerical methods to find optimum point and value of a function - Learn to solve the LPP.
CO4	**Explain or illustrate** transportation problems and assignment problems. - Apply in real life situations.
CO5	Learn applications of network models and analyses the model – Learn to use Tabu Search methods in various fields.
MODULE NUMBER	**COURSE CONTENT**
1.	**[7L]** Decision -making procedure under certainty and under uncertainty – Operation Research – Probability and decision – making – Queuing or Waiting line theory – Simulation and Monté – Carlo Technique – Nature and organization of optimization

	problems – Scope and hierarchy of optimization – Typical applications of optimization.
2.	**[6L]** Essential features of optimization problems – Objective function – Formulation of optimization problems – Continuous functions – Discrete functions – Unimodal functions –Convex and concave functions, Investment costs and operating costs in objective function –Optimizing profitably constraints – Internal and external constraints.
3.	**[6L]** Necessary and sufficient conditions for optimum of unconstrained functions – Numerical methods for unconstrained functions – One – dimensional search – Gradient – free search with fixed step size. Linear Programming – Basic concepts of linear programming –Graphical interpretation – Simplex method – Apparent difficulties in the Simplex method.
4.	**[6L]** Transportation Problem, Loops in transportation table, Methods of finding initial basic feasible solution, Tests for optimality. Assignment Problem, Mathematical form of assignment problem, methods of solution.
5.	**[6L]** Network analysis by linear programming and shortest route, maximal flow problem. Introduction to Non – traditional optimization, Computational Complexity – NP – Hard, NP – Complete. Tabu Search – Basic Tabu search, Neighbourhood, Candidate list, short term and Long term memory.
6.	**[5L]** Genetic Algorithms – Basic concepts, Encoding, Selection, Crossover, Mutation. Simulated Annealing – Acceptance probability, Cooling, Neighbourhoods, Cost function application of GA and Simulated Annealing in solving sequencing and scheduling problems and Travelling salesman problem.

Text Books:

1. Rao S.S., Optimization Theory and Applications, Wiley Eastern.
2. Hamdy A. Taha, Operations Research – An introduction, Prentice – Hall India.

Reference books:

1. Gass S. I., Introduction to Linear Programming, Tata McGraw Hill.
2. Reeves C., Modern heuristic techniques for combinatorial problems, Orient Longman.
3. Goldberg, Genetic algorithms in Search, optimization and Machine Learning, Addison Wesley.
4. K. Deb, Optimization for engineering design – algorithms and examples, Prentice Hall of India.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	-	2	-	2
CO5	2	2	3	3	-	-	-	-	-	-	-	2	2	2	3

SYLLABUS	
Semester – 8th	
Course Code	**CS(AM)893A**
Course Name	**Wireless Sensor Network and IoT Lab**
Practical (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Pre-requisite:

1. Basic concept of computer network and communication engineering
2. Basic knowledge of Microcontroller fundamentals

Course Objective(s):

The objective of the course is to make the students able to –

1. understand and illustrate the principles of sensor networks and IOT and their impact on protocol design
2. Design the networks for various application setups.
3. Develop appropriate data dissemination protocols and model links cost.
4. Evaluate the performance of the networks and identify bottlenecks.

Course Outcome(s):

After completion of the course students will be able to

CO1	Understand and explain the Fundamental Concepts and applications of wireless sensor networks and Internet of Things.
CO2	Design and analyze the basic protocols in wireless sensor network and IOT.
CO3	Design and develop the M2M communication protocols and analyze performance.
CO4	Describe and analyze the challenges in designing network architectures for WSN and IOT.
CO5	Develop IOT applications in different domain on embedded platforms and able to analyze their performance.
MODULE NUMBER	**COURSE CONTENT**
1.	Sensor Network lab: All the Experiments of Sensor Network lab may be Conducted using Network Simulation software like NS-2/ NSG2.1/ ONE Simulator/ Wire SHARK/ SDR etc. 1) Introduction of sensor network applications and its simulation.
2.	Sensor Network lab: All the Experiments of Sensor Network lab may be Conducted using Network Simulation software like NS-2/ NSG2.1/ ONE Simulator/ Wire SHARK/ SDR etc.

	2) Network Simulator installation for wireless sensor network.
3.	Sensor Network lab: All the Experiments of Sensor Network lab may be Conducted using Network Simulation software like NS-2/ NSG2.1/ ONE Simulator/ Wire SHARK/ SDR etc. 3) Evaluation of the performance of various LAN Topologies
4.	Sensor Network lab: All the Experiments of Sensor Network lab may be Conducted using Network Simulation software like NS-2/ NSG2.1/ ONE Simulator/ Wire SHARK/ SDR etc. 4) Evaluation of the performance of various routing protocols of ad-hoc network
5.	Sensor Network lab: All the Experiments of Sensor Network lab may be Conducted using Network Simulation software like NS-2/ NSG2.1/ ONE Simulator/ Wire SHARK/ SDR etc. 5) Evaluation of the performance of IEEE 802.11 and IEEE 802.15.4
6.	Sensor Network lab: All the Experiments of Sensor Network lab may be Conducted using Network Simulation software like NS-2/ NSG2.1/ ONE Simulator/ Wire SHARK/ SDR etc. 6) Capturing and Analysis of TCP and IP Packets
7.	IoT lab: 1. Introduction to Arduino platform and programming
8.	IoT lab: 2. Interfacing Arduino to Zigbee module
9.	IoT lab: 3. Interfacing Arduino to GSM module
10.	IoT lab: 4. Interfacing Arduino to Bluetooth Module
11.	IoT lab: 5. Introduction to Raspberry PI platform and python programming
12.	IoT lab: 6. Interfacing sensors to Raspberry PI

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	1	1	-	-	3	2	3	2	2	2
CO2	3	2	2	2	2	1	1	-	-	3	2	3	2	2	2
CO3	3	2	2	2	2	1	1	-	-	3	2	3	2	2	2
CO4	3	2	2	2	2	1	1	-	-	3	2	3	2	2	2
CO5	3	2	2	2	2	1	1	-	-	3	2	3	2	2	2

SYLLABUS	
Semester – 8th B. PRACTICAL	
Course Code	**CS(AM)893B**
Course Name	**Information Theory and Coding Lab**
Practical (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Pre-requisites:
Knowledge of C programming and MATLAB

Course Objective:
The objective of the course is to make the students able to

1. Illustrate and apply proper code in appropriate platform using suitable syntax to solve problems.
2. Understand the concept of variables, constants, data type, operator, expression, statements, loops, vector, matrix, array, function, file handling and apply this knowledge to design the problem.
3. Apply systematic approach to design the programs for solving problems.
4. Solve and analyse engineering-related computational problems by applying a variety of common numeric techniques.
5. Interpret the result of the experiments, prepare laboratory reports based on observed output and analyze it.

Course Outcomes:

After completion of the course students will be able to

CO1	**Illustrate** and **apply** proper code in appropriate platform using suitable syntax for developing program to **solve** problems related to Mathematics and Engineering field leading to lifelong learning.
CO2	**Understand** the concept of variables, constants, data type, operator, expression, statements, loops, vector, matrix, array, function, file handling and **apply** this knowledge to **design** the problem using modern tools for **solvin**g complex engineering problems.
CO3	**Apply** systematic approach to **design** the programs for **solving** problems as a professional engineering practice.
CO4	**Solve** and **analyze** engineering-related computational problems by **applying** a variety of common numeric techniques
CO5	**Interpret** the result of the experiments**, prepare** laboratory reports based on observed output and **analyze** it to validate professional ethics and responsibilities and norms of the engineering practice.
MODULE NUMBER	**COURSE CONTENT**
1.	Revision on programming using C language. Familiarization with MATLAB environment setup, syntax, variables, commands, data types, operators, decisions, loops, vectors, matrix, arrays, functions, and advanced part, creating and editing

	basic MATLAB program in an editor, compilation and execution of MATLAB program.
2.	Determination of various entropies and mutual information using C/MATLAB of the following channels a. Noise free channel b. Noisy channel
3.	Generation and evaluation of following variable source coding using C/MATLAB a. Shannon – Fano coding b. Huffman Coding and Decoding **c.** Lempel Ziv Coding and Decoding
4.	Coding & Decoding of the following codes using C/MATLAB a. Linear block codes b. Cyclic codes c. Convolutional codes
5.	Coding & Decoding of the following codes using C/MATLAB a. BCH code b. RS code
6.	n based on a. Coded and uncoded communication system (Calculate the error probability) us C/MATLAB. b. Source coding and channel coding for transmitting a text file using C/MATLAB.

Textbook:

1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Process Control – A First Course with MATLAB - Pao C. Chau; Cambridge University Press

Reference Books:

1. Introduction to Information Theory - M Mansurpur, McGraw Hill.
2. Information Theory - R B Ash; Prentice Hall.
3. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.
4. Information and Coding - N Abramson; McGraw Hill.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	-	-	-	3	-	-	-	-	3	3	3
CO4	3	3	3	3	-	-	-	3	3	-	-	-	3	3	3
CO5	-	-	-	-	-	-	-	3	-	3	-	-	3	2	3
CO	3	3	3	3	3	-	-	3	3	3	-	3	3	3	3

SYLLABUS	
Semester – 8th	
Course Code	**M(AM)893C**
Course Name	**Optimization Techniques Lab**
Practical (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Course Objective(s):

1. To introduce optimization techniques using both linear and non-linear programming.
2. To focus on the convex optimization though some techniques will be covered for non-convex function optimization.
3. To frame engineering minima maxima problems in the framework of optimization problems.

Course Outcome(s):

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

CO1	Demonstrate the basic principles and concepts of Python
CO2	Explore the applicability of programming skills in Python
CO3	Summarize various optimization techniques like LPP models.
CO4	Analyse the transportation, inventory and assignment problems.
CO5	Evaluate the concepts of sequencing, game theory and dynamic programming.

List of Experiments (Includes but Not Limited to)

1. Matrix Operations
2. Minimum Cost Path
3. Finding Maximum Number in An Array
4. Array Sorting
5. Linear Programming Problem
6. Queuing Problem
7. Sequencing Problem
8. Game Theory
9. Assignment Problem
10. Dynamic Programming Problem
11. Inventory Problem

Recommended Books:

1. Foulds, L. R. (2012). Optimization techniques: an introduction. Springer Science & Business Media.

2. Onwubolu G. C, Babu, B. V, (2013). New optimization techniques in engineering (Vol. 141). Springer.

3. Lopez, C. (2014). MATLAB optimization techniques. A Press.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	2	3
CO2	3	2	-	2	3	-	-	-	-	-	-	-	2	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	2	3
CO4	1	3	-	3	3	-	-	-	-	-	-	-	2	2	2
CO5	1	3	-	2	2	-	-	-	-	-	-	-	3	2	3