ISO 9001:2015 AICTE-CII: GOLD Category Institute NAAC-'A' Grade Institute (CGPA: 3.21) NIRF-2021 Rank : 197

KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE
Opp : Yerragattu Gutta, Hasanparthy (Mandal), WARANGAL - 506 015, Telangana, INDIA.
काकतीय प्रैद्योगिकी एवं विज्ञान संस्थान, वरंगल - ५०६ ०१५ तेलंगाना, भारत
కాకతీయ సాంకేతిక విజ్ఞాన శాస్త్ర విద్యాలయం, వరంగల్ - ౫౦౬ ౦౧౫ తెలంగాణ, భారతదేశము
(An Autonomous Institute under Kakatiya University, Warangal)
(Approved by AICTE, New Delhi; Recognised by UGC under 2(f) & 12(B); Sponsored by EKASILA EDUCATION SOCIETY)
website: www.kitsw.ac.in E-mail: principal@kitsw.ac.in ✆ : +91 9392055211, +91 7382564888

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(Artificial Intelligence & Machine Learning)

B.Tech. CSE (Artificial Intelligence & Machine Learning) – SCHEME
(URR-18 R23)
(w.e.f. 2023-27)

of

(V, VI, VII, VIII SEMESTERS)

KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL-15
(*An Autonomous Institution under Kakatiya University, Warangal*)

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VISION OF THE INSTITUTE

- *To make our students technologically superior and ethically strong by providing quality education with the help of our dedicated faculty and staff and thus improve the quality of human life*

MISSION OF THE INSTITUTE

- *To provide latest technical knowledge, analytical and practical skills, managerial competence and interactive abilities to students, so that their employability is enhanced*
- *To provide a strong human resource base for catering to the changing needs of the Industry and Commerce*
- *To inculcate a sense of brotherhood and national integrity*

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERIG

VISION OF THE DEPARTMENT

- *Attaining centre of excellence status in various fields of Computer Science and Engineering by offering worthful education, training and research to improve quality of software services for ever growing needs of the industry and society.*

MISSION OF THE DEPARTMENT

- *Practice qualitative approach and standards to provide students better understanding and profound knowledge in the fundamentals and concepts of computer science with its allied disciplines.*
- *Motivate students in continuous learning to enhance their technical, communicational, and managerial skills to make them competent and cope with the latest trends, technologies, and improvements in computer science to have a successful career with professional ethics.*
- *Involve students in analyze, design and experimenting with contemporary research problems in computer science to impact socio-economic, political and environmental aspects of the globe.*

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

UG - COMPUTER SCIENCE & ENGINEERING (AI&ML)

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)	**Within first few years after graduation**, the **COMPUTERSCIENCE AND ENGINEERING (AI&ML)** graduates will be able to …

PEO1: Technical Expertise	Apply the fundamental knowledge of the core courses of computer science, Artificial Intelligence and Machine Learning for developingthe effective and transformational software solutions.
PEO2: Successful Career	Excel in profession, higher education and entrepreneurship withupdated technologies in software, artificial intelligence and data science based domains.
PEO3: Soft Skills and Life LongLearning	Exhibit professional ethics, effective communication and team workin solving contemporary knowledge engineering problems and to excel in social innovations.

PROGRAM OUTCOMES (POs) & PROGRAM SPECIFIC OUTCOMES(PSOs)

UG - COMPUTER SCIENCE & ENGINEERING (AI&ML)

PROGRAM OUTCOMES (POs)	**At the time of graduation**, the **COMPUTER SCIENCE AND ENGINEERING (AI&ML)** graduates will be able to …
PO1: Engineering knowledge	*Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems*
PO2: Problem analysis	*Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences*
PO3:Design/development of solutions	*Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental Considerations*
PO4: Conduct investigations of complex problems	*Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions*
PO5: Modern tool usage	*Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations*
PO6: The engineer and society	*Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice*
PO7: Environment and sustainability	*Understand the impact of the professional engineering solutions in societal and environmental contexts, demonstrate the knowledge of, and need for sustainable development*
PO8: Ethics	*Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice*
PO9: Individual and team work	*Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings*

PO10: Communication	*Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions*
PO11: Project management and finance	*Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments*
PO12: Life-long learning	*Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change*

PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO1: Software Development and Quality assurance	*Apply the fundamentals of computer science and engineering knowledge indeveloping the effective computing solutions for real world complex engineering problems.*
PSO2: Maintenance	*Design and configure solutions for various artificial intelligence systems and cognitive applications using contemporary hardware and software tools.*
PSO3: Immediate professional practice	*Develop effective machine learning applications to improve efficiency of existing data processing applications by continuous adaptation of flourishing updates.*

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING(AI&ML)
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE: WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)

SCHEME OF INSTRUCTION & EVALUATION
V-SEMESTER OF 4-YEAR B. TECH DEGREE PROGRAM

Sl. No	Category	Course Code	Course Title	Periods/week			Credits	Evaluation scheme				
				L	T	P	C	CIE			ESE	Total Marks
								TA	MSE	Total		
1	MC	U18MH501	Universal Human Values –II	2	-	-	-	10	30	40	60	100
2	PE	U18AI502	Professional Elective - I / MOOC-I	3	-	-	3	10	30	40	60	100
3	PCC	U18AI503	Internet of Things	3	-	-	3	10	30	40	60	100
4	PCC	U18AI504	Software Engineering	3	-	-	3	10	30	40	60	100
5	PCC	U18AI505	Compiler Design	3	-	-	3	10	30	40	60	100
6	PCC	U18AI506	Machine Learning	3	-	-	3	10	30	40	60	100
7	PCC	U18AI507	Advanced Java Programming Laboratory	-	-	2	1	40	-	40	60	100
8	PCC	U18AI508	Internet of Things Laboratory	-	-	2	1	40	-	40	60	100
9	PCC	U18AI509	Machine Learning Laboratory	-	-	2	1	40	-	40	60	100
10	PROJ	U18AI510	Seminar	-	-	2	1	100	-	100	-	100
Total:				17	1	8	19	280	180	460	540	1000
Additional Learning*: *Maximum credits allowed for Honours/Minor in Engineering*				-	-	-	*7*	-	-	-	-	-
Total credits for students opted for Honours/Minor:				-	-	-	*19+7*	-	-	-	-	-

** List of courses for additional learning through **MOOCs** towards Honours/Minor in Engineering shall be prescribed by the department under Honours/ Minor Curricula*

Note :- U18AI502AR23: Practical approach to AI and Introduction to Quantum Computing syllabus will be taken care by the course faculty.

[L= Lecture, T = Tutorials, P = Practicals& C = Credits] **Total Contact Periods/Week : 26** **Total Credits : 19**

Professional Elective-I / MOOC-I:
U18AI502A: Practical approach to AI and Introduction to Quantum Computing
U18AI502B: Advanced Database Management System
U18AI502C: Computer Graphics
U18AI502M: MOOCs course

MOOCs: Students are encouraged to do Massive Open Online Courses (MOOCs) on SWAYAM platform(https://www.swayam.gov.in) offered by NPTEL, CEC, IIM-B, IGNOU. Students shall contact the Head of the Department (HoD) to get their interested MOOCs approved by the HoD/Dean Academic Affairs for proper transfer of the credits for the MOOCs.

U18MH501 UNIVERSAL HUMAN VALUES - II

Class: B. Tech. V-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
2	-	-	-

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

*** Pre-requisite: U18MH111 Universal Human Values - I (Induction Programme)**

Course Learning Objectives(LOs):

This course will develop student's knowledge in/on…

LO1: self-exploration, happiness and prosperity as the process of value education
LO2: harmony in the human being- self & family
LO3: co-existence of human being with society & nature
LO4: professional ethics, commitment and courage to act

UNIT – I (9)

Introduction - Need, Basic Guidelines, Content and Process for Value Education: Purpose and motivation for the course, Recapitulation from Universal Human Values - I (Induction programme)

Self-Exploration: Its content and process, Natural acceptance and experiential validation – As the process for self-exploration

Continuous Happiness and Prosperity: A look at basic human aspirations, Right understanding, Relationship and physical facility - The basic requirement for fulfillment of aspirations of every human being with their correct priority

Understanding Happiness and Prosperity correctly: A critical appraisal of the current scenario, Method to fulfill the above human aspirations - Understanding and living in harmony at various levels

UNIT - II (9)

Understanding Harmony in the Human Being- Harmony in Myself & Family

Harmony in Myself: Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Happiness and physical facility; Understanding the 'Body' as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of 'I' with the 'Body' - Sanyam and Health; Correct appraisal of physical needs, Meaning of prosperity in detail, Programs to ensure Sanyam and Health

Harmony in Family: Understanding values in human - Human relationship; Meaning of justice (Nine universal values in relationships), Program for its fulfillment to ensure mutual happiness, Trust and respect as the foundational values of relationship, Understanding the meaning of trust, Difference between intention and competence; Understanding the meaning of respect, Difference between respect and differentiation, The other salient values in relationship

UNIT - III (9)

Understanding Harmony with Society, Nature & Existence: Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, Fearlessness (trust) and Co-existence as comprehensive human goals, Visualizing a universal harmonious order in society – Undivided society; Universal order - From family to world family

Understanding the harmony in the nature: Interconnectedness and mutual fulfillment among the four orders of nature - Recyclability and self-regulation in nature

Whole Existence as Co-existence: Understanding existence as co-existence of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence

UNIT - IV (9)

Implications of Holistic Understanding of Harmony on Professional Ethics: Natural acceptance of human values, Definitiveness of ethical human conduct, Basis for Humanistic education,

Humanistic constitution and Humanistic universal order

Competence in professional ethics: a) Ability to utilize the professional competence for augmenting universal human order b) Ability to identify the scope and characteristics of people friendly and eco-friendly production systems and c) Ability to identify and develop appropriate technologies and management patterns for above production systems

Case studies: Case studies of typical holistic technologies, Management models and production systems, Strategy for transition from the present state to Universal human order – a) At the level of individual: As socially and ecologically responsible engineers, technologists and managers b) At the level of society: As mutually enriching institutions and organizations

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Text Book:

[1] R .R. Gaur, R. Sangal and G. P. Bagaria, *Human Values and Professional Ethics*, New Delhi: Excel Books, 2010.

Reference Books:

[1] A.Nagaraj, JeevanVidya: EkParichaya, *Raipur: Jeevan Vidya Prakashan*, Amarkantak, 2018.
[2] A.N. Tripathi, *Human Values*, 3rd ed. New Delhi: New Age International Publisher, 2019.
[3] M.Govindrajran, S. Natrajan& V.S. Senthil Kumar, *Engineering Ethics (includes Human Values)*, 12th ed. Haryana: PHI Learning Pvt. Ltd., 2011.
[4] Jayshree Suresh, B. S. Raghavan, *Human Values & Professional Ethics*, 4th ed. New Delhi: S. Chand & Co. Ltd., 2012.

Course Research Paper: Research paper(indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in Course Web page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in Course Web page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

Additional Resources:

[1] R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics (Teacher's Manual), New Delhi: Excel books, 2010.
[2] A set of DVDs containing - Video of Teachers' Orientation Program - PPTs of Lectures and Practice Sessions (Audio-visual material for use in the practice sessions)

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: interpret the importance of continuous happiness & prosperity through self exploration and imbibe skills to examine harmony
CO2: appraise the concept of sentience, distinguish between intention & competence and prioritize human values in relationships
CO3: build fearlessness & co-existence as comprehensive human goal and agree upon inter connectedness & mutual fulfillment
CO4: assess the understanding of harmony, adapt professional ethics and take part in augmenting universal human order

Course Articulation Matrix (CAM):U18MH501 UNIVERSAL HUMAN VALUES – II																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18MH501.1**	-	-	-	-	-	1	-	2	1	1	-	2	-	-	1
CO2	**U18MH501.2**	-	-	-	-	-	1	-	2	1	1	-	2	-	-	1
CO3	**U18MH501.3**	-	-	-	-	-	1	-	2	1	1	-	2	-	-	1
CO4	**U18MH501.4**	-	-	-	-	-	1	-	2	1	1	-	2	-	-	1
U18MH501		**-**	**-**	**-**	**-**	**-**	**1**	**-**	**2**	**1**	**1**	**-**	**2**	**-**	**-**	**1**

U18AI502B ADVANCED DATABASE MANAGEMENT SYSTEM

Class: B.Tech. V-Semester
Branch: Computer Science & Engineering (AI & ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop students knowledge in/on…

LO1: data storage, disk organization, tree structured indexing & hash-based indexing techniques
LO2: parallel & distributed database architectures, organization & management
LO3: object database systems, operators and query evaluation
LO4: deductive databases, web databases, X Query and spatial data management

UNIT-I (9)

Overview of Storage and Indexing: Data on external storage, File organizations and indexing, Index data structures, Indexes and performance tuning

Storing Data Disks and Files: The memory hierarchy, Redundant array so find dependent disks, Disk space management, Buffer manager,Files of records, Page formats, Record formats

Tree-Structured Indexing: Intuition for tree indexes, ISAM, B+trees-Search, insert, delete, duplicates, B+trees in practice;

Hash Based Indexing: Static hashing, Extendible hashing, Linear hashing, Extendible versus linear hashing

UNIT-II (9)

Parallel Databases: Introduction, Architectures for parallel databases, Parallel query evaluation, Parallelizing individual operations and parallel query optimization

Distributed Databases: Introduction, Distributed DBMS architectures, storing data in distributed DBMS, Distributed catalog management, Distributed query processing, Updating distributed data, Distributed transactions, Distributed concurrency control, Distributed recovery

UNIT-III (9)

Object-Database Systems: Motivating example, Structured data types, Operations on structured data, Encapsulation andADTS, Inheritance, Objects, OIDS and reference types, Database design for an ORDBMS, ORDBMS implementation challenges, OODBMS, Comparing RDBMS, OODBMS, and ORDBMS

Overview of Query Evaluation: The system catalog, Introduction to operator evaluation, Introduction to query optimization, what a typical optimizer does

Evaluating Relational Operators: The selection operation, General selection conditions, The projection operation, The join operation, The set operations, Aggregate operations

UNIT-IV (9)

Deductive Databases: Introduction to recursive queries, Recursive queries with negation, Data log to SQL, Evaluating recursive queries engines, Managing text in DBMS, A data model for XML

X Query: Querying XML data, Efficient evaluation of XML queries

Spatial Data Management: Types of spatial data and queries, Applications involving spatial data, Introduction to spatial indexes, Indexing based on space-filling curves

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Text Books:

[1] Raghu Rama krishnan, Johannes Gehrke, *Database Management Systems*, 4th ed. Hyderabad:Mc-GrawHill,2014. *(Chapters7to10,12,13,21,22,25,26,27)*

Reference Books

[1] Hector GarciaMolina, Jeffery D Ullman, and Jennifer Widom, *Database Systems: The Complete Book*, 2nd ed., New Jersey: Pearson, 2008.

[2] Ramez Elmasri, Shamkanth B.Navathe, *Fundamentals of Database Systems*, 7th ed. New Delhi:Pearson Education, 2017.

[3] Abraham Siberschatz, Henry F.Korth, and S.Sudarshan, *Database System Concepts*, 6th ed. New Delhi: Mc Graw-Hill 2011.

[4] R.P.Mahapatra, Govind Verma, *Database Management Systems*, 1st ed., New Delhi: Khanna publications, 2016.

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in Course Web page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in Course Web page.

Course Project: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: illustrate the way data stored & organized in external storage devices and apply various indexing techniques to efficiently access the data

CO2: analyze the architectures, data organization and management of parallel & distributed databases in transactional processing system

CO3: evaluate queries using various operators and features of object database systems

CO4: make use of the data management in deductive databases, web databases, X Queries & spatial databases

Course Articulation Matrix (CAM): U18AI502B ADVANCED DATABASE MANAGEMENT SYSTEM

Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**U18AI502B.1**	2	2	2	2	1	-	-	1	-	1	-	2	2	1	2
CO2	**U18AI502B.2**	2	2	2	2	1	-	-	1	-	1	-	2	2	1	2
CO3	**U18AI502B.3**	2	2	2	2	1	-	-	1	-	1	-	1	2	1	2
CO4	**U18AI502B.4**	2	2	2	2	1	-	-	1	-	1	-	2	2	1	2
U18AI502B		**2**	**2**	**2**	**2**	**1**	-	-	1	-	1	-	**1.75**	**2**	**1**	**2**

U18AI502C COMPUTER GRAPHICS

Class: B.Tech. V-Semester **Branch:** Computer Science & Engineering (AI & ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge on /in…

LO1: computer graphics primitives algorithms by drawing line drawing algorithms and 2D transformations
LO2: algorithms of segments, clipping &3D viewing transformations
LO3: deriving projections mathematically and identification of hidden surfaces for creating standard animations
LO4: fundamental concepts of multimedia systems

UNIT-I (9)

Geometry and line generation: Introduction, Application of computer graphics, Pixels and frame buffer, Graphics standards, Image representation, *DDA* and Bresenham line generation algorithms, Graphics primitive operations, Character generation methods, Aliasing and anti aliasing

Polygons: Polygon representation, Inside test methods, Seed filling, Scanline filling algorithms

Two dimensional transformations: Scaling, Translation and rotation transformations, Rotation about arbitrary point, Homogenous coordinates, Inverse transformations, Transformation routines, Reflection and shearing transformations, Instance transformations

UNIT-II (9)

Segments: Segment creation algorithm, Segment closing algorithm, Segment deletion and segment renaming algorithms, Image transformation

Windowing and clipping: Window and view port, Viewing transformation matrix, Implementation of viewing transformation, Multiple windowing, Cohen Sutherland out code algorithm , Sutherland hodgman algorithm, Midpoint subdivision algorithm, Generalized clipping

Three dimensions: *3D* primitives, *3D* transformations, Rotation about arbitrary axis, *3D* viewing, Viewing parameters

UNIT-III (9)

Projections: Parallel projection, Perspective projection, Derivation of parallel projection matrix, Derivation of perspective projection matrix

Hidden surface and line removal algorithms: *Z-buffer* algorithm, Painters algorithm, Warnock algorithm, Franklin algorithm, Back face removal algorithm

Computer based animation: Basic concepts, Animation languages, Methods of controlling animation, Display of animation, Transmission of animation

UNIT-IV (9)

Multimedia: Media and data streams, Main properties of multimedia system, Traditional data stream characteristics - Asynchronous transfer mode, Synchronous transfer mode

Sound / Audio: Basic sound concepts - Computer representation of sound, Audio formats, Music - *MIDI* concepts, *MIDI* devices, *MIDI* messages, *MIDI* software, Speech - Speech generation, Speech analysis, Speech transmission

Multimedia applications: Media preparation, Media composition, Media integration, Media communication, Media consumption, Media entertainment

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Text Books:

[1] Steven Harrington, *Computer Graphics, A Programming Approach*, 2nd ed. India: Mc Graw Hill Education, 2017.

[2] Ralf Steinmetz, Klara Nahrstedt, Multimedia: *Computing, Communications & Applications*, New Delhi: Pearson First Impression, 2006. (Chapters 2, 3, 17)

Reference Books:

[1] James D.FoleyAndries Van Dam Steven K. Fernier, John Hugs, *Computer Graphics Principles & Practice*, 2nd ed. New Delhi: Pearson Education, 2002.

[2] Donad Hearn, Pauline Baker, *Computer Graphics*, 2nded. New Delhi:Pearson Education, 1997.

[3] Fabio Ganovelli, Massimiliano Corsini, Sumanta Pattanaik, Marco Di Benedetto, *Introduction to computer graphics a practical learning approach*, Newyork: Chapman and Hall, 2014.

[4] Dr Rajiv chopra *Computergraphics : a practical approach, concepts, principles, case studies, experiments*, 4th ed.New Delhi: S Chand, 2011.

Course Research Paper: Research paper (Journal/Conference paper) relevant to the course content will be posted by the course faculty in Course Web page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in Course Web page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

C01: design and transform a line or polygon using two dimensional transformations

CO2: apply segmentation and clipping algorithms to transform 2D to basic 3D transformations

CO3: analyze the concepts of projections, computer-based animations, and apply algorithms to eliminate hidden surfaces and lines

CO4: make use of animation's design principles for creation of quality multimedia applications

Course Articulation Matrix (CAM): U18AI502C COMPUTER GRAPHICS																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI502C.1**	2	2	2	1	-	-	-	1	1	1	-	2	2	2	-
CO2	**U18AI502C.2**	2	2	2	1	-	-	-	1	1	1	-	2	2	2	-
CO3	**U18AI502C.3**	2	2	1	1	-	-	-	1	1	1	-	1	2	1	-
CO4	**U18AI502C.4**	1	1	-	-	1	-	-	1	1	1	-	2	1	1	1
U18AI502C		**1.75**	**1.75**	**1.66**	**1**	**1**	**-**	**-**	**1**	**1**	**1**	**-**	**1.75**	**1.75**	**1.5**	**1**

U18AI503 INTERNET OF THINGS

Class: B.Tech. V-Semester **Branch:** Computer Science & Engineering (AI & ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: fundamentals of IoT, sensors, actuators and IoT boards
LO2: iot network architecture, design, connectivity technologies
LO3: interoperability between systems, IoT connectivity technologies, data protocols
LO4: iot-cloud convergence and cloud based real world applications using IoT

UNIT – I(9)

Introduction: Introduction to IoT**,**Evolution of IoT**-**IoT versus M2M, IoT versus CPS, IoT versus WoT; Enabled technologies, Networking components, Challenges and applications
Sensors: Definition, Characteristics, Deviations, Types-Scalar, Multimedia, Hybrid and virtual; Considerations
Actuators: Definition, Types-Hydraulic, Pneumatic, Electric, Thermal or Magnetic, Mechanical, Soft and shape memory polymers; Characteristics
Classification of IoT boards: Micro controller boards, Single board controller, System on chipboard

UNIT - II (9)

IoT Network Architecture and Design: Drivers behind new network architectures, The OneM2M IoT standardized architecture, The IoT World Forum (IoTWF) standardized architecture, A simplified IoT architecture, The Core IoT functional stack, IoT Data management and Compute stack
IoT Connectivity Technologies: Introduction, IEEE 802.15.4- 802.15 standards, Architecture, Topology, Addressing modes and Packet structure, Security, Zigbee - overview, PHY and MAC layer, Protocol stack, Addressing modes and Packet structure, Topology, Security; Z-Wave-overview, Protocol stack, Addressing, Topology and routing

UNIT - III (9)

IoT Connectivity Technologies: LoRa - Introduction, Physical layer, MAC layer and topology, Physical layer, MAC layer, Protocol stack and topology, Thread, ISA100.11A, Wireless HART, RFID, NFC, DASH7, Weightless, NB - IoT, Wi-Fi, Bluetooth
Data Protocols: MQTT - Publish - Subscribe, architecture, packet structure and communication format; MQTT - SN - Architecture, Topology, Transparent and aggregating gateways, Gateway advertisement and discovery, COAP - Architecture, Message formats, Usage example; AMQP, XMPP, SOAT, REST, Web socket

UNIT - IV (9)

IoT-Cloud Platform in Industry: Amazon web services, Google app engine and Microsoft Azure
IoT-Cloud Convergence: Challenges and open issues, Architecture for convergence, data offloading and computation, Dynamic resource provisioning, Security aspects
Cloud-Based Smart City using IoT: Introduction to smart city, characteristics, standards and protocols for cloud-based smart city, Applications: Traffic management, Smart healthcare, Disaster management, Air pollution monitoring and Smart waste management.

Text Books:

[1] Arshdeep Bahga and Vijay Madisetti, *Internet of Things: A Hands-On Approach,* Hyderabad: University Press, 2015.

[2] David Hanes, Gonzalo Salgueiro and Patrick Grossetete, *IoT Fundamentals: NetworkingTechnologies, Protocols, andUse Cases for the Internet of Things,* Cisco Press, 2017. (Chapters: 2, 3, 4, 5, 8,13,15)

Reference Books:

[1] Bassi Alessandro, *Enabling things to talk*, Berlin: Springer-Verlag, 2016.
[2] Hersent, Olivier, David Boswarthick, and Omar Elloumi, *The internet of things: Key applications and protocols*.London: John Wiley & Sons, 2011.
[3] Buyya, Rajkumar, and Amir Vahid Dastjerdi, *Internet of Things: Principles and paradigms*. New York: Elsevier, 2016.

Course Research Paper: Research paper(indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in Course Web page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in Course Web page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: make use of the basics of IoT, sensors, actuators and IoT boards to design IoT based applications
CO2: analyze various IoT network architectures and connectivity technologies to address the heterogeneity in devices
CO3: analyze the protocol stack for wireless devices & data protocols to address the heterogeneity in networks
CO4: analyze the IoT-cloud convergence and design solutions for real world applications like smart mobile apps for societal applications

Course Articulation Matrix (CAM): U18AI503 INTERNET OF THINGS																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI503.1**	2	2	2	2	2	1	1	1	1	1	-	1	2	2	2
CO2	**U18AI503.2**	2	2	2	1	1	1	1	1	1	1	-	3	2	2	2
CO3	**U18AI503.3**	2	2	2	1	1	1	1	1	1	1	-	3	2	2	2
CO4	**U18AI503.4**	2	2	2	2	2	1	1	1	1	1	-	3	2	2	2
U18AI503		**2**	**2**	**2**	**2**	**1.5**	**1**	**1**	**1**	**1**	**1**	**-**	**2.5**	**2**	**2**	**2**

U18AI504 SOFTWARE ENGINEERING

Class: B. Tech. V-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on…

LO1: fundamental concepts of software and different types of software models

LO2: different types of design concepts and patterns

LO3: software design principles and test strategies

LO4: metrics for quality analysis of software and risk management

UNIT-I (9)

Software Engineering Concepts: The changing nature of software, Software application domains, Legacy software, Software myths, Software engineering layered technology, A process framework, The capability maturity model integration (*CMMI*), Agile software

Process Models: Prescriptive process models, RAD model, Specialized process models, Unified process model, Personal and team process models

Agile Development: Agility and the cost of change, Agile process, Extreme programming, Other agile process models

Software **Engineering Practices**: Communication principles, Planning principles, Modeling principles, Construction principles, Deployment principles

UNIT-II (9)

Requirements Engineering Tasks: Requirements analysis and modeling strategies, User requirement, System requirement, Software requirements document

Design Engineering: Design within the context of software engineering, Design process, Design concepts, The design model

Architectural Design: Software architecture, Architectural genres, Architectural styles, Architectural design, Assessing alternative architectural designs, Designing class based components, Conducting component level design, Design for WebApps, Designing traditional components

UNIT-III (9)

User Interface Design: The golden rules, User interface analysis and design, Interface analysis, Interface design steps, WebApp and mobile interface design

Testing Strategies: Software testing fundamentals, Test strategies for conventional software, Test strategies for object-oriented software, Validation testing, System testing, The art of Debugging, White box testing, Basis path testing, Control structure testing, Black box testing

Testing Web Applications: Testing concepts for webapps, The testing process, Content testing, User interface testing, Component-level testing, Navigation testing, Configuration testing, Security testing,Performance testing.

UNIT-IV (9)

Product Metrics: Measures, Metrics and indicators, Metrics for the requirements model, Metrics for the design model, Metrics for source code, Metrics for testing, Metrics for maintenance

Process and Project Metrics: Metrics in the process and project domains, Software measurement, Metrics for software quality, Integrating metrics within the software process, The *W5HH* principle

Project Scheduling: Project scheduling, Scheduling for WebApps projects, Earned value

analysis

Risk Management: Reactive versus Proactive risk strategies, Software risks, Risk identification, Risk projection, Risk refinement, RMMM plan

Text Book:

[1] Roger S.Pressman and Bruce R.Maxim, *Software Engineering: A Practitioner's Approach,*8th ed., NewDelhi:VMcGraw Hill, 2019

Reference Books:

[1] Ian Sommerville, *Software Engineering*, 10th ed., Delhi:Pearson Education, 2016
[2] Deepak Jain, *Software Engineering: Principles and Practices*, 3rd ed., Delhi:Oxford University Press, 2008
[3] Pankaj Jalote, *Software Engineering: A Precise Approach,*NewDelhi:Wiley India, 2010
[4] Waman S. Jawadekar, *Software Engineering: A Primer*, NewDelhi:TataMcgraw Hill, 2008

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in Course Web page.

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Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes(COs):

On completion of this course, students will be able to…

CO1: implement the appropriate software model for a given real time application
CO2: develop different types of software designs & patterns
CO3: apply an appropriate testing method for a given software
CO4: apply metrics to assess the quality of software and analyze the risk management in project scheduling

Course Articulation Matrix (CAM): U18AI504 SOFTWARE ENGINEERING																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI504.1**	1	1	1	1	-	-	-	-	1	1	2	1	2	1	2
CO2	**U18AI504.2**	1	1	1	1	-	-	-	-	1	1	2	1	1	1	2
CO3	**U18AI504.3**	2	2	1	1	-	1	1	-	1	1	2	1	2	1	2
CO4	**U18AI504.4**	2	2	2	1	-	1	1	-	1	1	2	1	2	1	2
U18AI504		**1.5**	**1.5**	**1.25**	**1**	**-**	**1**	**1**	**-**	**1**	**1**	**2**	**1**	**1.75**	**1**	**2**

U18AI505 COMPILER DESIGN

Class: B. Tech. V-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: phases of a compiler and design of a lexical analyzer
LO2: parsing techniques using context-free grammar and construction of syntax tree
LO3: specification of a type checker, storage allocation strategies and generating intermediate form for the given programming statements
LO4: generating target code from the intermediate form and applying code optimization techniques to improve the performance of the code

UNIT-I (9)

Introduction to Compiling: Compilers, Analysis of the source program, Phases of a compiler, Cousins of the compiler, Grouping of phases, Compiler construction tools

Lexical Analysis: Role of lexical analyzer, Input buffering, Specification of tokens, Recognition of tokens, A language for specifying lexical analyzers, Finite automata, Design of a lexical analyzer, Optimization of deterministic finite automata based pattern matchers

UNIT-II (9)

Syntax Analysis: Role of the parser, Writing grammars, Context free grammars, Top down parsing, Bottom up parsing, Operator precedence parsing, LR parsers, Using ambiguity grammars, Parser generators

Syntax Directed Translation: Syntax directed definitions, Construction of syntax trees, Bottom up evaluation of S-attributed definitions, L-attributed definitions, Top down translation, Bottom up evaluation of inherited attribute, Space for attribute values at compile time, Analysis of syntax directed definition

UNIT-III (9)

Type Checking: Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions

Runtime Environments: Source language issues, Storage organization, Storage allocation strategies, Symbol tables, Language facilities for dynamic storage allocation, Dynamic storage allocation techniques

Intermediate Code Generation: Intermediate languages, Declarations, Assignment statements, Boolean expressions, Back patching

UNIT-IV (9)

Code Generation: Issues in the design of code generator, The target machine, Runtime storage management, Basic blocks and flow graphs, Next-use information, A simple code generator, Register allocation and assignment, Directed acyclic graph representation of basic blocks, Peephole optimization, Generating code from directed acyclic graphs, Code generation algorithm

Code Optimization: Introduction, The principal sources of optimization, Optimization of basic blocks, Loops in flow graphs, Introduction to global data flow analysis, Code improving transformations

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Text Book:

[1] Alfred V.Aho, Ravi Sethi and Jeffrey D.Ullman, Compilers: Principles, Techniques and Tools, 2nd ed. Hong Kong: Pearson Education Asia, 2013.

Reference Books:

[1] Allen I. Holub, Compiler Design in C, 2nd ed. New Jersey: Prentice Hall of India, 2003.
[2] C. N. Fischer, R. J. LeBlanc, Crafting a compiler with C, California: Pearson Education, 2003.
[3] J.P. Bennet, Introduction to Compiling Techniques, 2nd ed. New York: McGraw-Hill, 2003.
[4] Henk Alblas, Albert Nymeyer, Practice and Principles of Compiler Building with C, London: PHI, 2001.

Course Research Paper: Research paper (Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, students' will be able to…

CO1: design lexical analyzer using regular expressions to generate tokens from the given programming statements
CO2: construct syntax tree and parsing table for the given context-free grammar
CO3: construct intermediate code for the given programming statements
CO4: develop target code from the intermediate form and apply code optimization techniques to improve the performance of the code

Course Articulation Matrix (CAM): U18AI505 COMPILER DESIGN																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI505.1**	3	3	2	2	1	-	-	1	1	1	-	2	1	1	1
CO2	**U18AI505.2**	3	3	2	2	1	-	-	1	1	1	-	2	1	1	1
CO3	**U18AI505.3**	3	3	3	3	1	-	-	1	1	1	-	3	1	1	1
CO4	**U18AI505.4**	3	3	3	3	1	-	-	1	1	1	-	3	1	1	1
U18AI505		**3**	**3**	**2.5**	**2.5**	**1**	**-**	**-**	**1**	**1**	**1**	**-**	**2.5**	**1**	**1**	**1**

U18CAI506 MACHINE LEARNING

Class: B. Tech. V-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on…

LO1: machine learning fundamentals, binary classification and handling more than two classes

LO2: dimensionality reduction, linear and kernel models

LO3: fundamentals of ANN, multi-layer feed forward and back propagation networks

LO4: reinforcement learning, decision making by ensemble learning

UNIT – I (9)

The ingredients of machine learning: The problems that can be solved with machine learning, The output of machine, The workhorses of machine

Binary classification: Classification, Scoring and Ranking, Class probability estimation

Beyond Binary Classification: Handling more than two classes

Case Study: Spam filtering

UNIT - II (9)

Dimensionality Reduction: Linear discriminant analysis (LDA), Principal components analysis (PCA), Factor analysis, Independent components analysis (ICA)

Linear Models: The Least-Squares method, Multivariate linear regression

Support Vector Machines: Optimal separat-ion, Kernels, The support vector machine algorithm, Extensions to the SVM

Case Study: Disease prediction using SVM

UNIT - III (9)

Artificial Neural Networks: Introduction, Neural network representation, Appropriate problems for neural network learning, Perceptron, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm

The Multi-layer Perceptron: Going forwards, Going backwards, Back-propagation of error, The Multi-layer perceptron in practice, Examples of using the MLP, A Recipe for using the MLP, Deriving Back-Propagation

UNIT - IV (9)

Reinforcement Learning: Overview, Example: getting lost, Markov decision processes, Values, Back on holiday: Using reinforcement learning, The difference between SARSA and Q-Learning, Uses of Reinforcement learning

Ensemble Learning: Boosting, Bagging, Random forests, Different ways to combine classifiers

Case Study: optimization of disease prediction using ensemble learning

Text Books:

[1] Peter Flach, *Machine Learning: The Art and Science of Algorithms that Make Sense of Data*, Cambridge University Press, 1st ed., ISBN: 978-1 -107-09639-4, 2012.

[2] StephenMarsland, Taylor & Francis, *Machine Learning: An Algorithmic Perspective*, CRC, ISBN -13: 978-1420067187, 2009.

Reference Books:

[1] Tom M. Mitchell, *Machine Learning*, MGH, Indian Edition, ISBN 1259096955, 2013

[2] S. Russell and P. Norvig, *Artificial Intelligence – A Modern Approach*, 2nd ed., Pearson Education, 2003, ISBN: 978-0137903955

[3] Jason Bell, *Machine Learning: Hands-On for Developers and Technical Professionals*, John Wiley & Sons, 1st ed., ISBN-13: 978-1118889060, 2014.

[4] William W Hsieh, *Machine Learning Methods in the Environmental Sciences, Neural Networks*, Cambridge University Press, ISBN -13: 978-0805822410, 2009.

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, students' will be able to…

CO1: classify given input class based on binary and multivariate classification techniques
CO2: apply linear models and dimensionality reduction in real world problems like disease prediction
CO3: analyze the ANN and its usage in real world problems like handwritten digit recognition
CO4: analyze the concepts of reinforcement learning and decision making by ensemble learning

Course Articulation Matrix (CAM): U18AI506 MACHINE LEARNING																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI506.1**	2	2	2	3	3	2	-	1	1	1	-	2	2	2	2
CO2	**U18AI506.2**	3	3	3	2	2	2	-	1	1	1	-	2	3	2	3
CO3	**U18AI506.3**	2	2	2	3	3	1	-	1	1	1	-	2	2	2	3
CO4	**U18AI506.4**	3	2	3	3	3	2	-	1	1	1	-	2	3	2	3
U18AI506		**2.5**	**2.5**	**2.5**	**2.75**	**2.75**	**1.75**	-	1	1	1	-	2	**2.5**	**2**	**2.75**

U18AI507 ADVANCED JAVA PROGRAMMING LABORATORY

Class: B. Tech. V-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
-	-	2	1

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LOs):

This course will develop student's knowledge in/on…

LO1: developing GUI based programs using the concept of swings

LO2: the concepts of generics and collections

LO3: sorting user-defined data using Comparable & Comparator interfaces and performing the unit testing with JUnit

LO4: lambda expressions and Stream API

Experiment-I

1. Create a JFrame program to display "Good Morning" if current time is between "6 AM to 12 PM" and "Good Afternoon" if the current time is between "12 PM to 6PM", and "Good Evening" if the current time is between "6PM to 12AM"
2. Create a JFrame program to perform basic arithmetic calculations on given two numbers with the help of button events

Experiment-II

1. Create a JFrame program from which you can open other frames with the help of button events
2. Design different JFrame's to demonstrate different layouts like Flow layout, Border layout, Grid layout & null layout
3. Create a JFrame program to work with window events

Experiment -III

1. Create a JFrame to add a menu bar with which you can select different options from different menus and perform some action on selection of every menu item
2. Create a JFrame program to open the text file using JFile Chooser and display the selected text file content on the JText Area
3. Design a registration form with the help of a JFrame and save the details in to the text file

Experiment -IV

1. Create a JFrame program to insert, delete & update the records of a database table
2. Create a JFrame program to select a database table using JComboBox component and display the content of the selected database table in JTable component

Experiment -V

1. Write a java program to demonstrate generic class
2. Write a java program to demonstrate methods and constructors in generics
3. Write a java program to demonstrate multiple type parameters in generic classes
4. Write a java program to demonstrate inheritances in generics

Experiment -VI

1. Write a java program to perform following operations on ArrayList, LinkedList, HashSet and LinkedHashSet
    i. Insertion
    ii. Deletion
    iii. Traversing using traditional-for, for-each, Iterator and ListIterator
    iv. Display the elements in reverse order

2. Write a program that will have a Vector which is capable of storing Employee objects. Use an Iterator and enumeration to list all the elements of the Vector

Experiment -VII

1. Write a java program to perform different operations on inbuilt Stack class
2. Write a java program to perform different operations on inbuilt Queue class
3. Write a java program to perform insertion, deletion, traversing and searching operations on HashMap and TreeMap

Experiment -VIII

1. Write a java program to store and retrieve user defined class objects from TreeSet
2. Write a java program to read a set of values and display the count of occurrences of each number using collection concept

Experiment-IX

1. Write a java program to display ArrayList values in sorted order
2. Write a java program to demonstrate Comparable interface for sorting user defined data type
3. Write a java program to demonstrate Comparator interface for sorting user defined data type

Experiment-X

1. Write a java program to test simple arithmetic operations of Calculator class using JUnit concept
2. Write a java program to demonstrate different Assert methods and annotations

Experiment-XI

1. Write a java program to demonstrate lambda expression with no parameter
2. Write a java program to demonstrate lambda expression with single and multiple parameters
3. Write a java program to iterate the List and Map using lambda expressions
4. Create two threads using lambda expressions, where one thread displays even numbers for every half second and the other thread displays odd numbers for every second

Experiment-XII

1.Write a java program to demonstrate following methods using streams on a List

a) filter **b)** sorted **c)** distinct **d)** limit **e)** count

2.Write a java program to read a string and collect upper case characters, lower case characters & digits into different ArrayList objects using streamAPI and display them

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Laboratory Manual:

[1] Advanced Java Programming Laboratory Manual, Dept. of CSE (AI & ML), KITSW.

Reference Books:

[1] Herbert Schildt,JAVA The Complete Reference, 10th ed.New York: McGraw-Hill Education India Pvt.Ltd, 2017.

[2] Sachin Malhotra, Saurabh Choudhary, Programming in JAVA, 2nd ed. New Delhi: Oxford University Press, 2013.

[3] UttamK.Roy, Advanced JAVA Programming, New Delhi: Oxford University Press, 2015.

[4] PualDeitel, Harvey Deitel, Java How to program, 10th ed. Chennai:Pearson Education, 2016.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: d*esign GUI programs by using the concept of swings*

CO2: apply the concept of generics &collections to work on dynamic data

CO3: demonstrate correct usage of Comparable & Comparator interfaces and examine the test cases to perform unit testing using the concept of JUnit

CO4: apply the lambda expressions instead of anonymous class and effectively process collections of objects using Stream API

Course Articulation Matrix (CAM): U18AI507 ADVANCED JAVA PROGRAMMING LABORATORY																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI507.1**	2	2	2	1	2	-	-	1	2	1	-	2	3	1	3
CO2	**U18AI507.2**	2	2	2	1	-	-	-	1	2	1	-	2	3	1	2
CO3	**U18AI507.3**	2	2	2	1	2	-	-	1	2	1	-	2	3	3	3
CO4	**U18AI507.4**	2	2	2	1	-	-	-	1	2	1	-	2	3	1	2
U18AI507		**2**	**2**	**2**	**1**	**2**	**-**	**-**	**1**	**1**	**1**	**-**	**2**	**3**	**1.5**	**2.5**

U18AI508 INTERNET OF THINGS LABORATORY

Class: B. Tech. V-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
-	-	2	1

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: configuring Raspberry Pi for IoT applications
LO2: running python program on Raspberry Pi for developing IoT applications
LO3: implementing cloud based IoT applications
LO4: usage of Pi camera and 7-segment display

List of Experiments

Experiment-I (UNIT-I)
1. Exploring sensors and actuators
2. Demonstrating Arduino board and Raspberry Pi
3. Installation of OS onto Raspberry Pi

Experiment-II (UNIT-I)
1. Raspberry Pi and try various Linux commands in command terminal window:
   i. ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip
   ii. cat, more, less, ps
2. Start Raspberry Pi and try various Linux commands in command terminal window:
   i. sudo, cron, chown, chgrp, ping etc.
   Ii. process-related commands

Experiment-III (UNIT-I)
1. Run a python program on Pi to Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input
2. Run a python program on Pi to demonstrate *while* loop
3. Run a python program on Pi to demonstrate *for* loop
4. Run a python program on Pi to demonstrate handle *Divide By Zero* Exception
5. Run a python program on Pi to demonstrate file operations

Experiment-IV (UNIT-II)
1. Demonstrate Light an LED through Python program.
2. Write a program to demonstrate light an LED which are connected in series
3. Write a program to demonstrate light an LED which are connected in parallel.
4. Design a program to infinitely blink a sequence of 4 LEDs connected to Pi, one after the other with the delay of 500 ms.

Experiment-V (UNIT-II)
1. Write a program to demonstrate LED with button.
2. Write a program to demonstrate two LEDs with Two buttons.
3. Write a program to demonstrate light an LED through web.

Experiment-VI (UNIT-II)
1. Get input from DHT sensor and upload on cloud

Experiment -VII (UNIT-III)
1. Get input from ultrasonic sensor and upload on cloud

Experiment-VIII (UNIT-III)
1. Working with LED, button, *pir*sensor

Experiment-IX (UNIT-III)
1. Design a program to sense temperature using DHT sensor and if the temperature is exceeds the 40^0C, servo motor is actuated for 10seconds. The actuated motor rotates between 0 to 180 degrees.

Experiment-X (UNIT-IV)
1. Design a program to demonstrate DC motor

Experiment-XI (UNIT-IV)
1. Design a program to demonstrate stepper motor

Experiment-XII (UNIT-IV)
1. Working with Pi camera
2. Working with 7-segment display using Raspberry PI

Laboratory Manual:
Internet of Things Laboratory Manual, Dept. of CSE(AIML), KITSW.

Text Books:

[1] ArshdeepBahga and Vijay Madisetti, *Internet of Things: A Hands-On Approach,* Hyderabad: University Press, 2015.
[2] David Hanes, Gonzalo Salgueiro and Patrick Grossetete, *IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things,* Cisco Press,2017. (Chapters: 2, 3, 4, 5, 8,13,15)

Reference Books:

[1] Bassi Alessandro, *Enabling things to talk*, Berlin: Springer-Verlag, 2016.
[2] Hersent, Olivier, David Boswarthick, and Omar Elloumi, *The internet of things: Key applications and protocols*.London: John Wiley & Sons, 2011.
[3] Buyya, Rajkumar, and Amir Vahid Dastjerdi, *Internet of Things: Principles and paradigms*. New York: Elsevier, 2016.

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Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.
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Course Learning Outcomes (COs):

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

CO1: analyse various commands used in Raspbian operating system
CO2: develop python programs for connecting sensor and actuators
CO3: make use of IoT-Cloud platform for uploading and visualizing sensor data
CO4: develop smart application such as automatic door opening and closing using actuators and sensors

Course Articulation Matrix (CAM): U18AI508 INTERNET OF THINGS LABORATORY															
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO 3**
CO1	**U18AI508.1**	1	2	2	1	2	1	1	1	1	-	-	1	2	1	1
CO2	**U18AI508.2**	1	2	2	2	2	1	1	1	1	-	-	1	2	1	1
CO3	**U18AI508.3**	1	2	2	2	2	1	1	1	1	-	1	1	2	1	1
CO4	**U18A508.4**	1	2	2	2	2	1	1	1	1	1	1	1	2	1	1
U18AI508		**1**	**2**	**2**	**1.75**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**

U18AI509 MACHINE LEARNING LABORATORY

Class: B. Tech. V-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
-	-	2	1

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This coursewilldevelopstudent'sknowledgein / on…

LO1: binary classification and handling more than two classes
LO2: dimensionality reduction, linear and kernel models classes
LO3: multi-layer feed forward and back propagation networks
LO4: reinforcement learning, decision making by ensemble learning

List of Experiments

Experiment-I (Unit-I)

1. Implement classification on spam filtering for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

Experiment-II (Unit-I)

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

Experiment-III (Unit-I)

1. Implement prediction of lung pneumonia disease to demonstrate multi label classification

Experiment-IV (Unit-II)

1. Implement Linear discriminant analysis (LDA) using an appropriate binary dataset.

Experiment-V (Unit-II)

1.Implement Independent components analysis (ICA) on any appropriate data set.
2. Implement Principal components analysis (PCA) on any appropriate data set.

Experiment-VI (Unit-II)

1.Implement logistic regression on any appropriate data set.

Experiment-VII (Unit-II)

1.Implement linear regression on any appropriate data set.

Experiment-VIII (Unit-II)

1. Build linear SVM model for any appropriate data set.
2. Build anon linear SVM model for any appropriate data set.

Experiment-IX (Unitb-III)

1. Build a Multi layer perceptron network for handwritten digit recognition.

Experiment-X (Unit-III)

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

Experiment-XI (Unit-IV)

1. Implement Recommendation system using reinforcement learning.

Experiment-XII (Unit-IV)

1. Build an ensemble classifier for disease prediction and tune the model using hyper parameter optimization.

Laboratory Manual: *Machine Learning Laboratory Manual*, Dept. of CSE (AI & ML), KITSW.

Text Books:

[1] Peter Flach, *Machine Learning: The Art and Science of Algorithms that Make Sense of Data*, Cambridge University Press, 1st ed., ISBN: 978-1 -107-09639-4, 2012.
[2] Stephen Marsland, Taylor & Francis, *Machine Learning: An Algorithmic Perspective*, CRC, ISBN - 13: 978-1420067187, 2009.

Reference Books:

[1] Tom M. Mitchell, *Machine Learning*, MGH, Indian Edition, ISBN 1259096955, 2013
[2] S.Russell and P. Norvig, *Artificial Intelligence – A Modern Approach*, 2nd ed., Pearson

Education, 2003, ISBN: 978-0137903955
[3] Jason Bell, *Machine Learning: Hands-On for Developers and Technical Professionals*, John Wiley & Sons, 1st ed., ISBN-13: 978-1118889060, 2014.
[4] William W Hsieh, *Machine Learning Methods in the Environmental Sciences, Neural Networks*, Cambridge University Press, ISBN -13: 978-0805822410, 2009.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: develop programs given input class based on binary and multivariate classification techniques
CO2: develop programs on linear models and dimensionality reduction in real world problems like disease prediction
CO3: develop programs on ANN and its usage in real world problems like handwritten digit recognition
CO4: develop programs on reinforcement learning and decision making by ensemble learning

Course Articulation Matrix (CAM): U18AI509 MACHINE LEARNING LABORATORY																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI509.1**	2	2	2	3	3	2	-	1	1	1	-	2	2	2	2
CO2	**U18AI509.2**	3	3	3	2	2	2	-	1	1	1	-	2	3	2	3
CO3	**U18AI509.3**	2	2	2	3	3	1	-	1	1	1	-	2	2	2	3
CO4	**U18AI509.4**	3	2	3	3	3	2	-	1	1	1	-	2	3	2	3
U18AI509		**2.5**	**2.5**	**2.5**	**2.75**	**2.75**	**1.75**	-	1	1	1	-	2	**2.5**	**2**	**2.75**

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING(AI&ML)
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE: WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)

SCHEME OF INSTRUCTION & EVALUATION
VI-SEMESTER OF 4-YEAR B. TECH DEGREE PROGRAM

[6Th+3P+Mini project]

Sl. No	Category	Course Code	Course Title	Periods/week			Credits	Evaluation scheme				
				L	T	P	C	CIE			ESE	Total Marks
								TA	MSE	Total		
1	HSMC	U18TP601	Quantitative Aptitude & Logical Reasoning	2	-	-	1	10	30	40	60	100
2	HSMC	U18MH602	Managerial Economics and Accountancy	3	-	-	3	10	30	40	60	100
3	PE	U18AI603	Professional Elective - II / MOOC-II	3	-	-	3	10	30	40	60	100
4	PCC	U18AI604	Design and Analysis of Algorithms	3	-	-	3	10	30	40	60	100
5	PCC	U18AI605	Deep Learning	3	-	-	3	10	30	40	60	100
6	PCC	U18AI606	Computer Vision and Image Processing	3	1	-	4	10	30	40	60	100
7	PCC	U18AI607	Design and Analysis of Algorithms Laboratory	-	-	2	1	40	-	40	60	100
8	PCC	U18AI608	Deep Learning Laboratory	-	-	2	1	40	-	40	60	100
9	PCC	U18AI609	Computer Vision and Image Processing Laboratory	-	-	2	1	40	-	40	60	100
10	PROJ	U18AI610	Mini Project	-	-	2	1	100	-	100	-	100
Total:				17	-	8	21	280	180	460	540	1000
***Additional Learning*:** *Maximum credits allowed for Honours/Minor in Engineering*				-	-	-	*7*	-	-	-	-	-
Total credits for** students opted for **Honours/Minor students:				-	-	-	*21+7*	-	-	-	-	-

List of courses for additional learning through **MOOCs towards Honours/Minor in Engineering shall be prescribed by the department under Honours/ Minor Curricula*

[L= Lecture, T = Tutorials, P = Practicals& C = Credits] **Total Contact Periods/Week: 26** **Total Credits: 21**

Professional Elective-II / MOOC-II:
U18AI603B: Computer Networks
U18AI603C: Soft Computing
U18AI603D: Information Retrieval Systems
U18AI603M: MOOCs Course

U18TP601 QUANTITATIVE APTITUDE AND LOGICAL REASONING

Class: B. Tech. VI-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
2	-	-	1

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

UNIT-I(6)

Course Learning Objectives (LOs):

This course will develop students knowledge on/in…

LO1: quantitative aptitude & problem solving skills
LO2: computing abstract quantitative information
LO3: application of basic mathematics skills & critical thinking to draw conclusions
LO4: evaluating the validity & possible biases in arguments presented in authentic contexts

Quantitative Aptitude-I: Number system, Averages, Percentages, Ratios & proportions, Time, Speed &distance, Time and work, Data interpretation

UNIT - II (6)

Quantitative Aptitude-II: Simple Interest, Compound Interest, Profit & loss, Ages, Permutations &Combinations, Probability

UNIT - III (6)

Logical Reasoning-I: Series completion, Analogy, Coding and decoding, Blood relations, Number, Ranking & Time sequence test, Linear & Circular arrangements

UNIT - IV (6)

Logical Reasoning-II: Data sufficiency, Logical Venn diagram, Syllogisms, Statement & Arguments, Statement & Assumptions, Direction sense test

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TextBooks:

[1] R S Agarwal, Quantitative Aptitude for Competitive Examinations, 3rd ed. NewDelhi: S.Chand Publications, 2019. (Chapters1,6,7,8,10,11,12,15,17,21,22,30,31)

[2] R S Agarwal, A Modern Approach to Verbal and Non-Verbal Reasoning, 3rd ed.NewDelhi: S.Chand Publications, 2019. (Chapters Section I: 1,3,4,5,6,8,16, Section II: 2,3)

Reference Books:

[1] Dinesh Khattar, *Quantitative Aptitude for Competitive Examinations*, NewDelhi: Pearson India, 2019.

[2] Nishit K Sinha, *Reasoning for Competitive Examinations*, NewDelhi: Pearson India, 2019.

[3] R.N.Thakur, *General Intelligence and Reasoning*, NewDelhi: Mc GrawHill Education, 2017.

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in Course Webpage.

Course Patent: Patent relevant to the course content will be posted by the course faculty in Course Webpage.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: solve arithmetic relationships and interpret data using mathematical models

CO2: compute abstract quantitative information

CO3: apply basic mathematics & critical thinking skills to draw conclusions and solve problems

CO4: evaluate the validity & possible biases in arguments presented in authentic contexts logically & sensibly

Course Articulation Matrix (CAM): U18TP601 QUANTITATIVE APTITUDE AND LOGICAL REASONING																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18TP601.1**	-	2	-	1	-	-	-	-	-	-	-	1	-	-	1
CO2	**U18TP601.2**	-	2	-	1	-	-	-	-	-	-	-	1	-	-	1
CO3	**U18TP601.3**	-	1	-	2	-	2	-	-	-	-	-	1	-	-	1
CO4	**U18TP601.4**	-	1	-	2	-	2	-	-	-	-	-	1	-	-	1
U18TP601		**-**	**1.5**	**-**	**1.5**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	1

U18MH602 MANAGEMENT ECONOMICS AND ACCOUNTANCY

Class: B. Tech. VI-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

UNIT - II (9)

Functions of Management: Planning - Definition, Characteristics; Organizing - Definition, Characteristics; Staffing- Meaning, Functions of personnel management; Directing- Leadership, Nature; Motivation – Nature, Types (financial, non-financial, intrinsic and extrinsic), Communication- Process, Types, Co- ordination- Definition, Steps to achieve effective coordination, Controlling- Definition, process (Chapters 1,3, 4, 5, 6, 7 of Part 4 of Text 1)

UNIT - II (9)

Economics: Meaning and definition, Scope, Micro and Macro Economics, Methods of Economics, Laws of Economics

Forms of Business Organization: Sole Proprietor ship, Partnership firm- Types of Partners, Cooperative society, Joint Stock Company- Features, Types, Merits and demerits (Chapters 1, 2, 3, 4 of Part 2 of Text 1)

UNIT - III (9)

Double Entry System and Book Keeping: Accounting concepts and conventions, Overview of accounting cycle, Journal- meaning, Journalizing, Ledger- Meaning, Ledger posting, Balancing; Cashbook (Single column), Preparation of Trial balance (Chapter 3, 4 of Text 2)

UNIT - IV (9)

Final Accounts: Trading Account, profit and loss account and Balance Sheet with simple adjustments (Chapter5 of Text2)

Text Book:

[1] Y.K. Bhushan, Fundamentals of Business Organization and Management, 20th ed. New Delhi: Sultan Chand & Sons, 2017. (Units 1,2)

[2] T. S. Grewal, S.C. Gupta, Introduction to Accountancy, 8th ed. New Delhi: Sultan Chand & Sons, 2014. (Units 3, 4)

Reference Books:

[1] L. M. Prasad, Principles and Practice of Management, 9th ed. New Delhi: Sulthan Chand, 2016.

[2] R.L.Gupta&V.K.Gupta, Principles and Practice of Accountancy, 14th ed. New Delhi: Sulthan Chand and Son, 2018.

Course Research Paper: Research paper (Journals/conference papers) relevant to the course content will be posted by the course faculty in Course Webpage.

Course Patent: Patent relevant to the course content will be posted by the course faculty in Course Webpage.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, students will be able to...

CO1: comprehend the basic concepts of management

CO2: distinguish between micro & macro economics and forms of business organizations

CO3: pass journal entries & post the minto ledgers

CO4: prepare proof & loss accounts and assess the financial position through the balance sheet

Course Articulation Matrix (CAM): U18MH602 MANAGEMENT ECONOMICS AND ACCOUNTANCY																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18MH602.1**	-	-	-	-	-	-	-	-	1	1	1	1	1	-	-
CO2	**U18MH602.2**	-	-	-	-	-	-	-	-	1	1	2	1	1	-	-
CO3	**U18MH602.3**	-	-	-	-	-	-	-	-	1	1	1	1	1	-	-
CO4	**U18MH602.4**	-	-	-	-	-	-	-	-	1	1	1	1	1	-	-
U18MH602		**-**								**1**	**1**	**1.25**	**1**	**1**		

U18AI603B COMPUTER NETWORKS

Class: B.Tech. VI-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: introduction to computer networks and reference models
LO2: types of data link and medium access control protocols
LO3: routing algorithms,congestion control algorithms and inter networking
LO4: transport and application layer protocols used in the networks

UNIT – I (9)

Introduction: Uses of computer networks, Network hardware, Network software
Reference Models: OSI reference model, TCP/IP reference model, Comparison of OSI and TCP/IP reference model
Physical Layer: Transmission media - Guided transmission media, Wireless transmission, Communication satellites; Digital modulation and multiplexing
Switching: Circuit and Packet switching

UNIT - II (9)

Data Link Layer: Data link layer design issues, Error detection and correction, Elementary data link protocols, Sliding window protocols
Medium Access Control Sub Layer: Channel allocation problem, ALOHA, Carriers sense multiple access, Collision free protocols, Limited contention protocol, IEEE standard 802.3, Token bus, Token ring, Switched ethernet, Fast ethernet, Gigabit ethernet, Data link layer switching

UNIT - III (9)

Network Layer: Network layer design issues, Routing algorithms - Optimality principle, Shortest path algorithm, Flooding, Distance vector routing, Link state routing, Hierarchical routing, broadcast routing, Multicast routing
Congestion Control Algorithms: Approaches to congestion control, Traffic aware routing, Admission control, Traffic throttling, Load shedding
Internetworking: How networks differ, How networks can be connected, Tunneling, Internetwork routing, Packet fragmentation

UNIT - IV (9)

Network Layer in The Internet: IP version 4 protocol, IP addresses, IP version 6 protocol, Internet control protocols, OSPF – Interior gateway routing protocol, BGP – Exterior gateway routing protocol, Internet multicasting
Transport Layer: Transport services, Elements of transport protocols – Connection establishment and release, Error control and flow control, Crash recovery, Multiplexing congestion control; Internet transport protocols - UDP, TCP
Application Layer: Domain name system (DNS), Electronic mail, World Wide Web

Text Book:

[1] Andrew S.Tannenbaum, David J.Wetherall, "Computer Networks", *5th Edition Pearson Education,* ISBN-13: 978-0-13-212695-3, 2011

Reference Books:

[1] William Stallings, "Data and Computer Communications", *9th Edition, Prentice-Hall of India(PHI),* ISBN-81-203-1240-6, 2011

[2] Forouzan, "Data Communication and Networking", *5th Edition, Tata McGraw Hill* , ISBN: 978-0-07-296775-3, 2012

Course Research Paper: Research paper (Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: make use of OSI & TCP/IP reference models for data transmission
CO2: analyze different types of sliding window protocols for reliable data transfer & CSMA/CD protocols to know whether the shared channel for transmission is busy or not
CO3: examine routing algorithms for directing internet traffic efficiently and congestion control algorithms for controlling data packets in the network
CO4: analyze the different services of transport layer for ensuring data packets arrival and application layer protocols for accessing and managing files in a remote computer

Course Articulation Matrix (CAM): U18AI603B COMPUTER NETWORKS																
Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**U18AI603B.1**	2	2	2	2	2	1	-	1	1	1	-	1	2	2	2
CO2	**U18AI603B.2**	2	2	2	2	2	1	-	1	1	1	-	1	2	2	2
CO3	**U18AI603B.3**	2	2	2	2	2	1	-	1	1	1	-	1	2	2	2
CO4	**U18AI603B.4**	1	2	2	1	1	1	-	1	1	1	-	1	2	2	2
U18AI603B		**1.75**	**2**	**2**	**1.75**	**1.75**	**1**	**-**	**1**	**1**	**1**	**-**	**1**	**2**	**2**	**2**

U18AI603C SOFT COMPUTING

Class: B.Tech. VI-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LOs):

This course will develop student's knowledge in/on…

LO1: key aspects and evolution of soft computing and building blocks of genetic programming

LO2: supervised learning through neural networks and adaptive network models

LO3: fuzzy logic, fuzzy rules, fuzzy reasoning and fuzzy inference systems

LO4: neuro fuzzy modeling and data clustering algorithms

UNIT – I (9)

Introduction to Soft Computing: Evolution of Computing – Soft Computing Constituents – From Conventional AI to Computational Intelligence – Neuro - Fuzzy and Soft Computing Characteristics

Genetic Programming: Introduction to Genetic Programming (GP) – Applications of GP - Other Evolutionary computing methods such as Ant Colony Optimization and Swarm Optimization

UNIT - II (9)

Neural Networks: Adaptive Networks – Architecture - Back propagation for Feed Forward Networks –Recurrent Neural Networks

Supervised Learning Neural Networks: Perceptron - Ada line - Back propagation for Multi layer Perceptron-Radial Basis Function Networks

UNIT - III (9)

Fuzzy Logic: Fuzzy Sets – Basic definitions and terminology- Set-theoretic Operations- Membership Functions Formulation and Parameterization -Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems

UNIT - IV (9)

Neuro - Fuzzy Modeling: Adaptive Neuro- Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rule based Structure Identification

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Text Book(s):

[1] Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2002 (Chapters 1, 2, 3, 4, 8, 9, 12, 13, 15, 16).

[2] David E.Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 1989.

Reference Books:

[1] George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 1996.

[2] James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.

[3] KwangH.Lee, "First course on Fuzzy Theory and Applications", Springer, 2005.

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: identify the differences between conventional AI and computational Intelligence and apply genetic programming to solve optimization problems

CO2: apply supervised learning concepts to design neural networks that provide robust solutions for classification and predictive analysis

CO3: design fuzzy inference system for data classification and decision analysis using fuzzy logic, fuzzy rules and fuzzy reasoning

CO4: design neuro fuzzy models for feature extraction, solving classification and regression problems

Course Articulation Matrix (CAM): U18AI603C SOFT COMPUTING																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI603C.1**	2	2	2	2	1	-	-	1	1	1	-	1	1	1	1
CO2	**U18AI603C.2**	2	2	2	2	1	-	-	1	1	1	-	1	1	1	1
CO3	**U18AI603C.3**	3	2	3	3	1	-	-	1	1	1	-	1	1	1	1
CO4	**U18AI603C.4**	3	2	3	3	1	-	-	1	1	1	-	1	1	1	1
U18AI603C		**2.5**	**2**	**2.5**	**2.5**	**1**	**-**	**-**	**1**	**1**	**1**	**-**	**1**	**1**	**1**	**1**

U18AI603D INFORMATION RETRIEVAL SYSTEMS

Class: B.Tech. VI-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs) :

This course will develop students' knowledge in/on

LO1: retrieval of information based on capabilities and imprecise nature of the search algorithms
LO2: search techniques and finding relevant items
LO3: concept of indexing and the data structures most commonly associated with information retrieval systems and technical platforms needed for sophisticated display
LO4: retrieval and evaluation techniques for information retrieval systems

UNIT - I (9)

Introduction: Definition, Objectives, Functional overview, Relationship to database management systems, Digital libraries and Data warehouses

Information Retrieval System Capabilities: Search, Browse and miscellaneous

Cataloging and Indexing: Objectives, Indexing process, Automatic indexing and information extraction

UNIT - II (9)

Data Structure: Introduction, Stemming algorithms, Inverted file structures, N-gram data structure, PAT Data structure, Signature file structure and Hypertext and XML data structures, Hidden markov models

Automatic Indexing: Classes of automatic indexing, Statistical indexing, Natural language, Concept indexing, Hypertext linkages

UNIT - III (9)

Document and Term Clustering: Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters

User Search Techniques: Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, Weighted searches of boolean systems, Searching the internet and hypertext

Information Visualization: Introduction, Cognition and perception, Information visualization technologies

UNIT - IV (9)

Text Search Algorithms: Introduction, Software text search algorithms, Hardware text search systems

Multimedia Information Retrieval: Spoken language audio retrieval, Non-speech audio retrieval, Graph retrieval, Image retrieval, Video retrieval

Information System Evaluation: Introduction, Measures used in system evaluation

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Text Book:

[1] Gerald J. Kowalski, Mark T.Maybury, "Information Storage and Retrieval Systems: Theory and Implementation", *Kluwer Academic Publishers (Springer Publisher)*, 2nd Edition, ISBN-10: 058532090X, ISBN-13: 9788181284976, 2009.

Reference Books:

[1] Ricardo Baeza-Yates, Berthier Ribeiro-Neto, "Modern Information Retrieval", *Addison Wesley Publication*, 1st Edition, ISBN-10: 020139829X, ISBN-13: 9780321416919, 2011.

[2] Christopher D. Manning, Prabhakar Raghavan, HinrichSchutze, "Introduction to Information Retrieval", *Cambridge University Press*, 1st Edition, ISBN-10: 0521865719, ISBN-13: 978-0521865715, 2008.

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: apply all the IRS capabilities and perform information extraction operation using cataloging and indexing
CO2: identify suitable data structure and indexing mechanism for manual and automatic clustering
CO3: choose index to define the searchable concepts that represent the items received by asystem and viewing the results of a search using a hierarchical paradigm
CO4: select appropriate search algorithm, apply different measures for evaluation and compare the measurement results of the designed IRS system

Course Articulation Matrix (CAM): U18AI603D INFORMATION RETRIEVAL SYSTEMS																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI603D.1**	2	1	1	-	-	-	-	1	-	1	-	-	1	-	-
CO2	**U18AI603D.2**	1	1	2	1	-	-	-	1	-	1	-	2	2	1	-
CO3	**U18AI603D.3**	1	2	1	2	1	-	-	1	-	1	-	2	2	2	1
CO4	**U18AI603D.4**	2	2	2	2	1	-	-	1	-	1	-	2	2	2	2
U18AI603D		**1.5**	**1.5**	**1.5**	**1.66**	**1**	**-**	**-**	**1**	**-**	**1**	**-**	**2**	**1.75**	**1.66**	**1.5**

U18AI604 DESIGN AND ANALYSIS OF ALGORITHMS

Class: B.Tech. VI-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: time and space complexity, asymptotic notations, set operations, problem solving with divide and conquer strategy
LO2: greedy and backtracking methods to solve computational problems
LO3: principle of optimality and problem solving with dynamic programming method
LO4: branch and bound method, classes of P,NP,NP-Hard and NP-Complete

UNIT-I (9)

Introduction: Algorithm analysis, Performance analysis, Space complexity and time complexity, Big 'O' notation, Omega notation, Theta notation, Different mathematical approach's for solving time complexity of algorithms

Sets and Disjoint Set Union: Introduction, Union, Find operations

Divide and Conquer: General method, Binary search, Merge sort, Quick sort, Strassen's matrix multiplication

UNIT-II (9)

Greedy Method: General method, Knapsack problem, Job sequencing with deadlines, Optimal storage on tapes, Optimal merge patterns, Single source shortest paths

Back Tracking: General method, N-Queens problem, Sum of subsets, Graph coloring problem

UNIT-III (9)

Dynamic Programming: General method, Multistage graphs, All pairs shortest paths, Single source shortest paths, Optimal binary search trees, String editing, 0/1 Knapsack problem, Reliability design problem, Travelling sales person problem

UNIT-IV (9)

Branch and Bound: General method, Least cost (LC) search, The 15-puzzle problem, Control abstractions for LC search, 0/1 Knapsack problem, Travelling salesperson problem

NP Hard and NP Complete Problems: Basic concepts - Nondeterministic algorithms, The classes NP hard and NP complete; COOK's theorem, NP hard graph problems - Clique decision problem, Node cover decision problem, Traveling sales person decision problem

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Text Book:

[1] E.Horowitz, S.Sahni, S.Rajasekaran, *Fundamentals of Computer Algorithms,* 2nd ed. *Hyderabad:* Universities Press, 2018

Reference Books:

[1] Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest, Cliford Stein, *Introduction to Algorithms*, 3rd ed. New Delhi:Prentice-Hall of India, 2010

[2] Gajendra Sharma, *Design and Analysis of Algorithms*, 4thed. Rajput: Khanna Publishing,2019

[3] S.Sridhar, *Design and Analysis of Algorithms*, 3rded. UK: Oxford University Press, India, *2015*

[4] Mark Allen Weiss, *Data Structures and Algorithm Analysis in Java,* 3rd ed. New Delhi: Pearson,2012

[5] Rajiv Chopra, Shipra Raheja, *Design and Analysis of Algorithms*, New Delhi: New Age

International Publishers, 2019

Course Research Paper: Research paper (Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: apply divide and conquer strategy for searching and sorting techniques with performance
CO2: analyze 0/1 Knapsack problem, optimal merge pattern and single source shortest path algorithms using greedy method and N-Queen problem, graph colouring problem using backtracking method
CO3: d*esign of algorithms using dynamic programming approach to find the shortest path*
CO4: analyze and categorize NP-Hard and NP-Complete problems for the classes of P and NP

Course Articulation Matrix (CAM): U18AI604 DESIGN AND ANALYSIS OF ALGORITHMS																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI604.1**	3	3	2	2	1	-	-	1	1	1	-	1	2	1	2
CO2	**U18AI604.2**	3	3	3	2	1	-	-	1	1	1	-	1	2	1	2
CO3	**U18AI604.3**	3	3	3	2	1	-	-	1	1	1	-	1	2	1	2
CO4	**U18AI604.4**	2	2	2	2	1	-	-	1	1	1	-	1	2	1	2
U18AI604		**2.75**	**2.75**	**2.5**	**2.5**	**2**	**-**	**-**	**1**	**1**	**1**	**-**	**1**	**2**	**1**	**2**

U18AI605 DEEP LEARNING

Class: B.Tech. VI-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: deep learning fundamental and regularization parameters
LO2: principles and architectures of convolutional neural networks
LO3: principles and architectures of recurrent and recursive neural networks
LO4: practical methodology and applications of deep neural networks

UNIT – I (9)

Introduction: Why Deep Learning? Deep learning architecture, Historical trends in deep learning and its performance, deep feed forward networks, Gradient based learning, Hidden Units, Back propagation's and differentiation algorithms, Case study: Deep learning applications and societal impact

Regularization for Deep learning: Parameters norm penalties, Norm penalties as constrained optimization, Regularization and under constrained problems, Dateset augmentation, Noise robustness, semi-supervised learning, multitask learning, Parameter tying and sharing, Sparse representation

UNIT –II (9)

Optimization for Training Deep Models: Pure optimization, challenges in neural network optimization, Basic algorithms, Parameter initialization strategies, Algorithms with adaptive learning rates

Convolutional Neural Networks: Convolution operations, Motivation, Pooling, Convolution and pooling as an infinitely strong prior, Variants of the basic convolution functions, Structured outputs, Data types, Efficient convolution algorithms, random or unsupervised features, Convolution networks and the history of deep learning **TensorFlow case study:** Using Convolutional Neural Networks for recognizing and classifying images

UNIT– III (9)

Recurrent Neural Networks: Architecture, Unfolding computational graphs, Recurrent neural networks, Bidirectional Recurrent neural networks, Encoder-decoder architectures, Deep recurrent networks

Recursive Neural networks: Architecture, Challenges of long-term dependencies, Echo state networks, Leaky units, Strategies for multiple time scales, Long and short term memory for recursive neural networks, Gated recursive neural networks, optimization for long term dependencies, Explicit memory

Case study: Tensor flow modeling for recognition of hand-written digits

UNIT - IV (9)

Practical Methodology: Performance Metrics, Default baseline models, selecting hyper parameters, debugging strategies, Case study: Multi digit number recognition

Applications: Large scale deep learning, Computer vision using deep learning, Speech recognition using deep learning, Natural language processing using deep learning, other deep learning applications,

TensorFlow case studies: Textual document processing, Deep learning on cloud

Text Book(s):

[1] Ian Goodfellow and YoshuaBengio and Aaron Courville, *Deep Learning*, 1st ed.,MIT Press,2017.

[2] Antonio Gulli, Amita Kapoor, Sujit Pal, *Deep Learning with TensorFlow 2.0 and Keras*, 2nd ed., Mumbai: Packt, 2019 (Chapters: 1, 3, 4, 5).

Reference Books:

[1] Deng & Yu, *Deep Learning: Methods and Applications,1st ed.,* USA:Now Publisher, 2013

[2] Ian Goodfellow, YoshuaBengio, Aaron Courville, *Deep Learning*, 1sted., Massachusetts: MIT Press, 2016.

[3] Sebastian Raschka, Vahid Mirjalili - *Python Machine Learning*, 2nd ed., Mumbai: Packt, 2019.

Course Research Paper: Research paper (indexed Journal/conference paper) relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: apply deep learning fundamentals and regularization techniques for tuning the performance of the deep learning models

CO2: design and analyze deep convolutional neural network models for image recognition

CO3: apply recurrent and recursive neural network architectures for handling long term dependencies and vanishing gradient problem

CO4: design deep learning models for computer vision, speech and natural language processing applications

Course Articulation Matrix (CAM):U18AI605 DEEP LEARNING

Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**U18AI605.1**	2	2	2	1	-	1	-	1	1	1	-	1	2	1	2
CO2	**U18AI605.2**	2	2	1	2	2	-	-	1	1	1	-	1	2	1	2
CO3	**U18AI605.3**	2	2	1	3	2	-	-	1	1	1	-	1	2	1	2
CO4	**U18AI605.4**	-	2	2	3	2	-	-	1	1	1	-	1	2	1	2
U18AI605		**2**	**2**	**1.5**	**2.25**	**2**	**1**	**-**	**1**	**1**	**1**	**-**	**1**	**2**	**1**	**2**

U18AI606 COMPUTER VISION AND IMAGE PROCESSING

Class: B.Tech. VI-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	1	-	4

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: fundamental concepts of image processing such as sampling, quantization, basic relationship between pixels, intensity transformation and spatial filtering techniques

LO2: frequency domain filters for smoothing and sharpening of input images along with image restoration and reconstruction techniques

LO3: morphological image processing and image segmentation techniques applied on input images to filter and segment the objects present in an input image

LO4: providing vision to a computer by extracting the features from an object present in an input image and identify the object using classification techniques

UNIT – I (9+3)

Introduction: What is digital image processing, Examples of fields that use digital image processing, Fundamental steps in digital image processing

Digital Image Fundamentals: Elements of visual perception, Light and the electromagnetic spectrum, Image sensing and acquisition, Image sampling and quantization, some basic relationships between pixels, Introduction to the mathematical tools used in digital image processing

Intensity Transformations & Spatial Filtering: The basics of intensity transformations and spatial filtering, Basic intensity transformation functions, Histogram processing, Fundamentals of spatial filtering, Smoothing spatial filters, Sharpening spatial filters, Combining spatial enhancement methods.

UNIT - II (9+3)

Filtering in the Frequency Domain: A brief history of the Fourier series and transform, Preliminary concepts, Discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, Some properties of the 2-D discrete Fourier transform, The basics of filtering in the frequency domain

Image Restoration and Reconstruction: A model of the image degradation/restoration process, Noise models, Restoration in the presence of noise only-spatial filtering, Periodic noise reduction using frequency domain filtering

UNIT - III (9+3)

Morphological Image Processing: Preliminaries, Erosion and dilation, Opening and closing, Hit-or-miss transformation, Some basic morphological algorithms

Image Segmentation: Fundamentals, Point, Line and edge detection**,** Thresholding, Segmentation by region growing and by region splitting and merging, Region segmentation using clustering and super pixels, Segmentation using morphological watersheds

UNIT - IV (9+3)

Feature Extraction: Background, Boundary preprocessing, Boundary feature descriptors, Region feature descriptors, Principal components as feature descriptors, Whole-image features, Scale-invariant feature transform

Image Pattern Classification: Background, Patterns and pattern classes, Pattern classification by prototype matching, Optimum (Bayes) statistical classifiers, Neural networks and deep learning, Deep convolution neural networks

Text Book:

[1] Rafael C. Gonzalez, Richard E. Woods,*Digital Image Processing*, 4th ed., New Delhi: Pearson, 2018. *(Chapters 1 to 5, 9 to 12)*

Reference Books:

[1] Anil K. Jain, *Fundamentals of Image Processing*, 1st ed., Chennai: Pearson, 2015.

[2] B. Chanda, D. Dutta Majunder, *Digital Image Processing and Analysis*, 2nd ed., New Delhi: Prentice Hall of India, 2011.

[3] S. Sridhar, *Digital Image Processing*, 2nd ed., Noida: Oxford University Press, 2016.

[4] Munesh C. Trivedi, *Digital Image Processing*, 1st ed., New Delhi: Khanna Book Publishing, 2014.

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: apply the image pre-processing techniques such as sampling, quantization, basic relationships between pixels, various intensity transformation and filtering techniques to enhance the look and feel of an input image for further processing

CO2: identify the effect of frequency domain filters, image restoration and reconstruction techniques and apply the same for smoothing, sharpening and image enhancement

CO3: apply morphological image processing techniques on objects present in input images to extract image components and discover various ways to segment the objects present in the input images

CO4: extract the features to depict the shape of an object and apply classification techniques to identify the object present in an input image

Course Articulation Matrix (CAM):U18AI606 COMPUTER VISION AND IMAGE PROCESSING																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI606.1**	2	2	2	2	1	-	-	1	1	1	-	1	1	1	1
CO2	**U18AI606.2**	3	3	3	3	1	-	-	1	1	1	-	3	1	1	1
CO3	**U18AI606.3**	3	3	3	3	1	-	-	1	1	1	-	3	1	1	1
CO4	**U18AI606.4**	3	3	3	3	1	-	-	1	1	1	-	3	1	1	1
U18AI606		**2.75**	**2.75**	**2.75**	**2.75**	**1**	**-**	**-**	**1**	**1**	**1**	**-**	**2.5**	**1**	**1**	**1**

U18AI607 DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY

Class: B.Tech. VI-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
-	-	2	1

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LOs):

This course will develop student's knowledge in/on…

LO1: searching and sorting techniques using divide and conquer strategy
LO2: computational problems using greedy and backtracking methods
LO3: computational problems using dynamic programming technique
LO4: computational problems using branch and bound methods

List of Experiments

Experiment-I (UNIT-I)

1. Program to implement binary search algorithm.
2. Program to implement min-max algorithm.

Experiment-II(UNIT-I)

1. Program to implement merge sort algorithm
2. Program to implement quick sort algorithm

Experiment-III(UNIT-I)

1.Apply strassen's matrix multiplication to multiply following matrix

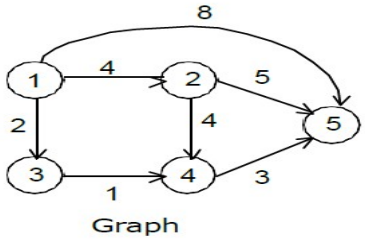
$$A=\begin{pmatrix}1 & 2\\ 3 & 4\end{pmatrix} \qquad B=\begin{pmatrix}2 & 1\\ 4 & 3\end{pmatrix}$$

Experiment-IV(UNIT-II)

1. Program to implement 0/1 knapsack problem.
2. Program to implement Job sequencing with deadlines .

Experiment-V(UNIT-II)

1. Apply Dijkstras algorithm find the shortest path from 1 to each of the other five ertices in the graph



Graph

2. Program to implement N-Queens problem.

Experiment-VI(UNIT-II)

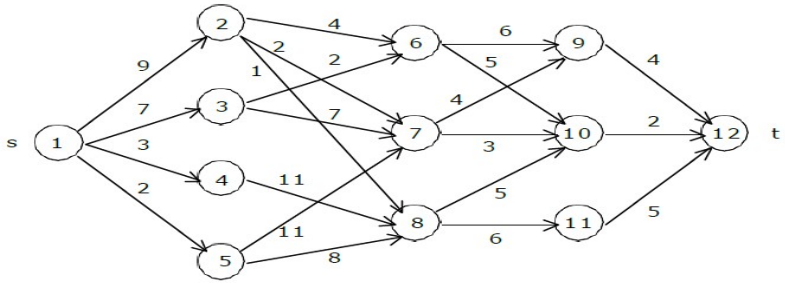
1. Program to implement sum of subsets

Experiment-VII(UNIT-III)

1. Implement bellman ford algorithm for Single source shortest paths using

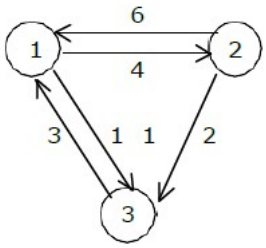
Experiment-VIII(UNIT-III)

1. Apply Multistage graph algorithm and find shortest path



Experiment-IX(UNIT-III)

1. Apply All pairs shortest paths algorithm and find shortest path



Experiment-X(UNIT-III)

1. Program to implement Optimal binary search trees.

Experiment-XI(UNIT-III)

1. Apply travelling sales person algorithm using dynamic programming and find shortest path

$$\begin{pmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{pmatrix}$$

Experiment-XII(UNIT-IV)

1. Apply travelling salesperson algorithm using branch and bound and find shortest path

$$\begin{pmatrix} \infty & 20 & 30 & 10 & 11 \\ 15 & \infty & 16 & 4 & 2 \\ 3 & 5 & \infty & 2 & 4 \\ 19 & 6 & 18 & \infty & 3 \\ 16 & 4 & 7 & 16 & \infty \end{pmatrix}$$

Note: Students are required to develop generalized programs. The above specified examples can be taken as sample input only.

Laboratory Manual:

[1] *Design and analysis of algorithms laboratory manual*, Dept. of CSE, KITSW.

Reference Books:

[1] E.Horowitz, S.Sahni, S.Rajasekaran, *Fundamentals of Computer Algorithms,* 2nd ed, Universities Press, 2018

[2] Mark Allen Weiss, *Data Structures and Algorithm Analysis in Java,* 3rd ed, Pearson. 2012

[3] Kathy Sierra, Bert Bates, *Head First Java8*, 2nd ed, O'Reilly Publications, 2020.

[4] Narasimha Karumanchi, *Data Structures and Algorithms Made Easy inJava*, careermonk 2011
[5] Uttam K. Roy, *Advanced JAVA Programming*, Oxford Publications, 2015

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: demonstrate programs on binary search, min-max, mergesort, quicksort and strassen's matrix multiplication problems
CO2 : develop knapsack, job sequencing with deadline, shortest path using greedy method, N-Queens and sum of subsets using backtracking method
CO3 : construct programs on single source shortest path, multistage graph and all pairs shortest path using dynamic programming technique
CO4: develop programme for travelling sales person problem using branch and bound method

Course Articulation Matrix (CAM):U18AI607 DESIGN AND ANALYSIS OF ALGORITHMS LAB																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI607.1**	3	3	2	2	1	-	-	1	1	1	-	1	2	1	2
CO2	**U18AI607.2**	3	3	3	2	1	-	-	1	1	1	-	1	2	1	2
CO3	**U18AI607.3**	3	3	3	2	1	-	-	1	1	1	-	1	2	1	2
CO4	**U18AI607.4**	2	2	2	2	1	-	-	1	1	1	-	1	2	1	2
U18AI607		**2.75**	**2.75**	**2.5**	**2**	**1**	**-**	**-**	**1**	**1**	**1**	**-**	**1**	**2**	**1**	**2**

U18AI608 DEEP LEARNING LABORATORY

Class: B.Tech. VI-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
-	-	2	1

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in / on…

LO1: deep learning fundamentals and regularization parameters
LO2: principles and architectures of convolutional neural networks
LO3: principles and architectures of recurrent and recursive neural networks
LO4: practical methodology and applications of deep neural networks

List of Experiments

Experiment-I (Unit-I)
1. Implement Gradient descent algorithm using neural networks

Experiment-II (Unit-I)
1. Implement Back propagation algorithm using neural networks

Experiment-III (Unit-I)
1. Implement Regularization Techniques in Deep Learning – L1, L2 and Dropout

Experiment-IV (Unit-II)
1. Implement Adaptive learning rate algorithms-Adam, Adagrad, Adadelta and RMSProp

Experiment-V (Unit-II)
1. Build a CNN classification model for Image Recognition using tensor flow

Experiment- VI (Unit-III)
1. Build a CNN classification model for recognition of hand-written digits using tensor flow

Experiment- VII (Unit-III)
1. Build a classification model for text classification using Recurrent Neural Networks

Experiment- VIII (Unit-III)
1. Implement a recursive neural network model for predictive analysis

Experiment - IX (Unit-IV)
1. Build a deep learning model for multi digit number recognition

Experiment- X (Unit-IV)
1. Build a deep learning model for Speech recognition

Experiment-XI (Unit-IV)
1. Build a deep learning model for Natural language processing
2. Build a deep learning model for Textual document processing

Experiment- XII (Unit-IV)
1. Build a deep learning model for handwritten digit recognition using tensorflow

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Laboratory Manual:

[1] *Deep Learning Laboratory Manual*, Dept. of CSE (AI&ML), KITSW.

Text Books:

[1] Ian Goodfellow and YoshuaBengio and Aaron Courville, *Deep Learning*, 1st ed.,MIT Press, 2017.

[2] Antonio Gulli, Amita Kapoor, Sujit Pal, *Deep Learning with TensorFlow 2.0 and Keras*, 2nd ed., Mumbai: Packt, 2019 (Chapters : 1, 3, 4, 5).

Reference Books:

[1] Deng & Yu, *Deep Learning: Methods and Applications,1st ed.,* USA:Now Publisher, 2013.

[2] Ian Goodfellow, YoshuaBengio, Aaron Courville, *Deep Learning*, 1sted., Massachusetts: MIT Press, 2016.

[3] Sebastian Raschka, Vahid Mirjalili - *Python Machine Learning*, 2nd ed., Mumbai: Packt, 2019.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: develop deep learning models and regulate parameters for effective performance

CO2: develop adaptive learning rate algorithms and convolutional neural networks

CO3: develop programs for predictive analysis using recurrent neural networks and recursive neural networks

CO4: develop deep learning models for speech recognition, natural language processing and textual document processing

Course Articulation Matrix (CAM):U18AI608 DEEP LEARNING LABORATORY																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI608.1**	2	2	2	1	-	1	-	1	1	1	-	1	2	1	2
CO2	**U18AI608.2**	2	2	1	2	2	-	-	1	1	1	-	1	2	1	2
CO3	**U18AI608.3**	2	2	1	3	2	-	-	1	1	1	-	1	2	1	2
CO4	**U18AI608.4**	2	2	2	3	2	-	-	1	1	1	-	1	2	1	2
U18AI608		**2**	**2**	**1.5**	**2.25**	**2**	**1**	**-**	**1**	**1**	**1**	**-**	**1**	**2**	**1**	**2**

U18AI609 COMPUTER VISION AND IMAGE PROCESSING LABORATORY

Class: B.Tech. VI-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
-	-	2	1

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on...

LO1: image pre - processing techniques such as intensity transformation techniques and spatial filtering techniques
LO2: Frequency domain filters for smoothing and sharpening of input images along with image restoration and reconstruction techniques
LO3: morphological image processing and image segmentation techniques
LO4: feature extraction and classification techniques

List of Experiments

Experiment-I (Unit-I)
1. Write a program to read an image and display an image.
2. Write a program to convert a color image to gray scale and binary image.
3. Write a program to apply various affine transformations to an input image.

Experiment-II (Unit-I)
1. Write a program to apply basic intensity transformation functions.
2. Write a program to implement contrast stretching.
3. Write a program to implement intensity level slicing.
4. Write a program to implement bit-plane slicing and show all bit planes during experimentation.
5. Write a program to generate histogram of an input image.
6. Write a program to implement histogram equalization.
7. Write a program to implement histogram processing.

Experiment-III (Unit-I)
1. Write a program to demonstrate 1-D correlation.
2. Write a program to demonstrate 1-D convolution.
3. Write a program to demonstrate smoothing linear filters.
4. Write a program to demonstrate order statistic (non-linear) filters.

Experiment-IV (Unit-II)
1. Write a program to demonstrate sharpening filters.

Experiment-V (Unit-II)
1. Write a program to demonstrate various frequency domain filtering techniques.

Experiment-VI (Unit-II)
1. Write a program to demonstrate various image restoration and reconstruction techniques.

Experiment-VII (Unit-III)
1. Write a program to demonstrate erosion and dilation.
2. Write a program to demonstrate opening and closing.
3. Write a program to demonstrate hit or miss transform.

Experiment-VIII (Unit-III)
1. Write program to demonstrate boundary extraction.
2. Write a program to demonstrate convex hull.
3. Write a program to demonstrate thinning.

4. Write a program to demonstrate thickening.
5. Write a program to demonstrate skeletonization.

Experiment-IX (Unit-III)

1. Write a program to demonstrate the detection of point.
2. Write a program to demonstrate the detection line.
3. Write a program to demonstrate the detection of an edge.

Experiment-X (Unit-III)

1. Write a program demonstrate various segmentation techniques.

Experiment-XI (Unit-IV)

1. Write a program to demonstrate various feature extraction techniques.

Experiment-XII (Unit-IV)

1. Write a program to demonstrate object detection using various classification techniques.

Laboratory Manual:

[1] *Computer Vision and Image Processing Laboratory Manual*, Dept. of CSE(AI&ML), KITSW.

Text Book:

[1] Rafael C. Gonzalez, Richard E. Woods,*Digital Image Processing*, 4th ed., New Delhi: Pearson, 2018. *(Chapters 1 to 5, 9 to 12)*

Reference Books:

[1] Anil K. Jain, *Fundamentals of Image Processing*, 1st ed., Chennai: Pearson, 2015.
[2] B. Chanda, D. Dutta Majunder, *Digital Image Processing and Analysis*, 2nd ed., New Delhi: Prentice Hall of India, 2011.
[3] S. Sridhar, *Digital Image Processing*, 2nd ed., Noida: Oxford University Press, 2016.
[4] Munesh C. Trivedi, *Digital Image Processing*, 1st ed., New Delhi: Khanna Book Publishing, 2014.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: develop programs to enhance the look and feel of the image by using various intensity transformation function various filtering techniques
CO2: develop programs to enhance the look and feel of the input image by using various frequency domain filtering techniques and image restoration and re-construction techniques
CO3: apply various morphological algorithms to extract the components of an input image and segment the image for further processing
CO4: develop programs to extract the features from input image for identification and classification of objects

Course Articulation Matrix (CAM):U18AI609 COMPUTER VISION AND IMAGE PROCESSING LABORATORY

Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**U18AI609.1**	2	2	2	2	1	-	-	1	1	1	1	1	1	1	1
CO2	**U18AI609.2**	3	3	3	3	1	-	-	1	1	1	1	3	1	1	1
CO3	**U18AI609.3**	3	3	3	3	1	-	-	1	1	1	1	3	1	1	1
CO4	**U18AI609.4**	3	3	3	3	1	-	-	1	1	1	1	3	1	1	1
U18AI609		**2.75**	**2.75**	**2.75**	**2.75**	**1**	**-**	**-**	**1**	**1**	**1**	**1**	**2.5**	**1**	**1**	**1**

SCHEME OF INSTRUCTION & EVALUATION
VII-SEMESTER OF 4-YEAR B. TECH DEGREE PROGRAM

[4Th+2P+1MC+1MP-I]

Sl. No	Category	Course Code	Course Title	Periods/week			Credits	Evaluation scheme				
				L	T	P	C	CIE			ESE	Total Marks
								TA	MSE	Total		
1	OE	U18OE701	Open Elective - III	3	_	_	3	10	30	40	60	100
2	PE	U18AI702	Professional Elective - III / MOOC-III	3	-	-	3	10	30	40	60	100
3	PE	U18AI703	Professional Elective - IV / MOOC-IV	3	-	-	3	10	30	40	60	100
4	PCC	U18AI704	Cloud Computing	3	-	-	3	10	30	40	60	100
5	PCC	U18AI705	Cloud Computing Laboratory	-	-	2	1	40	-	40	60	100
6	PCC	U18AI706	Natural Language Processing Laboratory	-	-	2	1	40	-	40	60	100
7	PROJ	U18AI707	Major Project - Phase - I	-	-	6	3	100	-	100	-	100
8	MC	U18AI708	Internship Evaluation	-	-	2	-	-	-	-	-	-
Total:				**12**	**_**	**12**	**17**	**220**	**120**	**340**	**360**	**700**
Additional Learning*: *Maximum credits allowed for Honours/Minor in Engineering*				-	-	-	*7*	-	-	-	-	-
Total credits for students opted for Honours/Minor students:				**-**	**-**	**-**	***17+7***	**-**	**-**	**-**	**-**	**-**

** List of courses for additional learning through **MOOCs** towards Honours/Minor in Engineering shall be prescribed by the department under Honours/ Minor Curricula*

[L= Lecture, T = Tutorials, P = Practicals & C = Credits] **Total Contact Periods/Week: 24** **Total Credits: 17**

Open Elective-III:	Professional Elective-III / MOOC-III:	Professional Elective-IV / MOOC-IV:
U18OE701A: Disaster Management	U18AI702A: Reinforcement Learning	U18AI703B: Cognitive Computing Systems
U18OE701B: Project Management	U18AI702B: Big Data Analytics	U18AI703C: Cryptography and Network Security
U18OE701C: Professional Ethics in Engineering	U18AI702C: Social and Information Network Analysis	U18AI703D: Natural Language Processing
U18OE701D: Rural Technology and Community Development	U18AI702M: MOOCs course	U18AI703M: MOOCs course

U18OE701A DISASTER MANAGEMENT

Class: B. Tech. VII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: disaster types, its impact & national policy on disaster management
LO2: prevention, preparedness and mitigation measures for different disasters, emergency support functions and relief camps
LO3: different types of vulnerability, macroeconomic, financial management of disaster and its related losses
LO4: disaster management for infrastructure, treatment of plants, geo spatial information in agriculture, multimedia technology in disaster risk management and training

UNIT – I (9)

Introduction & Principles of Disaster Management: Nature – Development, Hazards and disasters; Natural disasters – Earth quakes, Floods, Fire, Landslides, Cyclones, Tsunamis, Nuclear; Chemical dimensions and Typology of disasters – Public health disasters, National policy on disaster management

UNIT - II (9)

Prevention Preparedness and Mitigation Measures: Prevention, Preparedness and Mitigation Measures for various disaster reliefs and logistics management, Emergency support functions and their coordination mechanism, Resources and material management, Management of relief camp

UNIT - III (9)

Risk and Vulnerability: Building codes and land use planning, Social vulnerability, Environmental vulnerability, Macroeconomic management and sustainable development, Climate change, Risk rendition, Financial management of disaster and related losses

UNIT - IV (9)

Role of Technology in Disaster Management: Disaster Management for infrastructures, Taxonomy of infrastructure, Treatment plants and process facilities, Electrical sub stations, Roads and Bridges, Geo spatial information in agriculture, Drought assessment, Multimedia technology in disaster risk management and training

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Text Book:

[1] Rajib Shah and R.R Krishnamurthy, *Disaster management-Global challenges and local solutions*, Hyderabad: Universities Press(India) Pvt.Ltd., 2009.

Reference Book:

[1] Satish Modh, *Introduction to Disaster management*, Bengaluru: Macmillan India Ltd., 2010.

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: classify the disasters and discuss natural & non-natural disasters, their implications, the institutional & legal framework for national policy on disaster management in India

CO2: identify mitigation strategies, preparedness & prevention measures and prioritizes the rescue and relief operations to reduce the impact of a disaster.

CO3: list the vulnerable groups in disaster; examine the concepts of macroeconomic & sustainability & impact disaster on development

CO4: discuss disaster management for infrastructure, utilize geospatial information in agriculture and apply multimedia technology for disaster risk management and training

Course Articulation Matrix (CAM): U18OE701A DISASTER MANAGEMENT																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18OE701A.1**	-	-	-	-	-	2	2	1	-	-	1	1	-	-	-
CO2	**U18OE701A.2**	-	-	-	-	-	2	2	1	-	-	1	1	-	-	-
CO3	**U18OE701A.3**	-	-	-	-	-	2	2	1	-	-	1	1	-	-	-
CO4	**U18OE701A.4**	-	-	-	-	-	2	2	1	-	-	1	1	-	-	-
U18OE701A		**-**	**-**	**-**	**-**	**-**	**2**	**2**	**1**	**-**	**-**	**1**	**1**	**-**	**-**	**-**

U18OE701B PROJECT MANAGEMENT

Class: B. Tech. VII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: role of project manager, organization and management functions
LO2: effective time & conflict management, ethics & professional responsibilities
LO3: project planning, scheduling and budgeting
LO4: cost control, risk management and quality control techniques

UNIT – I (9)

Project Management: Understanding project management, Role of project manager, Classification of projects, Project management growth, Definitions and concepts, Organizational structures-Organizing and staffing the project management office and team; Management functions

UNIT - II (9)

Time and Conflict Management: Understanding time management, Time management forms, Effective time management, Stress and burnout, Conflict environment, Conflict resolution, Management of conflicts, Performance measurement, Financial compensation and rewards, Morality, ethics, Corporate culture, Professional responsibilities, Success variables, Working with executives

UNIT - III (9)

Project planning: General planning, Life-cycle phases, Proposal preparation, Project planning, The statement of work, Project specifications, Milestone schedules, Work breakdown structure, Executive role in planning, The planning cycle, Handling project phase outs and transfers, Stopping projects, Scheduling techniques – CPM and PERT, Pricing and estimating

UNIT - IV (9)

Cost and quality control: Understanding cost control, Earned Value Measurement System, Cost control problems, Methodology for trade-off analysis, Risk management process, Risk analysis, Risk responses, Monitoring and control of risks, Contract management, Quality management concepts, Cost of quality, Quality control techniques

Text Book:

[1] Harold Kerzner, *Project Management: A Systems Approach to Planning, Scheduling an Controlling*, 10th ed. Hoboken, NJ: John Wiley & Sons Inc., 2009

Reference Books:

[1] Jack R Meredith & Samuel J mantel Jr., *Project Management: A Managerial Approach*, 8th ed. Hoboken, NJ: John Wiley & Sons Inc., 2012
[2] John M Nicholas & Herman Steyn, *Project Management for Business, Engineering and Technology*, 4th ed. Abingdon, UK: Taylor & Francis, 2012
[3] Adedeji B.Badiru, *Project Management: Systems, Principles and Applications*, Florida. USA: CRC Press, 2012

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project

titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: evaluate the desirable characteristics of effective project managers
CO2: plan to resolve issues in conflicting environments
CO3: apply appropriate approaches to plan a new project in-line with project schedule & suitable budget
CO4: estimate the risks to be encountered in a new project and apply appropriate techniques to assess & improve ongoing project performance

Course Articulation Matrix (CAM): U18OE701B PROJECT MANAGEMENT																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18OE701B.1**	-	-	-	-	-	1	-	-	-	1	1	-	-	-	-
CO2	**U18OE701B.2**	-	-	-	-	-	1	-	2	-	1	1	-	-	-	-
CO3	**U18OE701B.3**	1	1	-	-	-	1	-	-	-	1	1	-	-	-	-
CO4	**U18OE701B.4**	1	1	-	-	-	1	-	-	-	1	1	-	-	-	-
U18OE701B		**1**	**1**	**-**	**-**	**-**	**1**	**-**	**2**	**-**	**1**	**1**	**-**	**-**	**-**	**-**

U18OE701C PROFESSIONAL ETHICS IN ENGINEERING

Class: B. Tech. VII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: human values and engineering ethics
LO2: professionalism, theory of virtues and code of ethics
LO3: safety & risk benefit analysis, professional and intellectual property rights
LO4: environmental & computer ethics and various roles of engineers in a company

UNIT–I (9)

Human Values: Morals, Values & ethics, Integrity, Work ethic, Service learning, Civic virtue, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage, Valuing time, Co-operation, Commitment, Empathy, Self-confidence, Character, Spirituality

Engineering Ethics: Senses of "Engineering Ethics", Variety of moral issues, Types of inquiry, Moral dilemmas, Moral autonomy, Kohlberg's theory, Gilligan's theory – Consensus and controversy

UNIT–II (9)

Profession and professionalism: Profession and its attributes, Models of professional roles

Theory of Virtues: Definition of virtue and theories of virtues, Self-respect, Responsibility and senses, Modern theories of virtues, Uses of ethical theories

Engineering a social experimentation: Engineering as experimentation, Engineers as responsible experimenters, Codes of ethics, A balanced outlook on law, The challenger case study

UNIT–III (9)

Safety, Responsibilities and Rights: Safety and risk, Assessment of safety and risk, Risk benefit analysis and reducing risk - Three Mile Island and Chernobyl case studies; Collegiality and loyalty, Respect for authority, Collective bargaining, Confidentiality, Conflicts of interest, Professional rights, Employee rights, Intellectual Property Rights (IPR), Discrimination

UNIT–IV (9)

Global Issues: Multinational corporations-Environmental ethics, Computer ethics, Engineers as managers, Consulting engineers, Engineers as expert witnesses and advisors, Moral leadership, Sample code of ethics (*Specific to a particular engineering discipline*)

Text Book:

[1] D.R.Kiran, *Professional Ethics and Human Values*, New York: Mc Graw Hill, 2013 *(Chapters1 to 5)*

Reference Books:

[1] Govindarajan.M, Natarajan.S, SenthilKumar.V.S, *Professional Ethics and Human Values,* New Delhi: Prentice Hall of India, 2013.

[2] Mike Martin and Roland Schinzinger, *Ethics in Engineering*, 4th ed. New York: Mc Graw Hill, 2014.

[3] Charles D. Fleddermann, *Engineering Ethics*, 4th ed. New Delhi: Prentice Hall, 2004.

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: identify the need for human values, morals & ethics and apply Gilligan's & Kohlberg's theories for morale development
CO2: identify the desired characteristics of a professional & the need for code of ethics & balanced outlook on law
CO3: estimate the safety margin & threshold level and describe the procedure for obtaining a patent
CO4: analyze the role of engineer in multinational companies as an advisor, consultant & manager

Course Articulation Matrix (CAM): U18OE701C PROFESSIONAL ETHICS IN ENGINEERING															
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18OE701C.1**	-	-	-	-	-	1	-	2	1	-	-	1			
CO2	**U18OE701C.2**	-	-	-	-	-	1	-	2	1	-	-	1			
CO3	**U18OE701C.3**	-	-	-	-	-	1	-	2	1	-	-	1			
CO4	**U18OE701C.4**	-	-	-	-	-	1	-	2	1	-	-	1			
U18OE701C		**-**	**-**	**-**	**-**	**-**	**1**	**-**	**2**	**1**	**-**	**-**	**1**			

U18OE701D RURAL TECHNOLOGY AND COMMUNITY DEVELOPMENT

Class: B. Tech. VII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on...

LO1: building technologies, modern agricultural implements and food processing methods
LO2: medicinal & aromatic plants to fulfill the needs of pharmaceutical industries and rural energy for eradication of drudgery
LO3: purification of drinking water, rainwater harvesting and employment generating technologies in rural areas

UNIT–I (9)

Technologies and Process: Building materials and components - Micro concrete roofing tiles, Water & fire proof mud walls and thatch, Red mud/rice husk cement, Types of bricks, Ferro-cement water tanks and other products, Cement blocks, Preservation of mud walls, Agricultural implements- Naveen sickle, Animal drawn digger, Grubber weeder, Self propelled reaper, Seed drill, Improved bakhar

Food Processing: Fruit and vegetable preservation - Process flow sheet, Scale of operation, Economic feasibility, Source of technology; Soya milk - Process, Economics; Dehydration of fruits and vegetables, Cultivation of oyster mushroom - Preparation of beds, Spawning, Removal of bags for production of mushrooms, Harvesting and marketing, Economics, Process flow sheet, Source of technology

UNIT–II (9)

Medicinal and Aromatic plants: Plants and its use, Aromatic plants, Cymbopogons, Geranium, Manufacturing of juice, Gel and powder, Rural energy – Cultivation of jatrophacurcus and production of biodiesel, Low cost briquetted fuel, Solar cookers and oven, Solar drier, Biomass gasifier

Bio-fertilizers: Introduction, Vermicompost, Improvement over traditional technology/process, Technoeconomics, Cost of production, Utilization of fly ash for wasteland development and agriculture

UNIT–III (9)

Purification of Drinking water: Slow sand filtration unit, Iron removal plant connected to hand pump, Chlorine tablets, Pot chlorination of wells, Solar still, Fluoride removal, Rain water harvesting through rooftop, Rain water harvesting through percolation tank, Check dams, Recharging of dug wells

Employment Generating Technologies: Detergent powder and cake - Process, Process for liquid detergent, Carcass utilization - Improvement over traditional technology, Flow chart, Process, Capital investment; Indigo blue - Dye, Organic plant production, Dye extraction techniques, Aspects of indigo market, Economics; Modernization of bamboo based industries - Process for bamboo mat making, Machinery, Products, Agarbatti manufacturing; Vegetable tanning of leathers - Raw material, Soaking, Liming, Reliming, Deliming, Pretanning, Malani, Setting, Yield

UNIT–IV(9)

Community Development: Community organization- Definition, Need, Functions, Principles, Stages; Community development - Definition, Need, Objectives, Characteristics, Elements, Indicators; Differences between community organization and community development

Community Mobilization: Need, Benefits, Preparing, Initial contact with community, Coordinating, Functions of the community, Challenges, Techniques for mobilizing community, Community contributions, Leadership and capacity building, Community participation, Role of community worker in community mobilization, Models of community organization practice - Local development model, Social planning model, Social action model, Approaches to community organization

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Text Books:

[1] M. S. Virdi, *Sustainable Rural Technology*, New Delhi: Day a Publishing House, 2009 *(Chapters 1 to 4 & 7)*

[2] Asha Ramagonda Patil, *Community Organization and Development: An Indian Perspective*, New Delhi: Prentice Hall of India, 2013.

Reference Books:

[1] Punia Rd Roy, *Rural Technology*, New Delhi: SatyaPrakashan Publishers, 2009.

[2] S.B.Verma, S.K.Jiloka, Kannaki Das, *Rural Education and Technology*, New Delhi: Deep & Deep Publications Pvt. Ltd., 2006.

[3] Edwards, Allen David and Dorothy G.Jones, *Community and Community Development*, The Hague, Netherlands: Mouton, 1976.

[4] Lean, Mary, *Bread, Bricks and Belief: Communities in Charge of Their Future*, West Hartford, US: Kumarian Press, 1995.

[5] Heskin, Allen David, *The Struggle for Community*, Colorado, US: West View Press, 1991

[6] Clinard, Marshall Barron, *Slums and Community Development: Experiments in Self- Help*, Mumbai: Free Press, 1970.

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: discuss various building technologies, modern agricultural implements and food processing methods which can be implemented in rural areas

CO2: identify major medicinal plants that are required for pharmaceutical companies & alternative fuel that meets substantial oil need in the country and the need and usage of bio- fertilizers

CO3: analyze several cost effective technologies for purification of water, rain water harvesting techniques for collection & storage of rain water and examine the employment generating technologies in tribal/rural areas

CO4: distinguish between community organization and community development and identify techniques for community mobilization & approaches to community organization for social change

Course Articulation Matrix (CAM): U18OE701D RURAL TECHNOLOGY AND COMMUNITY DEVELOPMENT																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18OE701D.1**	-	-	1	-	-	1	2	-	-	-	-	1	-	-	-
CO2	**U18OE701D.2**	-	-	1	-	-	1	2	-	-	-	-	1	-	-	-
CO3	**U18OE701D.3**	-	-	1	-	-	1	2	-	-	-	-	1	-	-	-
CO4	**U18OE701D.4**	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-
U18OE701D		-	-	1	-	-	1	2	-	-	-	-	1	-	-	

U18AI702A REINFORCEMENT LEARNING

Class: B. Tech. VII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: basic concepts, examples of reinforcement learning and multi-armed bandits
LO2: finite Markov decision processes and dynamic programming
LO3: monte Carlo methods and temporal-difference learning
LO4: function approximation and policy gradient methods

UNIT – I (9)

Reinforcement Learning: Introduction, Examples, Elements of reinforcement learning, Limitations and scope. An extended example: Tic-Tac-Toe.

Multi-armed Bandits: A k-armed bandit problem, Action-value methods, Tracking a non-stationary problem, Optimistic initial values, Upper-confidence-bound action selection, Gradient bandit algorithms, Associative search (Contextual Bandits).

UNIT –II (9)

Markov Decision Processes: The Agent–environment interface, Goals and rewards, Returns and episodes, Policies and value functions, Optimality and approximation.

Dynamic Programming: Policy evaluation (Prediction), Policy improvement, Policy iteration, Value iteration, Asynchronous dynamic programming, Generalized policy iteration, Efficiency of dynamic programming

UNIT– III (9)

Monte Carlo Methods: Monte Carlo prediction, Monte Carlo estimation of action values, Monte Carlo control, On-policy & Off-policy Monte Carlo control and Incremental Implementation.

Temporal-Difference Learning: TD prediction, Optimality of TD (0), SARSA, Q-learning, R-learning, Games and after states.

UNIT - IV (9)

Function Approximation: Value prediction, gradient descent methods, linear function approximation, ANN based function approximation, lazy learning, instability issues.

Policy Gradient Methods: Non-associative learning – REINFORCE algorithm, exact gradient methods, estimating gradients, approximate policy gradient algorithms, actor-critic methods.

Text Book:

[1] Richard S. Sutton and Andrew G. Barto, *Reinforcement Learning*, 2nd ed. United Kingdom: MIT Press, 2018(*Chapters 1-8*)

Reference Books:

[1] Wiering, Marco, and Martijn Van Otterlo, *Reinforcement learning*, United States: Springer, 2012.
[2] Russell, Stuart J., and Peter Norvig, *Artificial intelligence: a modern approach*, United Kingdom: Pearson Education Limited, 2016.

Course Research Paper: Research paper (indexed Journal/conference paper) relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: solve Multi-armed Bandits problem in reinforcement learning algorithms
CO2: apply Markov decision processes to define the interaction between alearning agent and its environment
CO3: apply Monte Carlo Methods to model the probability of different outcomes in a process
CO4: make use of Policy Gradient Methods for policy approximation and parameterization

Course Articulation Matrix (CAM): U18AI702A REINFORCMENT LEARNING																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI702A.1**	2	2	2	1	-	1	-	1	1	1	-	1	2	1	2
CO2	**U18AI702A.2**	2	2	1	2	2	-	-	1	1	1	-	1	2	1	2
CO3	**U18AI702A.3**	2	2	1	3	2	-	-	1	1	1	-	1	2	1	2
CO4	**U18AI702A.4**	-	2	2	3	2	-	-	1	1	1	-	1	2	1	2
U18AI702A		**2**	**2**	**1.5**	**2.25**	**2**	**1**	**-**	**1**	**1**	**1**	**-**	**1**	**2**	**1**	**2**

U18AI702B BIG DATA ANALYTICS

Class: B. Tech. VII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on…

LO1: fundamental of big data platform and its technologies
LO2: optimize the apache hadoop, mapreduce and mongoDB
LO3: analyze the cassandra and hive
LO4: asses the pig and jasper reports

UNIT-I (9)

Introduction to Digital & Big Data: Types of digital data, Classification of digital data, Characteristics of data, Evolution of big data, Definition of big data, Challenges with big data, 3V's of Big data, Non definitional traits of Big Data - Business intelligence Vs Big Data - Data warehouse and hadoop environment, Coexistence

Big Data Analytics: Classification of analytics, Data science, Terminologies in big data, CAP Theorem, BASE concept, Few top analytics tools

The Big Data Technology Landscape: NoSQL (Not Only SQL), Hadoop

UNIT-II (9)

Introduction to Hadoop: History of hadoop, Hadoop overview, RDBMS vs hadoop, Distributed computing challenges, Use case of hadoop, Hadoop distributors, Hadoop distributed file system(HDFS), Processing data with hadoop, Managing resources and applications with hadoop YARN (Yet Another Resource Negotiator), Interacting with hadoop ecosystem

Map Reduce: Mapper, Reducer, Combiner, Partitioner, Searching, Sorting and Compression

Mongo DB: Terms used in RDBMS and mongoDB, Data types in mongoDB, mongoDB query language

UNIT-III (9)

Introduction to Cassandra: Features of cassandra, CQL data types, CQLSH, Keyspaces, CRUD (Create, Read, Update, and Delete) operations, Collections, Using a counter, Time to live (TTL), Alter commands, Import and export, Querying system tables

Introduction to Hive: Hive architecture, Hive data types, Hive file format, Hive query language (HQL), RCFile implementation, SerDe, User defined function (UDF)

UNIT-IV (9)

Introduction to Pig: Pig on hadoop, Use case for pig-ETL processing, Data types in pig, Running pig, Execution modes of pig, HDFS commands, Relational operators, Eval function, Complex data types, Piggy bank, User defined functions (UDF), Parameter substitution, Diagnostic operator, Word count example using pig, Pig vs hive

Introduction to Jasper Reports: Connecting to mongoDB NoSQL database, Connecting to cassandra NoSQL database

Case Study: Global innovation network and analysis (GINA)

Text Book:

[1] Seema Acharya and Subhashini Chellappan, *Big Data and Analytics*, 2nd ed., New Delhi: Wiley India Pvt. Ltd., 2019. *(Chapters 1 to 11)*

Reference Books:

[1] John Wiley, *Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data*, 1st ed., United States: Indianapolis - EMC Education Services, 2015.

[2] DT Editorial Services, *BIG DATA, Black Book*, 1st ed., New Delhi: DreamTech Press,2016.

[3] Russell Bradberry, Eric Blow, *Practical Cassandra A developers Approach*, 1st ed., New York: Pearson Education, 2014.

[4] Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, *Big Data for Dummies*, 1st ed., New York: John Wiley & Sons, Inc., 2013.

[5] Kyle Banker, *Mongo DB in Action*, 1sted., George Town: Manning Publications Company, 2012.

[6] Tom White, *Hadoop: The Definitive Guide*, 4th ed., New York: O'Reilly Publications, 2011.

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: fundamentals of big data and its business implications
CO2: examine the use cases of hadoop and mapreduce operations
CO3: inspect various query languages such as cassandra and hive
CO4: asses the various concepts of pig and its applications

Course Articulation Matrix (CAM): U18AI702B BIG DATA ANALYTICS																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI702B.1**	2	2	1	1	1	-	-	1	1	1	-	1	2	1	2
CO2	**U18AI702B.2**	2	2	2	1	1	-	-	1	1	1	-	1	2	1	2
CO3	**U18AI702B.3**	2	2	2	2	1	-	-	1	1	1	-	2	2	1	2
CO4	**U18AI702B.4**	2	2	2	2	2	-	-	1	1	1	-	2	2	2	2
U18AI702B		**2**	**2**	**1.75**	**1.5**	**1.25**	**-**	**-**	**1**	**1**	**1**	**-**	**1.5**	**2**	**1.25**	**2**

U18AI702C SOCIAL AND INFORMATION NETWORK ANALYSIS

Class: B. Tech. VII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: mathematical concepts and research design
LO2: multivariate techniques, visualization and testing hypotheses
LO3: directed and undirected networks
LO4: structural equivalence and regular equivalence

UNIT – I (9)

Introduction: Network essentials, Types of relations, Goals of analysis, Network variables as explanatory variables, Network variables as outcome variables

Mathematical Foundations: Introduction, Graphs, Paths and components, Adjacency matrices, Ways and modes, Matrix products

Research Design: Introduction, Experiments and field studies, Whole-network and personal-network research designs, Sources of network data, Types of nodes and types of ties, Actor attributes, Sampling and bounding, Sources of data reliability and validity issues, Ethical considerations

UNIT - II (9)

Multivariate Techniques Used in Network Analysis: Introduction, Multidimensional scaling, Correspondence analysis, Hierarchical clustering

Visualization: Introduction, Layout, Embedding node attributes, Node filtering, Ego networks, Embedding tie characteristics, Visualizing network change, Exporting visualizations, Closing comments

Testing Hypotheses: Introduction, Permutation tests, Dyadic hypotheses, Mixed dyadic–monadic hypotheses, Node-level hypotheses, Whole-network hypotheses, Exponential random graph models, Stochastic actor-oriented models (SAOMs)

UNIT - III (9)

Characterizing Whole Networks: Introduction, Cohesion, Reciprocity, Transitivity and the clustering coefficient, Triad census, Centralization and core–periphery indices

Centrality: Introduction, Basic concept, Undirected, non-valued networks, Directed, non-valued networks, Valued networks, Negative tie networks

Subgroups: Introduction, Cliques, Girvan–Newman algorithm, Factions and modularity optimization, Directed and valued data, Computational considerations, Performing a cohesive sub graph analysis, Supplementary material

UNIT - IV (9)

Equivalence: Introduction, Structural equivalence, Profile similarity, Block models, The direct method, Regular equivalence, The REGE algorithm, Core–periphery models

Analyzing Two-mode Data: Introduction, Converting to one-mode data, converting valued two-mode matrices to one-mode, Bipartite networks, Cohesive subgroups and community detection, Core–periphery models, Equivalence

Large Networks: Introduction, Reducing the size of problem, Choosing appropriate methods, Sampling, Small-world and scale-free networks

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Text Book:

[1] Stephen P Borgatti, Martin G Everett, Jeffrey C Johnson, *Analyzing Social Networks*, 2nd ed. Melbourne: Sage publications, 2018.

Reference Books:

[1] Stanley Wasserman, Katherine Faust, *Social Network Analysis: Methods And Applications*, New York: Cambridge University Press, 1999.

[2] Derek. L. Hansen, Ben Shneiderman, Marc A. Smith, *Analyzing social media networks with NodeXL*, Burlington: Elsevier Publication, 2010

[3] MaKsim Tsvetovat, Alexander Kouznetsov, *Social Network Analysis for Startups*, California: O'Reilly Media publications, 2011.

[4] Borko Furht, *Handbook of Social Network Technologies and Applications*, New York: Springer publications, 2010.

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: illustrate networks in graph-theoretic language and identify sources and boundaries of network data.

CO2: apply clustering algorithms to detect groups in proximity data and analyze testable hypothesis at the dyadic, monadic and whole-network level

CO3: analyze directed & undirected networks and evaluate measures of transitivity, reciprocity & clustering

CO4: anterpret sampling methods and block models for both regular and structural equivalence

Course Articulation Matrix (CAM): U18AI702C SOCIAL AND INFORMATION NETWORK ANALYSIS

Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**U18AI702C.1**	1	1	1	1	-	-	1	-	1	1	1	2	1	1	1
CO2	**U18AI702C.2**	1	1	1	-	-	1	1	-	1	1	1	2	1	1	1
CO3	**U18AI702C.3**	1	-	1	-	1	1	-	-	-	2	-	2	1	1	1
CO4	**U18AI702C.4**	1	1	1	1	-	1	-	-	-	2	1	2	1	1	1
U18AI702C		**1**	**1**	**1**	**1**	**1**	**1**	**1**	**-**	**1**	**1.5**	**1**	**2**	**1**	**1**	**1**

U18AI703B COGNITIVE COMPUTING SYSTEMS

Class: B. Tech. VII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: introduction to cognitive science and cognition modeling paradigms
LO2: essential components of memory and language in cognitive systems
LO3: cognitive modeling
LO4: different cognitive architectures

UNIT – I (9)

Introduction to Cognitive Science: Understanding Cognition, IBM's Watson, Design for Human Cognition, Augmented Intelligence

Cognition Modeling Paradigms: Declarative/ logic-based computational cognitive modeling, Connectionist models of cognition, Bayesian models of cognition, A dynamical systems approach to cognition

UNIT - II (9)

Cognitive Models of memory and language, Computational models of episodic and semantic memory, Modeling psycholinguistics.

UNIT - III (9)

Cognitive Modeling: modeling the interaction of language, Memory and learning, Modeling select aspects of cognition classical models of rationality, Symbolic reasoning and decision making.

History of cognitive systems and cognitive computing: A case study of Watson Engagement Manager (WEM)

UNIT - IV (9)

Formal models of inductive generalization, Causality, Categorization and similarity, The role of analogy in problem solving, Cognitive Development Child concept acquisition. Cognition and Artificial cognitive architectures such as ACT-R, SOAR, OpenCog, CopyCat, Memory Networks.

Case Study: Healthcare Concierge by Welltok using IBM Watson

Text Book:

[1] Ron Sun (ed.),"*The Cambridge Handbook of Computational Psychology*", Cambridge University Press.

Reference Books:

[1] Emmanuel M. Pothos, Andy J. Wills ,"*Formal Approaches in Categorization*" , Cambridge University Press

[2] Judith S. Hurwitz, Marcia Kaufman, Adrian Bowles," *Cognitive Computing and Big Data Analytics*", Wiley

[3] Vijay V Raghavan, Venkat N. Gudivada, Venu Govindaraju, "*Cognitive Computing: Theory and Applications: Volume 35 (Handbook of Statistics*)", North Holland.

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: compare traditional approaches and cognition computing along with cognitive modeling paradigms
CO2: elaborate essential components of memory and language in cognitive systems
CO3: apply cognitive modeling techniques
CO4: analyze different cognitive architectures

Course Articulation Matrix (CAM): U18AI703B COGNITIVE COMPUTING SYSTEMS																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI703B.1**	1	2	1	1	-	1	-	1	1	1	1	1	2	2	2
CO2	**U18AI703B.2**	1	2	2	2	1	-	-	-	1	1	1	-	2	2	2
CO3	**U18AI703B.3**	1	2	2	2	1	-	-	-	2	1	1	1	2	2	2
CO4	**U18AI703B.4**	1	2	1	1	1	-	-	-	2	1	1	1	2	2	2
U18AI703B		**1**	**2**	**1.5**	**1.5**	**1.5**	**1**	**-**	**1**	**1.5**	**1**	**1**	**1**	**2**	**2**	**2**

U18AI703C CRYPTOGRAPHY AND NETWORK SECURITY

Class: B. Tech. VII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: basic concepts of security attacks, services, mechanisms and symmetric key cryptographic algorithms.
LO2: number theory and public key cryptographic algorithms.
LO3: hash techniques, message authentication techniques and key management & distribution.

UNIT –I (9)

Overview: The OSI security architecture, Security attacks, Security services, Security mechanisms, A model for network security

Classical Encryption Techniques: Symmetric cipher model, Substitution techniques, Transposition techniques, Steganography.

Block Ciphers and the Data Encryption Standard: Traditional block cipher structure, The data encryption standard, The strength of DES, Block cipher design principles, Block cipher operation.

Advanced Encryption Standard: AES structure, AES transformation functions, AES key expansion.

UNIT-II (9)

Number Theory: Prime numbers, Fermat's and Euler's theorems, Discrete algorithms.

Public-Key Cryptography and RSA: Principles of public-key cryptosystems, The RSA algorithm.

Other Public-Key Crypto systems: Diffie Hellman key exchange, Elliptic curve arithmetic, Elliptic curve cryptography.

UNIT-III (9)

Cryptographic Hash functions: Applications of cryptographic hash functions, Two simple hash functions, Secure hash algorithm (SHA).

Message Authentication Codes: Message authentication requirements, Message authentication functions, Requirements for message authentication codes, Security of MACs, HMAC.

Digital Signature and Authentication Protocols: Digital signatures, Schnorr digital signature scheme.

Key Management and Distribution: Symmetric key distribution using symmetric encryption, Symmetric key distribution using a symmetric encryption, Distribution of public keys, X.509 certificates.

Electronic Mail Security: Pretty good privacy, S/MIME.

UNIT-IV (9)

IP Security: IP security overview, IP security policy, encapsulating security payload, Combining security associations.

Transport-Level Security: Web security considerations, Secure sockets layer, Transport layer security.

Malicious Software: Types of malicious software, Propagation-infected content-viruses, Virus counter measures.

Firewalls: The need for firewalls, Firewall characteristics, Types of firewalls.

Text Book:

[1] William Stallings, *Cryptography and Network Security: Principles and Practice,* 6th ed., England: Pearson Education,2014.

Reference Books:

[1] Behrouz A. Forouzan and Deb deep Mukhopadhyay, *Cryptography and Network Security*, 2nd ed., New Delhi:McGraw Hill Education, 2010.

[2] Atul Kahate,*Cryptography and Network Security*, 3rd ed., New Delhi:McGraw-Hill Education ,2003

[3] D, *Cryptography and Data Security*,1st ed., United Kingdom: Addison Wesley, 1982
[4] V.K.Iain, *Cryptography and Network Security*, 2nd ed., New Delhi: Khanna Publishing House, 2013.

Course Research Papers: Research papers (Journals/conference papers) relevant to the course content will be posted by the course faculty in Course Web page.
Course Patents: Patents relevant to the course content will be posted by the course faculty in Course Web page.
Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: analyze different security attacks, services, mechanisms and symmetric key cryptographic algorithms
CO2: apply mathematical concepts in cryptographic algorithms for providing security & key exchange
CO3: categorize the hash & message authentication techniques and examine key management for distribution of keys
CO4: analyze the security issues at network layer & transport layer for protecting data from malicious Software

Course Articulation Matrix (CAM): U18AI703C CRYPTOGRAPHYAND NETWORK SECURITY																
Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	U18AI703C.1	3	2	2	1	2	-	-	1	1	1	-	1	2	1	2
CO2	U18AI703C.2	3	2	2	1	2	-	1	1	1	1	-	1	2	2	1
CO3	U18AI703C.3	3	2	2	2	2	1	-	1	1	1	-	1	2	2	2
CO4	U18AI703C.4	3	2	2	2	2	1	-	1	1	1	-	1	2	2	2
U18AI703C		**3**	**2**	**2**	**1.5**	**2**	**1**	**1**	**1**	**1**	**1**	**-**	**1**	**2**	**1.75**	**1.75**

U18AI703D NATURAL LANGUAGE PROCESSING

Class: B. Tech. VII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LOs):

This course will develop student's knowledge in/on…

LO1: fundamental concepts of natural language processing
LO2: language morphology and part of speech tagging
LO3: syntax parsing and semantic analysis
LO4: applications of natural language processing

UNIT-I(9)

Natural Language Processing (NLP): Introduction to NLP, ambiguity, Language, Thought and Understanding.

Regular Expressions, Text Normalization, Edit Distance: Regular expression, words, morphology, morphology parsing, word tokenization, lemmatization, stemming, edit distance.

UNIT-II(9)

N-gram Language Models: N-Grams, Evaluating language models and smoothing, Kneser-Ney Smoothing, Perplexity's Relation to Entropy.

Naive Bayes and Sentiment Classification: Naive Bayes Classifiers, Training the Naive Bayes Classifier, Worked example, Optimizing for Sentiment Analysis.

UNIT-III(9)

Sequence Labeling for Parts of Speech and Named Entities: English Word Classes, Part-of-Speech Tagging, Named Entities and Named Entity Tagging, HMM Part-of-Speech Tagging.

Constituency Parsing: Ambiguity, CKY parsing, Partial Parsing.

UNIT-IV(9)

Compositional semantics: Introduction, Semantic Role Labeling and Semantic Parsing, Discourse Analysis.

Applications: Named entity recognition and relation extraction-IE using sequence labeling-Machine Translation (MT) - Basic issues in MT-Statistical translation-word alignment-phrase-based translation – Question Answering, Chatbots and dialog system.

Text book:

[1] Daniel Jurafsky and James H. Martin, *Speech and Language Processing*, Pearson Education, Second edition, ISBN: 978-9332518414, 2009.

[2] Daniel Jurafsky and James H. Martin, *Speech and Language Processing*, Pearson Education, Third edition – Drafted Copy – available online.

Reference books:

[1] Steven Bird, Ewan Klein and Edward Loper, *Natural Language Processing with Python*, O'Reilly Media, 1st edition, ISBN: 978-0596516499, 2009.

[2] Roland R. Hausser, *Foundations of Computational Linguistics: Human-Computer Communication in Natural Language*, MIT Press, First edition, ISBN: 978-3540424178, 2011.

Course Research Paper: Research paper (Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: make use of the essential concepts of natural language processing to train a machine to understand text and spoken words in much the same way human beings can
CO2: apply the lexical analysis models for morphology and part of speech tagging
CO3: develop the syntax and semantic parsing methods for language analysis
CO4: analyze and develop different applications based on natural language processing such as named entity recognition, question answering and language translation

Course Articulation Matrix (CAM):U18AI703D NATURAL LANGUAGE PROCESSING																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI703D.1**	2	2	2	2	1	-	-	1	1	1	-	2	1	1	1
CO2	**U18AI703D.2**	3	3	3	3	1	-	-	1	1	1	-	2	1	1	1
CO3	**U18AI703D.3**	3	3	2	3	1	-	-	1	1	1	-	2	1	1	1
CO4	**U18AI703D.4**	3	3	3	3	1	-	-	1	1	1	-	2	1	1	1
U18AI703D		**2.75**	**2.75**	**2.5**	**2.75**	**1**	**-**	**-**	**1**	**1**	**1**	**-**	**2**	**1**	**1**	**1**

U18AI704 CLOUD COMPUTING

Class: B. Tech. VII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: basic concepts of cloud and computing environments.
LO2: cloud architecture and virtualization techniques.
LO3: cloud platforms and real time applications used in industry.
LO4: importance of security and federated cloud.

UNIT –I (9)

Introduction: Cloud computing at a glance, Historical developments, Building cloud computing environment, Computing platforms and technologies

Principles of Parallel and Distributive Computing: Eras of computing, Parallel vs. distributive computing, Elements of parallel computing, Elements of distributive computing, Technologies for distributive computing

UNIT - II (9)

Virtualization: Introductions, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples

Cloud Computing Architecture: Introduction, Cloud reference model, Types of cloud, Economics of the cloud, Open challenges

UNIT - III (9)

Data Intensive Computing: What is data intensive computing? Technologies for data intensive computing

Cloud Platform in Industry: Amazon web services, Google app engine, Microsoft azure Cloud **Applications:** Scientific applications: ECG analysis in the cloud, Business and consumer applications: CRM and ERP

UNIT - IV (9)

Advanced Topics in Cloud Computing: Federated clouds/InterCloud characterization and definition, Cloud federation stack, Aspects of interest, Technologies for cloud federation

Cloud Security: Security the top concern for cloud users, Cloud security risks, Privacy and privacy impact assessment, Trust, Cloud data encryption, Security of database services, Operating system security, Virtual machine security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management operating system, Mobile devices and cloud security

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Text Book:

[1] Rajkumar Buyya, Christian Vecchiola, Thamarai Selvi, *Mastering Cloud Computing*, New Delhi: McGraw Hill, 2019. *(Chapters 1,2 3,4,8,9,10 and 11)*

[2] Dan C. Marnescu, *Cloud Computing Theory and Practice*, 2nd ed. Cambridge: Elsevier, 2018.

(Chapter 9)

Reference Books:

[1] Dr. Kumar Saurabh, *Cloud Computing: Architecting Next-Gen Transformations Paradigms*, 4th ed. New Delhi: Wiley India Private Limited, 2018.
[2] Barrie Sosinsky, *Cloud Computing Bible*, Indiana: Wiley Publications, 2011.
[3] Anthony T.Velte, Toby J Velte and Robert Elsenpeter, *Cloud Computing: A practical Approach*, New York: McGraw Hill, 2010.
[4] Dan C. Marinescu *Cloud Computing: Theory and Practice,* 3rd ed. USA: Morgan Kaufmann 2013.

Course Research Papers: Research papers (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Patents: Patents relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: make use of different cloud computing environments.
CO2: identify various cloud architectures and importance of virtualization along with their technologies.
CO3: apply cloud platforms, technologies and applications in industry.
CO4: analyse federated cloud techniques, cloud security and carry out further study & research.

Course Articulation Matrix (CAM): U18AI704 CLOUD COMPUTING																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI704.1**	2	2	2	1	2	-	-	1	1	1	-	1	2	1	1
CO2	**U18AI704.2**	2	2	2	1	2	-	1	1	1	1	-	1	2	1	1
CO3	**U18AI704.3**	2	2	2	2	2	1	-	1	1	1	-	1	2	1	2
CO4	**U18AI704.4**	2	2	2	2	2	1	-	1	1	1	-	1	2	1	2
U18AI704		**2**	**2**	**2**	**1.5**	**2**	**1**	**1**	**1**	**1**	**1**	**-**	**1**	**2**	**1**	**1.5**

U18AI705 CLOUD COMPUTING LABORATORY

Class: B. Tech. VII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
-	-	2	1

Examination Scheme :

ContinuousInternal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: i*nstallation and configuration of cloud.*
LO2: virtualization techniques.
LO3: implement parallel programming using Hadoop.
LO4: implementing cloud based applications.

List of Experiments

Experiment-I (UNIT-I)

1. Install Oracle Virtual box and create two VMs on your laptop.
2. Install a C compiler in the VM created using virtual box and executes simple programs

Experiment-II (UNIT-I)

1. Simulate a cloud scenario using Cloud Sim to create a datacenter with one host and run on cloudlet on it.
2. Simulate a cloud scenario using CloudSim to create a datacenter with one host and run two cloud lets on it. The cloudlets run in VMs with the same MIPS requirements. The cloudlets will take the same time to complete the execution.

Experiment-III (UNIT-I)

1. Simulate a cloud scenario using CloudSim to create a datacenter with two hosts and run two cloudlets on it. The cloudlets run in VMs with different MIPS requirements.The cloudlets will take different time to complete the execution depending on the requested VM performance.
2. Simulate a cloud scenario using CloudSimto create two datacenters with one host each and run two cloudlets on them.
3. Simulate a cloud scenario using CloudSimto create two datacenters with one host each and run cloudlets of two users on them.

Experiment-IV (UNIT-II)

1. Simulate a cloud scenario using CloudSim and run a SJF scheduling algorithm.
2. Simulate a cloud scenario using CloudSim and run a FCFS scheduling algorithm.

Experiment-V (UNIT-II)

1. Simulate a cloud scenario using CloudSim and run a Round Robin scheduling algorithm.

Experiment-VI(UNIT-II)

1. Simulate a cloud scenario using CloudSim and propose new scheduling algorithm.

Experiment -VII (UNIT-III)

1. Develop a word count program to demonstrate the use of Map and Reduce task.

Experiment-VIII(UNIT-III)
1.Create a word document of your class time table and store on the cloud with docx and pdf format.
2. Develop a program to generate 'n' even numbers and deploy in cloud.

Experiment-IX (UNIT-III)
1. Create your own Virtual Private Cloud (VPC).
2. Create public and private subnet.

Experiment-X(UNIT-IV)
1.Create Public Routing Table, associate subnet and add routing rules.

Experiment-XI (UNIT-IV)
1. Create Private Routing Table, associate subnet and add routing rules.

Experiment-XII (UNIT-IV)
1. Write a program to validate user, create a database login (username, password) and deploy in cloud.

Laboratory Manual:
[1] Cloud Computing Laboratory Manual,prepared by the faculty of Department of CSE(N), KITS Warangal.

Text Books:

[1] Rajkumar Buyya, Christian Vecchiola, ThamaraiSelvi, *Mastering Cloud Computing*, New Delhi : McGraw Hill, 2013 (reprint 2019).
[2]Dan C. Marinescu, *Cloud Computing Theory and Practice*, 2nd ed. Cambridge: Elsevier, 2018.
[3] Dr. Kumar Saurabh, *Cloud Computing: Architecting Next-Gen Transformations Paradigms*, 4th ed. New Delhi: Wiley India Private Limited, 2018.
[4] Gautham Shroff Enterprise *Cloud Computing Technology, Architecture, Applications,* UK, Cambridge University Publisher, 2010
[5] Dan C. Marinescu *Cloud Computing: Theory and Practice,* 3rd ed. USA: Morgan Kaufmann 2013.

Course Learning Outcomes (COs):

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

CO1: analyse installation of virtualization using different types of Hypervisors.
CO2: develop java programs for cloud architecture.
CO3: make use of Hadoop platform for parallel programming.
CO4: analyse the functioning of components in cloud platform, technologies and applications in industry.

Course Articulation Matrix (CAM): U18AI705 CLOUD COMPUTING LABORATORY

Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	U18AI705.1	2	2	2	2	2	-	-	1	1	1	1	1	2	1	2
CO2	U18AI705.2	2	2	2	2	2	-	-	1	1	1	1	1	2	1	2
CO3	U18AI705.3	2	2	2	2	2	-	-	1	2	1	1	1	2	1	2
CO4	U18AI705.4	2	2	2	2	2	-	-	1	1	1	1	1	2	1	2
U18AI705		**2**	**2**	**2**	**2**	**2**	**-**	**-**	**1**	**1.25**	**1**	**1**	**1**	**2**	**1**	**2**

U18AI706 NATURAL LANGUAGE PROCESSING LABORATORY

Class: B. Tech. VII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
-	-	2	1

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on...

LO1: regular expression, stemming, lemmatization and tokenization
LO2: n-gram model, smoothing techniques
LO3: hmm tagger, Markov chains, POS tagging and named entity tagging
LO4: thematic role, propbank, framenet and relation extraction algorithms.

List of Experiments

Experiment-I (Unit-I)

1. Develop a regular expression to parse all plural words from a given text.
2. Develop a program to split the given text into words and remove the special characters and punctuations.

Experiment-II (Unit-I)

1. Apply Porter stemmer algorithm for stemming the words present in given text.
2. Apply Word Net Lemmatizer for Lemmatization of the words present in text.
3. Develop a program for stop word removal from given text.

Experiment-III (Unit-I)

1. Develop a program for sentence tokenization.
2. Develop a program to compute the Edit distance between two given strings.

Experiment-IV (Unit-II)

1. Develop a program to build a N-Gram model from the words present in the given text.
2. Apply the add-one smoothing to smooth the probability distribution of the bi-gram model built from the given text.

Experiment-V (Unit-II)

1. Develop a program to implement the Kneser-Ney smoothing technique for language modeling.
2. Develop a program to apply naïve bayes classification for the given text.

Experiment-VI (Unit-III)

1. Develop a program to implement the process of chunking on the given text.

Experiment-VII (Unit-III)

1. Develop a program for constructing an HMM part of speech tagger.
2. Develop a program to implement POS tagging.

Experiment-VIII (Unit-III)

1. Develop a program to implement named entity tagging.

Experiment-IX (Unit-III)

1. Develop a program to implement the markov chains.

Experiment-X (Unit-IV)

1. Develop a program to implement thematic role.
2. Develop a program to implement propbank.

Experiment-XI (Unit-IV)

1. Develop a program to implement framenet.
2. Develop a program to implement relation extraction using handwritten pattern.

Experiment-XII (Unit-IV)

1. Develop a program to implement relation extraction using supervised learning.

Laboratory Manual:

[1] *Natural language Processing Laboratory Manual*, Dept. of CSE (AI & ML), KITSW.

Text Book:

[1] Daniel Jurafsky and James H.Martin, "Speech and Language Processing", Pearson Education, Second edition, ISBN: 978-9332518414, 2009.

Reference Book:

[1] Steven Bird, Ewan Klein and Edward Loper, "Natural Processing with Python', O'Reilly Media, 1 edition, ISBN: 978-0596516499, 2009.

[2] Roland R.Hausser, "Foundations of Computational Linguistics: Human-Computer Communication in Natural Language", MIT Press first edition, ISBN: 978-3540424178, 2011.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: develop regular expressions, apply stemming, lemmatization and tokenization
CO2: apply various smoothing techniques, develop N-gram model
CO3: implement HMM tagger, markov chains , POS tagging and named entity tagging
CO4: *implement thematic role, propbank, framenet and relation extraction algorithms.*

Course Articulation Matrix (CAM): U18AI706 NATURAL LANGUAGE PROCESSING LABORATORY

Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**U18AI706.1**	2	2	2	1	1	-	-	1	2	1	-	1	2	1	1
CO2	**U18AI706.2**	2	2	2	2	1	-	-	1	2	1	-	2	2	1	2
CO3	**U18AI706.3**	2	2	1	2	1	-	-	1	2	1	-	2	2	2	2
CO4	**U18AI706.4**	2	2	2	2	1	-	-	1	2	1	-	2	2	2	2
U18AI706		**2**	**2**	**1.75**	**1.75**	**1**	**-**	**-**	**1**	**2**	**1**	**-**	**1.75**	**2**	**1.5**	**1.75**

U18AI707 MAJOR PROJECT WORK PHASE-I

Class: B. Tech. VII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
-	-	6	3

Examination Scheme :

Continuous Internal Evaluation	100 marks
End Semester Examination	--

Course Learning Objectives (LOs):

The major project work will develop students' knowledge on /in…

LO1: real-world complex engineering problems, literature review, problem formulation; and experimental and data analysis techniques

LO2: design/development of solutions to real-world engineering problems; conduct of investigations of complex problems; modern tool usage to design, build and test a prototype; impact of solution in society, environment and sustainability contexts

LO3: ethics, team work and project management skills such as budgeting, scheduling

LO4: oral, written and multimedia communication skills; self-directed independent learning and

1. Final Year Major Project work represents the culmination of study towards the B. Tech degree. ***Major project offers an opportunity to integrate the knowledge acquired from various courses and apply it to solve real-world complex engineering problems***. The **student learning assessment process** (SLAP) shall include good number of presentations, demonstration of work undertaken, submission of a project report, writing project paper in scientific journal style & format, preparing project poster and creating video pitch on the complete project work.
2. Activities of major project SLAP shall be planned in such a way to ensure that the students acquire the essential knowledge, skills and qualities (KSQ) of a professional engineer.
3. **Team work:** Major project work is a team work.

i. The students of a project team shall work together to achieve a common objective.

ii. Every student of a project team is expected to function effectively as an individual, and also with others as a team member in an ecosystem of team having knowledge diversity, gender diversity, social and cultural diversity among its members.

4. **Two phases:** Major project work shall be carried out in two phases. Nearly 50 - 75% of the propose work to be completed in 7th semester as *Phase-I* and the remaining work to be continued and completed in 8th semester as *Phase-II.*
5. Every student is expected to put approximately **72 hours of work** into the major project *phase-I* course over the 12 weeks of 7th semester.
6. **Major project work *Phase-I*: 7th semester**

i. The HoD shall constitute the ***department project evaluation committee (DPEC)*** with following composition

Department project evaluation committee (DPEC)	
HoD	Chairman
Senior Faculty	Convener
Coordinator(s)	Section - wise coordinator(s) *One coordinator for each section*

Three Faculty members	Section-wise faculty members *three faculty members for each section representing various socializations.* *(Five specializations will be covered including the coordinator's and Convener's)*

ii. Major project allotment to students during last working week of 6th semester:

a. **First / Second week of 6th Semester**: The process shall be initiated during the first/second week of 6th semester by collecting project titles from the department faculty research groups, on offering innovative ideas/solutions for engineering problems.

b. **MSE-I period of 6th Semester – Notifying project titles**: The finalized project titles shall be notified to students during the MSE-I period of 6th semester and student teams shall be allowed to exercise their options on titles that interest them.

c. **Last working week of 6th Semester – Allotment of titles and supervisors to project teams**:The project title allotment to major project teams shall be completed before the last day of instruction of 6th semester

d. **6th semester summer break - Literature review**: This 6th semester schedule enables students to complete literature review, preliminary simulations / investigations / experimentation during 6th semester summer break and *start the work from day-one in 7th semester*

e. **Registration Presentatio -Notifying the tentative dates:** The major project teams are expected to give registration presentation during second / third week from the commencement of 7th semester. The tentative dates for conducting the registration presentation shall be notified at the time of releasing the circular on allotted project title and project supervisors, as indicated in (c) above. This enables student teams to plan the work accordingly during Summer break,to complete the literature review, preliminary simulations / investigations and get ready for informative, confident and comfortable presentations on their project work.

iii. The convener DPEC shall notify, during MSE-I period of 6th semester, the list of implementable project titles offered by the faculty of different research groups of the department

a. Project titles shall come with the following details to be made available to students on dept webpage and notice boards, facilitating students to select problems that interest them.
   i. Abstract
   ii. deliverables / outcomes
   iii. knowledge and skills required to complete the project
   iv. resources required
   v. one of the deliverables shall be writing a technical paper out of the major project work done for submission to a reputed non-predatory conference/non-paid peer reviewed journal

iv. The major project teams, finalized by the convener DPEC, shall be allowed to exercise their options on the titles that interest them from the notified list

v. Project supervisor allotment: The convener DPEC shall allot, during the last week of 6th semester, the faculty supervisors to all project teams

a. The project supervisors shall

i. define project objectives and expected deliverables

ii. help the students plan their project work and timeline

iii. provide enough resources for successful project completion

vi. The faculty supervisors are expected to provide guidance to project teams on

a. *Knowledge, skills and qualities (KSQ) to be acquired* to propose solutions to the identified real-world problems

b. *Problem analysis* - to identify, formulate, review research literature, and analyze complex

engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

c. *Applying engineering knowledge* - to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

d. *Design/development of solutions* - to design solutions for complex engineering problem and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalConsiderations

e. *Conduct investigations of complex problems* - to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data,and synthesis of the information to provide valid conclusions

f. *Modern tool usage* – to create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

g. *Engineering and society* – to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

h. *Environment and sustainability* – to understand the impact of the professional engineering solutions in societal and environmental contexts, demonstrate the knowledge of, and need for sustainable development

i. *Ethics* – to apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice

j. *Individual and team work* – to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

k. *Communication* – to communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

l. *Project management and finance* – to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

m. *Life-long learning* – to recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

vii. The project supervisors are also expected to continuously emphasize and guide students on

a. Meeting Cadence:

i. **Regular meetings with supervisor:** Short and frequent meetings increase a team's work momentum. Regular meetings with supervisor to review the status of project are very essential. All students of the team shall participate in discussions and take notes.

ii. **Meeting Frequency: Semi-weekly cadence,** i.e., the meeting frequency shall be **twice a week.** Due weightage will be given to meeting cadence and considered for evaluation during presentations, i.e., number of planned meetings and number attended by students

b. Project Log Book: The activity journaling in project log book is very important for a successful project.

i. Project log book is a written record showing the daily project activity on project goals from the very first thing like starting the project (an introduction statement what the project is all about), to the completion of the work (including the final results, and whether project met the core objectives / outcomes, etc.).

ii. In project log book, the activities like regular meetings with project supervisor, and

work carried out on daily/weekly basis are to be recorded. This ensures that the student progress is being monitored well.

iii. The project supervisor shall regularly check the log book of every student of project team and endorse each and every activity by affixing his signature with date. With this, the number of planned meetings and number attended by the students will be also monitored.

iv. Log books are to be shown during all presentations and will be graded along with the project.

v. At the conclusion of the project work *phase-I*, the supervisor shall specifically comment, in the project log book, on whether the project team met each of the project work *phase-I* goals and to give evidence which describes the quality of work. For project teams, this also serves as self-assessment.

c. **Following project timeline**: completing the tasks as planned in project timeline

d. He relevant knowledge, skills and qualities (**KSQ**) an engineering graduate should possess, which can be specially acquired by participating in major project work

e. **Writing down whatever is done and making notes of whatever is read**. Writing down the procedures/models followed, designs made, experiments conducted, simulations carried out, intermediate results obtained, ***difficulties faced and how they were fixed*** are very important. This kind of documenting the whole process as we go with project implementation is a very effective way and will help preparing a well- documented report having original content. Note down and include information about all the resources that you used, magazines, Journals, patents, books, and so on. This information will be needed for the bibliography in your project report. On the other hand, documenting a report ***on the spur of the moment*** would end up copying things from other sources resulting in a plagiarized document.

f. **Good and sufficient literature review**: Literature review is a description and analysis of information related to the topic of project work. Reading good number of review articles, research articles published in recent issues of peer reviewed journals, technical magazines, patents, reference books on the topics of potential interest, will help one understand what has already been discovered and what questions remain to identify gaps in the literature.

g. Completing nearly 50 - 75% of the proposed work during phase-I

h. Right conduct of research to promote academic integrity, honesty and time management

i. Preparing a well-documented report in proper format, covering the progress made during Phase-I

j. Consequences of plagiarism and use of anti-plagiarism software to detect plagiarism in documents

k. Submission of major project phase-I report within acceptable plagiarism levels, as per the Anti-plagiarism policy-2020 of our institute.

l. **Video pitch:** Capturing short videos, photos, screenshots on experiments conducted, simulations carried out, prototype / working model / process /software package/system developed during course of project execution ,photos showing interaction with supervisor for creating a short video pitch on the work done during *phase-I.*

m. **Project Paper**: Writing a technical paper at the end of *phase-II* based on the solution(s) proposed, results obtained and prototype / working model / process software package /system developed, for submission to a reputed non-predatory conference/non-paid peer reviewed journal.

n. **Project poster**: At the end of phase-II, the project teams shall have to present their project in the form of posters, at the time of demonstration of complete prototype/ working model / software package / system developed.

viii. Phase – I evaluation: There shall be only Continuous Internal Evaluation (CIE) for major project work *phase-I* with following components

a. Registration Presentation *(during second / third week of 7th semester):* The Registration Presentation shall include a brief report and presentation focusing the identifie problem objective(s), literature review, identifying research gap in the literature, implementation of existing methods, proposed solution, and expected outcome(s).

i. The registration presentation shall invariably include the **project plan timeline** with actual start and finish dates– monthly/weekly project milestones/ timeline prepared in MS Excel or any other project management tool.

ii. Project timeline – *Weekly project milestones*: It's a compact and creative way to presenta project plan. Identify the project intermediate goals and related tasks for completing each of those goals. Categorize tasks for each week. In the project timeline use different colors to the tasks for each week. Horizontal timeline layouts shall be preferred or any other layout of team's choice.

iii. Project teams shall create and present the following during registration presentation

1. Complete project timeline
2. Phase-I project timeline
3. *Phase-II project timeline*

iv. During every presentation, project teams shall compulsorily show the following aspart of their presentation

1. The slides on project timeline and
2. A table showing targeted tasks as per timeline and status – whether tasksaccomplished?

v. Project log book: Every student of the Project team shall compulsorily show theactivity journaling in the log book (*with due signatures of project supervisor*) during presentations

b. Progress Presentation-I *(during penultimate week of 7th semester):* At the end of first stage (7th semester), student teams shall be required present, before the DPEC, the progress made during phase-I and submit a well-documented report of work done for evaluation to the project coordinator

1. **Following project timeline**: The project timeline shall be meticulously followed and the tasks shall be completed as planned in project timeline.
2. Project teams shall compulsorily show the following as part of their progress presentation-I

1. The slides on project timeline and
2. *A table showing targeted tasks as per timeline and whether tasks accomplished?*
3. **Project log book**: Every student of the Project team shall compulsorily show the activity journaling in the log book (*with due signatures of project supervisor*)

c. CIE schedule: The convener DPEC shall release complete schedule of CIE before start of 7th semester well in advance, so that student teams will complete the scheduled works and get ready with informative, confident and comfortable presentation for registration and progress presentations.

ix. CIE for the Major project work phase-I shall be as given below:

Major project work Phase-I Assessment *(7th semester)*	**Weightage**
A. Supervisor Assessment	**20%**
B. DPEC Assessment *(i) Registration Presentation (10%)* *(ii) Progress Presentation-I (20%)* *(iii) Project progress*: Part of working model/ process/software package/system developed (30%)* *(iv) Well-documented Progress Report on Phase-I work (10%)*	**80%**

(v) Video pitch on Phase-I (10%)	
Total Weightage	**100 %**

**Students are advised to complete major part of the project in phase-I only*

a. Working Model: Every project team shall be required to develop a working model/ process/software package/system, on the chosen work. The progress made in this shall be demonstrated during progress presentation-I at the end of *phase-I* and the completed working model/ process/software package/system before the DPEC as per the dates specified by DPEC atthe end of *phase-II*.

b. Progress Report on *phase-I*: Every project team shall be required to submit a well-documented progress report on dissertation phase-I as per format specified by DPEC.

i. Tangible outcomes of *phase-I* in Conclusions - Chapter: These are the lessons learnt from doing a project work. The students have to describe in their own words what they learnt from the *phase-I* project work experience. They have to describe what specific KSQs are acquired by them, with reference to the expected COs, after successful completion of *phase-I* work. Finally, a table depicting systematic mapping of what they have learnt and the expected major project work COs, is to be presented in the conclusions chapter of *phase-I* Report

c. Video pitch on *phase-I*: Every project team shall be required to create a pitch video, which is a video presentation on their major project work *phase-I*. The project team shall present the produced video pitch during progress presentation-I. The produced video pitch should

- **i.** Be 3 to 5-minute-long video (no longer than 5 minutes)
- **ii.** Be concise and to the point, on the problem and proposed solution
- **iii.** Show project timeline and sample page of log book
- ***iv.*** Highlight the progress made at various stages during *phase-I* project implementation with the help of short videos / photos / screenshots on experiments conducted, simulations carried out, part of prototype / working model / process / software package / system being under development as part of proposed solution and also photos showing team interactions with supervisor and the team working in the lab on project
- ***v.*** Discuss the impact of proposed solution in *ethical, environmental, societal and sustainable development contexts.*
- ***vi.*** Emphasize key points about *business idea, potential market for the proposed solution*

x. It is mandatory for

a. Every student of the team to *appear for oral presentation and viva-voce*, as part of progress presentation -I to qualify for course evaluation

b. Every project team *to submit a well-documented progress report on major project work phase-I*, as part of progress presentation -I to qualify for course evaluation

c. Every project team to create and present a good video pitch on major project work *phase-I*, as part of progress presentation -I to qualify for course evaluation

xi. A student shall register for supplementary examination for the Major project work *phase-I* in the following cases:

a. He/she is absent for oral presentation and viva-voce as part of progress presentation - I

b. The project team fails to submit the progress report on *phase-I* in prescribed format

c. The project team fails to submit the video pitch on the progress made during the Phase - I

period.

d. He/she fails to fulfill the requirements of Major project work *phase-I* evaluation as per specified guidelines

xii. Supplementary examination for Major project work *phase-I*

a. The CoE shall send the list of students, registered for supplementary examination, to the HoDsconcerned

b. The DPEC, duly constituted by the HoD, shall conduct Major project phase-supplementary examand send the award list to the CoE within the stipulated time

****

Course Learning Outcomes (COs):

On completion of major project work, students will be able to…

CO1: review research literature, identify gaps in the literature, formulate problem, apply knowledge of mathematics, sciences, engineering fundamentals, experimental and data analysis techniques; synthesize technical knowledge and innovative approaches to generate suitable solutions for real- world complex engineering problems (**Technical skills**)

CO2: d*esign a system or product based on product/customer specifications; develop, analyze, and critically evaluate the design alternatives in order to justify the solutions to a real-world problem guided by ethical, environmental, societal and sustainable development considerations; use modern engineering and IT tools to design, build and test a prototype within specified project timeline and budget* (**Problem solving and critical thinking skills**)

CO3: apply project management and organizational skills; demonstrate integrity, leadership, creativity, professional and ethical responsibilities as an individual and as a member or leader to produce time- sensitive deliverables in a multi-disciplinary team (**Ethics and teamwork**)

CO4: *collate the results, compare performance of prototype to design specifications and present*

Course Articulation Matrix (CAM); U18AI707 MAJOR PROJECT WORK PHASE-I																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI707.1**	2	2	2	2	-	-	-	3	-	2	-	3	3	3	3
CO2	**U18AI707.2**	2	2	2	-	2	2	2	3	-	-	-	3	3	3	3
CO3	**U18AI707.3**	-	-	-	-	-	-	-	3	2	-	2	3	3	3	3
CO4	**U18AI707.4**	-	-	2	2	-	-	-	3	-	2	-	3	3	3	3
U18AI707		**2**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**3**

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING(AI&ML)
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE: WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)

SCHEME OF INSTRUCTION & EVALUATION

VIII-SEMESTER OF 4-YEAR B. TECH DEGREE PROGRAM

[3Th+1MP-II]

Sl. No	Category	Course Code	Course Title	Periods/week			Credits	Evaluation scheme				
				L	T	P	C	CIE			ESE	Total Marks
								TA	MSE	Total		
1	PE	U18AI801	Professional Elective - V / MOOC-V	3	-	-	3	10	30	40	60	100
2	PE	U18AI802	Professional Elective - VI / MOOC-VI	3	-	-	3	10	30	40	60	100
3	OE	U18OE803	Open Elective - IV / MOOC-VII	3	-	-	3	10	30	40	60	100
4	PROJ	U18AI804	Major Project - Phase - II	-	-	14	7	60	-	60	40	100
Total				9	-	14	16	90	90	180	220	400
Additional Learning*: *Maximum credits allowed for Honours/Minor in Engineering*				-	-	-	*7*	-	-	-	-	-
Total credits for students opted for Honours/Minor students:				-	-	-	***16+7***	-	-	-	-	-

** List of courses for additional learning through **MOOCs** towards Honours/Minor in Engineering shall be prescribed by the department under Honours/ Minor Curricula*

[L= Lecture, T = Tutorials, P = Practicals & C = Credits] **Total Contact Periods/Week: 23** **Total Credits: 16**

Professional Elective-V / MOOC-V:	Professional Elective-VI/ MOOC-VI:	Open Elective-IV/MOOC-VII:
U18AI801A: Ethical Hacking U18AI801B: Virtual Reality Technologies U18AI801C: Robotic Process Automation U18AI801M: MOOCs course	U18AI802A: Data Visualization U18AI802B: Fog and Edge Computing U18AI802C: Block Chain Technologies U18AI802M: MOOCs course	U18OE803A: Operations Research U18OE803B: Management Information Systems U18OE803C: Entrepreneurship Development U18OE803D: Forex & Foreign Trade U18OE803M: MOOCs Course

U18AI801A ETHICAL HACKING

Class: B. Tech. VIII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: methodologies and framework of ethical hacking for enhancing the security.
LO2: business perspective and planning for a controlled attack
LO3: reconnaissance, preparing for a hack, enumeration and exploitation
LO4: deliverable and integration

UNIT – I (9)

Introduction: Hacking impacts, The hacker-Type of hacker, Script kiddies

Framework: Planning the test, Sound operations, Reconnaissance, Enumeration, Vulnerability analysis, Exploitation, Final analysis, Deliverable, Integration

Information Security Models: Computer security, Network security, Service security, Application security, Security architecture

Information Security Program: The process of information security, Component parts of information security programs, Risk analysis and ethical hacking

UNIT - II (9)

The Business Perspective: Business objectives, Security policy, Previous test results, Business challenges

Planning for a Controlled Attack: Inherent limitations, Imposed limitations, Timing is everything, Attack type, Source point, Required knowledge, Multi-phased attacks, Teaming and attack structure, Engagement planner, The right security consultant, The tester, logistics, Intermediates, Law enforcement

UNIT - III (9)

Reconnaissance: Social engineering, Physical security, Internet reconnaissance

Preparing for a Hack: Technical preparation, Managing the engagement

Enumeration: Enumeration techniques, Soft objective, looking around or attack, Elements of enumeration, Preparing for the next phase

Exploitation: Intuitive testing, Evasion, Threads and groups, Operating systems, Password crackers, Rootkits, Applications, Wardialing, Network, Services and areas of concern

UNIT - IV (9)

Deliverable: The deliverable, The document, Overall structure, Aligning findings, Presentation

Integration: Integrating the results, Integration summary, Mitigation, Defense planning, Incident management, Security policy, Conclusion

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Text Book:

[1] James S. Tiller, *The Ethical Hack: A Framework for Business Value Penetration Testing*, New York: Auerbach Publications, CRC Press, 2019.

Reference Books:

[1] Michael Simpson, Kent Backman, James Corley, Hands-On Ethical Hacking and Network 2nd ed. New York: Cengage Learning, 2005.

[2] Patrick Engebreston, The Basics of Hacking and Penetration testing, New York: Syngress

Publishers, 2011.
[3] EC-Council, Ethical Hacking and Countermeasures: Attack Phases, New York: Course Technology Press, 2016.
[4] Hein Smith, Hilary Morrison, ETHICAL HACKING: Comprehensive Beginner's Guide to Learn and Master Ethical Hacking, New York: Kindle Edition, 2018.

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1 *demonstrate phases of the penetration testing framework*
CO2 *identify various types of attacks*
CO3 *make use of reconnaissance tools to gather information*
CO4 *analyze the dangers associated with penetration testing*

Course Articulation Matrix (CAM): U18AI801A ETHICAL HACKING																
Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	U18AI801A.1	2	2	2	1	-	1	-	1	-	1	-	1	1	1	2
CO2	U18AI801A.2	2	2	2	2	-	1	-	1	-	1	-	1	1	1	2
CO3	U18AI801A.3	2	2	2	2	-	1	-	1	-	1	-	1	2	1	2
CO4	U18AI801A.4	2	2	2	3	-	1	-	1	-	1	-	1	2	1	2
U18AI801A		**2**	**2**	**2**	**2**	**-**	**1**	**-**	**1**	**-**	**1**	**-**	**1**	**1.5**	**1**	**2**

U18AI801B VIRTUAL REALITY

Class: B. Tech. VIII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: concepts and components of VR, multiple models of input & output interface in VR
LO2: geometric modeling, kinematics modeling, physical modeling and behavioral modeling
LO3: development tools like Java-3D, World Tool-Kit, Haptic General open source tool kit
LO4: augmented and mixed reality, AR methods, visualization techniques and applications of VR

UNIT – I (9)

Introduction of Virtual Reality: Fundamental Concept and Components of Virtual Reality. Primary Features and Present Development on Virtual Reality.

Input and Output Interface in Virtual Reality: Input - Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3D Scanner etc. Output - Visual / Auditory / Haptic Devices.

UNIT – II (9)

Modeling: Geometric Modeling, Virtual Object Shape, Object Visual Appearance.

Kinematics Modeling: Homogeneous Transformation Matrices, Object Position, Transformation Invariants, Object Hierarchies, Viewing the Three-Dimensional World.

Physical Modeling: Collision Detection, Surface Deformation, Force Computation, Force Smoothing and Mapping, Haptic Texturing.

Behavior Modeling: Model Management Level-of-Detail Management, Cell Segmentation

UNIT – III (9)

VR Programming: Toolkits and Scene Graphs.

World Tool-Kit: Model Geometry and Appearance, The WTK Scene Graph, Sensors and Action Functions, WTK Networking.

Java 3D: Model Geometry and Appearance, Java 3D Scene Graph, Sensors and Behaviors, Java 3D Networking, WTK and Java 3D Performance Comparison.

General Haptics Open Software Toolkit: GHOST Integration with the Graphics Pipeline, The GHOST Haptics Scene Graph, Collision Detection and Response, Graphics and PHANTOM Calibration.

UNIT – IV (9)

Augmented Reality: Introduction to Augmented Reality, Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods

AR Hardware: Major Hardware Components for Augmented Reality Systems

AR Software: Major Software Components for Augmented Reality Systems, Software used to Create Content for the Augmented Reality Application

Interaction in AR: mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.

Traditional VR Applications: Medical applications, military applications, manufacturing.

Text Books:

[1] Burdea, G. C. and P. Coffet. *Virtual Reality Technology*, Second Edition, Wiley-IEEE Press, 2003/2006. *(Chapters 1 to 9)*

[2] Alan B. Craig, *Understanding Augmented Reality, Concepts and Applications*, Morgan Kaufmann, 2013. *(Chapters-1, 2, 3, 4 and 6)*

Reference Book(s):

[1] Alan Craig, William Sherman and Jeffrey Will, *Developing Virtual Reality Applications, Foundations of Effective Design*, Morgan Kaufmann, 2009

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: understand the components of VR, multiple models of input and output interface in VR
CO2: make use of modeling techniques to prepare object position, object behavior and collision detection in VR
CO3: apply the tools like Java-3D, World Tool-Kit, haptic general open source tool kit for designing VR apps
CO4: understand augmented reality and mixed reality, challenges , visualization techniques and applications

Course Articulation Matrix (CAM): U18AI801B VIRTUAL REALITY																
Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	U18AI801B.1	2	2	2	2	-	-	-	-	-	1	-	2	2	1	2
CO2	U18AI801B.2	2	2	2	2	-	-	-	-	-	1	-	2	2	1	2
CO3	U18AI801B.3	2	2	2	2	-	-	-	-	-	1	-	3	3	1	3
CO4	U18AI801B.4	2	2	2	2	-	-	-	-	-	1	-	3	3	1	3
U18AI801B		**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**2.5**	**2.5**	**1**	**2.5**

U18AI801C ROBOTIC PROCESS AUTOMATION

Class: B. Tech. VIII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: a thorough understanding of Robotic Process Automation (RPA), its principles, concepts, and practical applications.

LO2: the practical skills and knowledge required to design, develop, and implement Robotic Process Automation (RPA) solutions using RPA tooling.

LO3: advanced automation concepts and techniques to develop RPA solutions that can automate complex business processes effectively and efficiently.

LO4: best practices for designing and developing maintainable and scalable automation solutions that can handle a wide range of user interactions and exceptions.

UNIT – I (9)

Introduction: Scope and techniques of automation, Robotic process automation - What can RPA do?, Benefits of RPA, Components of RPA, RPA platforms, the future of automation. **RPA Basics:** History of automation, What is RPA, RPA vs Automation, Processes & flowcharts, Programming constructs in RPA, What processes can be automated, Types of bots, Workloads which can be automated, RPA advanced concepts, Standardization of processes, RPA development methodologies, Difference from SDLC, Robotic control flow architecture, RPA business case, RPA team, Process design document/solution design document, Industries best suited for RPA, Risks & challenges with RPA, RPA and emerging ecosystem.

UNIT - II (9)

RPA Tool Introduction and Basics: The user interface, Variables, Managing variables, Naming best practices, The variables panel, Generic value variables, Text variables, True or False variables, Number variables, Array variables, Date and time variables, Data table variables, Managing arguments, Naming best practices, The arguments panel, Using arguments, About imported namespaces, Importing new namespaces, Control flow introduction, If-else statements , Loops, Advanced control flow, Sequences, Flowcharts, About control flow, Control flow activities, The assign activity, The delay activity, The do-while activity, The if activity, The switch activity, The while activity, The for each activity, The break activity, Data manipulation introduction, Scalar variables, collections and tables, Text manipulation, Gathering and assembling data

UNIT - III (9)

Advanced Automation Concepts & Techniques: Recording introduction, Basic and desktop recording, Web recording, Input/output methods, Screen scraping, Data scraping, Scraping advanced techniques, Selectors, Defining and assessing selectors, Customization, Debugging, Dynamic Selectors, Partial selectors, RPA challenge, Image, Text & advanced citrix automation, Introduction to image & text automation, Image based automation, Keyboard based automation, Information retrieval, Advanced citrix automation challenges, Best practices, Using tab for images, Starting apps, Excel data tables & PDF - data tables in RPA, Excel and data table basics, Data manipulation in excel, Extracting data from PDF, Extracting a single piece of data, Anchors, Using anchors in PDF

UNIT - IV (9)

Handling User Events & Assistant Bots, Exception Handling: What are assistant bots?, Monitoring system event triggers, Hotkey trigger, Mouse trigger, System trigger, Monitoring

image and element triggers, An example of monitoring email, Example of monitoring a copying event and blocking it, Launching an assistant bot on a keyboard event.

Text Book:

[1] Alok Mani Tripathi, "*Learning Robotic Process Automation*", Packt Publishing, 2018. *(Chapters 1 to 9)*

Reference Books:

[1] Frank Casale , Rebecca Dilla, Heidi Jaynes , Lauren Livingston, "*Introduction to Robotic Process Automation: a Primer*", Institute of Robotic Process Automation,1st Edition 2015.

[2] Richard Murdoch, *Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant*", Independently Published, 1st Edition 2018.

[3] Srikanth Merianda,"R*obotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automatio*n", Consulting Opportunity Holdings LLC, 1st Edition 2018.

[4] Lim Mei Ying, "*Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes*", Packt Publishing, 1st Edition 2018.

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: apply their knowledge of RPA to evaluate real-world scenarios and make informed decisions about the implementation of RPA in different industries and organizations.

CO2: make use of RPA tools to develop a solution to automate a business process for a real-world scenario.

CO3: apply advanced automation concepts and techniques to develop RPA solutions that can automate a wide range of business processes.

CO4: develop and deploy RPA solutions that can handle user events and assistant bots, effectively automating complex business processes.

Course Articulation Matrix (CAM): U18AI801C ROBOTIC PROCESS AUTOMATION

Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**U18AI801C.1**	2	2	2	2	1	-	-	1	1	1	-	1	2	2	2
CO2	**U18AI801C.2**	3	3	3	3	2	-	-	1	1	1	-	3	2	2	2
CO3	**U18AI801C.3**	3	3	3	3	3	-	-	1	1	1	-	3	2	2	2
CO4	**U18AI801C.4**	3	3	3	3	2	-	-	1	1	1	-	3	2	2	2
U18AI801C		**2.75**	**2.75**	**2.75**	**2.75**	**2**	**-**	**-**	**1**	**1**	**1**	**-**	**2.5**	**2**	**2**	**2**

U18AI802A DATA VISUALIZATION

Class: B. Tech. VIII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: fundamentals of data visualization and categories of data
LO2: spatial and geospatial data visualization techniques
LO3: time-oriented, trees, graphs and network-based data visualization techniques
LO4: text & document visualization and research directions

UNIT – I (9)

Data Visualization: Visualization functionalities, importance, The difference between visualization and computer graphics, The visualization process, The scatter plot.

Data Foundations: Types of data, Data preprocessing, Visualization foundations, The eight visual variables, Taxonomies.

.UNIT - II (9)

Visualization Techniques for Spatial Data: One-dimensional data, Two-dimensional data, Three-dimensional data, Visualizing volume data, Dynamic data

Visualization Techniques for Geospatial Data: Visualizing geospatial data, Map projections, Visualization of point data, line data.

UNIT - III (9)

Visualization Techniques for Time-Oriented Data: Introduction, Definitions, characterizing time-oriented data, Relating data and time, Visualizing time-oriented data, Categorization

Visualization Techniques for Trees, Graphs, and Networks: Displaying hierarchical structures, Displaying arbitrary graphs, networks, Node-link graphs, Matrix representations for graphs

UNIT - IV (9)

Text and Document Visualization: Levels of text representations, The Vector space model, Single document and Document collection visualizations**.**

Image Visualization: Image Data Representation, Image Processing and Visualization, Basic Imaging Algorithms, Shape Representation and Analysis, Conclusion

Visualization Systems: Systems based on data type, Systems based on analysis type, Toolkits, Libraries, Research directions in visualization

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Text Book:

[1] Matthew O. Ward, Georges Grinstein, Daniel Keim , *Interactive Data Visualization: Foundations, Techniques, and Applications*, 2nd ed., Boca Raton: A K Peters/CRC Press, 2015.

[2] Alexandru C. Telea , *Data Visualization: Principles and Practice* , 2nd ed., Boca Raton :CRC Press, 2015.

Reference Books:

[1] Claus Wilke, *Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures*, 1st ed., Sebastopol: O'Reilly Media Inc, 2019.

[2] Kristen Sosulski, *Data Visualization Made Simple Insights into Becoming Visual*, 2nd ed.,Oxon: Routledge, 2015..

[3] Ben Fry, *Visualizing Data*, 1st ed., Sebastopol, O'Reilly Media Inc, 2008.

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: understand the basic and advanced techniques of data visualization, types of data and data processing
CO2: apply visualization techniques for representing the spatial and geospatial data
CO3: apply visualization techniques for representing the time-oriented and unstructured data
CO4: analyze text and document visualization techniques

Course Articulation Matrix (CAM):U18AI802A DATA VISUALISATION																
Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**U18AI802A.1**	2	2	2	2	1	-	1	-	1	2	1	2	1	2	2
CO2	**U18AI802A.2**	2	2	2	1	1	-	1	-	1	3	1	3	1	2	2
CO3	**U18AI802A.3**	2	2	2	2	1	-	-	-	1	2	-	2	1	2	2
CO4	**U18AI802A.4**	2	2	2	2	1	-	-	-	1	2	1	2	1	2	2
U18AI802A		**2**	**2**	**1.75**	**1.75**	**1**	**-**	**0.5**	**-**	**1**	**2.25**	**0.75**	**2.25**	**1**	**2**	**2**

U18AI802B FOG AND EDGE COMPUTING

Class: B. Tech. VIII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: fundamental concepts of Fog computing
LO2: fundamental concepts of Edge computing
LO3: network slicing in Fog and Edge computing
LO4: optimize the performance of Fog and Edge based applications

UNIT – I (9)

Introduction: Relevant technologies, Fog and Edge computing completing the Cloud, Advantages of FEC-SCALE, How FEC achieves these advantages: SCANC, Hierarchy of Fog and Edge computing outer-edge, Business models, Opportunities and challenges
Introduction to Fog Computing: Fog computing definition, Characteristics, Application scenarios, Issues and challenges, Cloud vs Fog computing
Fog Computing architecture: Communication and network model, Programming models.
Fog Computing Communication Technologies: Introduction, IEEE 802.11, 4G, 5G standards, WPAN, Short-range technologies, LPWAN and other medium, Long-range technologies.
Fog Computing Case Study: Intelligent Traffic Lights Management (ITLM) system

UNIT - II (9)

Introduction to Edge Computing: Edge Computing purpose and definition, Need of Edge computing, Key techniques that enable Edge computing, Characteristics, Application scenarios, Edge vs Fog Computing, Edge computing architectures
Edge Computing Systems: Apache Edgent, OpenStack, EdgeX Foundry, Data processing on the edge, Edge computing applications
Challenges: The Networking challenge, The management challenge, Miscellaneous challenges
Edge Computing Case study: A Wearable ECG Sensor, Smart home

UNIT - III (9)

Management and Orchestration of Network Slices in 5G, Fog, Edge and Clouds: Background, 5G, Cloud computing, Mobile Edge Computing (MEC), Edge and Fog computing
Network Slicing in 5G: Infrastructure layer, Network function and virtualization layer, Service and application layer, Slicing management and orchestration (MANO).
Network Slicing in Software-Defined Clouds: Network-aware virtual machines management, Network-aware virtual machine migration planning, Virtual network functions management. Network slicing management in Edge and Fog.

UNIT - IV (9)

Optimization Problems in Fog and Edge Computing: Introduction, The case for optimization in Fog computing, Formal modeling framework for Fog computing.
Metric: Performance, Resource usage, Energy consumption, Financial costs, Further quality attributes, Optimization opportunities along the Fog architecture, Optimization opportunities along the service life cycle
Middleware for Fog and Edge Computing Design Issues: Need for Fog and Edge computing Middleware, Design goals, State-of-the-art middleware infrastructures, System model, Proposed architecture, Case study example – data analytics, mobility support, scheduling and security

Text Book:

[1] Rajkumar Buyya and Satish Narayana Srirama - *Fog and Edge Computing: Principles and Paradigms* 1st Ed. ,*USA,* Wiley Series on Parallel and Distributed Computing, 2019. *(Chapters 1 to 6)*

Reference Books:

[1] Assad Abbas, Samee U. Khan, Albert Y. Zomaya - *Fog Computing: Theory and Practice,* 1st Ed. USA*: W*iley Series on Parallel and Distributed Computing, 2020.

[2] David Jensen - *Beginning Azure IoT Edge Computing: Extending the Cloud to the Intelligent Edge,* 1st Ed. USA: MICROSOFT AZURE, *2021.*

[3] Zaigham Mahmood - *Fog Computing Concepts, Frameworks and Technologies*, 1st Ed. , UK: Springer publication, 2018.

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: design applications based on Fog computing technologies.
CO2: design applications based on Edge computing technologies.
CO3: apply network slicing in 5G, software defined networks, Fog and Edge applications.
CO4: analyze optimization problems and apply metrics with middleware technologies in Fog and Edge applications.

Course Articulation Matrix (CAM): U18AI802B FOG AND EDGE COMPUTING

Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**U18AI802B.1**	2	2	2	2	1	-	-	1	1	1	-	1	1	1	1
CO2	**U18AI802B.2**	2	2	2	2	1	-	-	1	1	1	-	1	1	1	1
CO3	**U18AI802B.3**	2	2	2	2	1	-	-	1	1	1	-	2	1	1	1
CO4	**U18AI802B.4**	2	2	2	2	1	-	-	1	1	1	-	2	1	1	1
U18AI802B		**2**	**2**	**2**	**2**	**1**	**-**	**-**	**1**	**1**	**1**	**-**	**1.5**	**1**	**1**	**1**

U18AI802C BLOCKCHAIN TECHNOLOGIES

Class: B. Tech. VIII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge on/in…

LO1: basics of Blockchain, types of Blockchains & consensus algorithms
LO2: cryptographic primitives, Bitcoin Blockchain & alternative coins
LO3: ethereum ecosystem & development tools
LO4: architecture of Hyper ledger Fabric, Corda architecture & Alternative Blockchain

UNIT – I (9)

Distributed systems:

The History of Blockchain and Bitcoin: Electronic cash, Blockchain, Generic elements of a Blockchain, Benefits and limitations of Blockchain, Tiers of blockchain technology, Features of a Blockchain

Types of blockchain: Distributed ledgers, Distributed Ledger Technology, Public Blockchains Private Blockchains, Shared ledger, fully private and proprietary Blockchains, Tokenized blockchains, Token less Blockchains

Consensus: Consensus mechanism, Types of consensus mechanisms, Consensus in Blockchain

CAP theorem and Blockchain

UNIT – II (9)

Public Key Cryptography: Asymmetric cryptography

Public and private keys: RSA, Discrete logarithm problem in ECC, Hash functions, RSA digital signature algorithm, Elliptic curve digital signature algorithm

Introducing Bitcoin: Bitcoin, Digital keys and addresses, Transactions, Blockchain, Mining

Bitcoin Network and Payments: The Bitcoin network, Wallets, Bitcoin payments, Innovation in Bitcoin

Bitcoin Clients and APIs: Bitcoin installation

Alternative Coins: Theoretical Foundations, Bitcoin limitations, Litecoin, Zcash

UNIT – III (9)

Smart Contracts: History, Definition, Ricardian contracts

Ethereum: Introduction, Ethereum - bird's eye view, The Ethereum network, Components of the Ethereum ecosystem

Further Ethereum: Programming languages

Ethereum Development Environment: Test networks, setting up a private net, starting up the private network

Development Tools and Frameworks: Languages, Solidity language

Introducing Web3: Web3

UNIT – IV (9)

Hyper ledger: Projects under Hyper ledger, Hyper ledger as a protocol, The reference architecture, Fabric

Corda: Architecture, Components, The development environment – Corda

Alternative Blockchains: Ripple, Quorum, Multi chain, Rootstock, BigchainDB, Storj, Tezos
Current Landscape and What Next: Start-ups, Strong research interest, Real-world implementations, Education of blockchain technology Employment, Cryptoeconomics, Research in cryptography, Interoperability efforts, Blockchain as a Service
Other challenges: Regulation, Dark side
Blockchain research: Smart contracts, Centralization issues, Limitations in cryptographic functions, Consensus algorithms, Scalability, Code obfuscation

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Text Book:

[1] Imran Basir, Mastering Bockchain, 2nd ed., Packt Publishing Ltd., Birmingham –Mumbai, 2018.(chapters1,4,7to 16,19)

Reference Books:

[1] Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Crypto currency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
[2] Josh Thompson, Blockchain: The Blockchain for Beginnings, Guild to Blockchai Technology and Blockchain Programming, Create Space Independent Publishing Platform, 2017.
[3] Andreas Antonopoulos, Mastering Ethereum: Building Smart Contracts and Dapps, O'REILLY 2018
[4] Draft version of S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, Blockchain Technology: Crypto currency and Applications, Oxford University Press, 2019.

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: distinguish the type of Blockchain and consensus algorithm
CO2: install Bitcoin client and describe the functionality of various alternative coins
CO3: develop a smart contract using Ethereum development tools
CO4: explain Hyperledger Fabric and Corda architecture

Course Articulation Matrix (CAM): U18AI802C BLOCKCHAIN TECHNOLOGIES																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI802 C.1**	1	2	2	2	1	-	-	-	-	1	-	2	1	1	3
CO2	**U18AI802C.2**	3	3	2	2	1	-	-	-	-	1	-	2	1	2	3
CO3	**U18AI802 C.3**	3	2	3	2	2	-	-	-	-	1	-	3	3	3	3
CO4	**U18AI802 C.4**	1	2	3	2	1	-	-	-	-	1	-	3	1	2	3
U18AI802C		**2**	**2.25**	**2.5**	**2**	**1.25**	**-**	**-**	**-**	**-**	**1**	**-**	**2.5**	**1.5**	**2**	**3**

U18OE803A OPERATIONS RESEARCH

Class: B. Tech. VIII-Semester

Branch: ME, CSE, CSE (AI &ML), CSE (IoT), IT, CE, EEE, ECE, EIE

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives:

This course will develop students' knowledge in/on

LO1: concepts to solve linear programming problems which arise in real life using various methods and their advantages
LO2: applications of linear programming namely transportation and assignment problems which arise in different engineering fields.
LO3: non-linearity in optimization problems, direct search techniques and iterative methods.
LO4: various queuing systems and their practical relevance.

UNIT – I (9)

Linear Programming Problem (LPP): Mathematical models and basic concepts of linear programming problem; Solution of linear programming problem - Graphical method, Simplex method, Artificial variable techniques, Duality in linear programming, dual simplex method

UNIT – II (9)

Special types of LPP: Mathematical model of transportation problem, Methods of finding initial basic feasible solution, optimal solution of transportation problem, Degeneracy in transportation problem; Exceptional cases in transportation problem- Unbalanced transportation problem, Maximization transportation problem; Assignment problem- Mathematical formulation of the problem, Hungarian method to solve an assignment problem, Special cases in assignment problem- Maximization assignment problem

UNIT – III (9)

Non-linear Programming Problem (NLPP): Classical method of optimization using Hessian matrix; Iterative methods - Random search methods-Random jump method, Random walk method, Steepest decent method and Conjugate gradient method; Direct methods - Lagrange's method, Kuhn-Tucker conditions

UNIT – IV (9)

Queueing Theory: Queueing system- Elements and operating characteristics of a queuing system; Probability distributions in queueing systems- Distribution of arrivals (Pure Birth Process); Page 103 of 70

Classification of queueing models; Poisson queueing systems- Study of various characteristics of single server queuing model having infinite population $\{(M/M/1):(\infty/FIFO)\}$ and single server queuing model having finite population $\{(M/M/1):(N/FIFO)\}$, Generalized model (Birth-Death process)

Textbooks:

[1] Kanti swarup et.al, *Operations Research*, 16th ed., New Delhi: S. Chand & Sons, 2013. *(Unit-I, Unit-II, Unit-IV)*

[2] Singiresu S. Rao, *Engineering Optimization Theory and Practice*, 4th ed., Hoboken, New Jersey:

John Wiley & Sons, Inc, 2009 (*Unit-III)*

Reference Books:

[1] Hamdy. A. Taha, *Operations Research*, 7th ed., New Delhi: Prentice Hall of India Ltd, 2002.
[2] J.C. Pant, *Introduction to Optimization*, 7th ed., New Delhi*: Jain* Brothers, 2012.

Course Research Paper: Research papers (Journal/Conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Patent: Patents relevant to the course content will be posted by the course faculty in CourseWeb page.

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

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

CO1: model engineering real time problems and solve them using various LPP techniques

CO2: obtain the optimal solution of transportation, assignment problems and their real time applications

CO3: optimize the engineering problems using NLPP techniques

CO4 : apply various queuing models and their practical relevance

Course Articulation Matrix (CAM): U18OE803A OPERATIONS RESEARCH																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18OE803A.1**	2	2	-	-	-	-	-	-	-	1	-	1	-	-	-
CO2	**U18OE803A.2**	2	2	-	-	-	-	-	-	-	1	-	1	-	-	-
CO3	**U18OE803A.3**	2	2	-	-	-	-	-	-	-	1	-	1	-	-	-
CO4	**U18OE803A.4**	2	2	-	-	-	-	-	-	-	1	-	1	-	-	-
U18OE803A		**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**-**	**-**	**-**

U18OE803B MANAGEMENT INFORMATION SYSTEMS

Class: B. Tech. VIII-Semester **Branch:** CSE, CSE (AI&ML), CSE (IoT) & IT

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on…

LO1: basic concepts and challenges of management information systems
LO2: e-business and decision support systems techniques
LO3: development process and design of management information systems
LO4: different applications of management information systems

UNIT – I (9)

Management Information Systems: Systems: An Overview : Introduction, Need for management information systems, A concept, MIS - A definition, Management information system and Information technology, Nature and scope of MIS, MIS characteristics, Structure of MIS, Types of MIS, Role of MIS in global business, Challenges of managing information systems, IT Infrastructure and emerging technology

UNIT - II (9)

Business Applications of Information Systems:

E-Commerce, E-Business and E-Governance: Introduction, E-commerce, E-commerce sales life cycle, E-commerce infrastructure, E-commerce applications, E-commerce payment systems, Management challenges and opportunities, E-business, E-governance

Decision Support Systems: Introduction, Decision-Making: A concept, Simon's model of decision-making, Types of decisions, Methods for decision-making, Decision support techniques, Decision-making and role of MIS, Decision support systems, Business intelligence, Knowledge management systems

UNIT - III (9)

Development process of MIS: Development of long range plans of the MIS, Ascertaining the class of information, Determining the information requirement, Development and implementation of the MIS, Management of information quality in the MIS, Organisation for development of MIS, MIS: Development process mode

Strategic Design of MIS: Strategic management of the business, Why strategic design of MIS, Balance score card, Score card and Dash board, Strategic design of MIS, Development process steps for strategic design (SD) of MIS, Illustrating SD of MIS for big bazaar, Strategic management of business and SD of MIS, Business strategy determination, Business strategy implementation

UNIT - IV (9)

Management of Global Enterprise: Enterprise management system, Enterprise resource planning (ERP) System, ERP model and modules, Benefits of the ERP, ERP product evaluation, ERP implementation, Supply chain management (SCM), Information management in SCM, Customer relationship management (CRM), Management of global enterprise, EMS and MIS

Applications in Manufacturing Sector: Introduction, Personnel management (PM), Financial management (FM), Production management (PM), Raw materials management (RMM), Marketing management, Corporate overview.

Text Books:

[1] D.P.Goyal, Vikas, *Management Information Systems–Managerial Perspective*, 4th ed., Addison-Wesley, 2014. *(Unit 1)*
[2] Waman S. Jawadekar, *Management Information Systems Text and Cases: a Global Digital Enterprise Perspective,* 5th ed., McGraw Hill, 2014 *(Unit 2,3,4)*

Reference Books:

[1] Kenneth C. Laudon & Jane P. Laudon, *Management Information Systems,12th ed.,* New Delhi: Prentice Hall, 2012.
[2] S. Sadagopan, *Management Information Systems,2nd ed.,* New Delhi: PHI Learning, 2014.

Course Research Paper: Research papers (Journal/Conference papers) relevant to the course content will be postedby the course faculty in CourseWeb page.
Course Patent: Patents relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, students' will be able to…

CO1: examine the structure and importance of management information systems
CO2: analyze management information systems for decision making
CO3: apply the methodology to design and develop a management information system
CO4: asses the applications of management information systems in various manufacturing sectors

Course Articulation Matrix (CAM): U18OE803B MANAGEMENT INFORMATION SYSTEMS

Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**U18OE803B.1**	2	2	1	1	1	-	-	-	-	1	-	1	2	1	2
CO2	**U18OE803B.2**	2	2	2	1	1	-	-	-	-	1	-	1	2	1	2
CO3	**U18OE803B.3**	2	2	2	3	1	-	-	-	-	1	-	2	2	1	2
CO4	**U18OE803B.4**	2	2	3	3	1	-	-	-	-	1	-	2	3	1	3
U18OE803B		**2**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**1.5**	**2.25**	**1**	**2.25**

U18OE803C ENTREPRENEURSHIP DEVELOPMENT

Class: B. Tech. VIII-Semester **Branch:** ME, CSE ,IT, CE,EEE, ECE, EIE, CSE(AI&ML), CSE (IoT)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on…

LO1: fundamental characteristics of entrepreneur and his role in development of the nation

LO2: optimize the creativity and business plan

LO3: analyze the functions of various managements/managers in industry

UNIT–I (9)

Entrepreneurship: Definition, Role of entrepreneurship in economic development, Characteristics and types of an entrepreneur, Forms of business organizations – agencies dealing with entrepreneurship and small scale Industries, Case studies of successful entrepreneurs- identification of business opportunities in various branches of engineering

UNIT-II (9)

Creativity and Business Idea: Sources of new ideas, Methods of generating ideas and Creative problem solving, Concepts of innovation and incubation

Business Plan: Definition, scope and value of business plan, Market survey and demand survey

Feasibility studies: Technical feasibility, Financial viability and Social acceptability, Preparation of preliminary and bankable project reports

UNIT-III (9)

Project Planning: Product planning and development process, Sequential steps in executing the project

Plant layout: Principles, Types and factors influencing layouts,

Material Management: Purchase procedures, Issues of Materials -LIFO, FIFO, HIFO and Base stock

Fundamentals of Production Management: Production Planning and Control (PPC)-Concepts and functions, Long & short run problems

Marketing Management: Definition, Functions and market segmentation

UNIT-IV(9)

Financial Management: Introduction, Sources of finance-internal and external

Human Resource Management: Introduction, importance, selection, recruitment, training, placement, development

Legal Issues in Entrepreneurship: Mechanisms for resolving conflicts, Industrial laws-Indian Factories Act, Workmen Compensation Act, Intellectual Property Rights (IPR) – patents, Trademarks and copyrights

Text Book: -

[1] Robert D. Hisrich, Michael P.Peters,"Entrepreneurship",Tata Mc Graw-Hill,9th ed., 2014 (Chapters 1, 2, 4, 5, 6, 7, 8, 11 and 13).

Reference Books:

[1] David H. Holt, "*Entrepreneurship New venture creation*" 1st ed., New Delhi: Prentice Hall of India, 2004.

[2] Handbook for "*New Entrepreneurs*", 1st ed., New Delhi: Entrepreneurship Development

Institute of India, 1999.
[3] T.R. Banga, "*Project Planning and Entrepreneurship Development*",1st ed.,New Delhi: *CBS Publishers*, 1984.
[4] S. Chand & Co., "*A Practical Guide to Industrial Entrepreneurs*", New Delhi: S Chand, 2018.

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of this course, student's will be able to…

CO1: fundamental characteristics of entrepreneur and his role in economic development
CO2: apply creative problem solving methods to real time situations
CO3: analyze the functions of production and marketing managements
CO4: assess the legal issues in entrepreneurship and explain intellectual property rights

Course Articulation Matrix (CAM): U18OE803C ENTREPRENEURSHIP DEVELOPMENT

Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**U18OE803C.1**	2	-	-	-	-	1	-	1	1	1	1	1	1	-	-
CO2	**U18OE803C.2**	2	-	-	-	-	1	-	1	1	1	1	1	1	-	-
CO3	**U18OE803C.3**	2	-	-	-	-	1	-	1	1	1	1	1	1	-	-
CO4	**U18OE803C.4**	2	-	-	-	-	1	-	1	1	1	1	1	1	-	-
U18OE803C		**2**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**1**	**1**	**1**	**1**	**1**	**-**	**-**

U18OE803D FOREX&FOREIGN TRADE

Class: B. Tech. VIII-Semester **Branch:** ME, CSE ,IT, CE,EEE, ECE, EIE, CSE(AI&ML), CSE (IoT)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on…..

LO1: business, business system, objectives and types of companies
LO2: fundamentals of foreign trade and EXIM procedure
LO3: foreign exchange rate and methods of payments
LO4: foreign exchange control

UNIT–I (9)

Business: Nature and scope, Classification of business activities, Functions of commerce and trade

Business System: Characteristics and components of business system, objectives of business, classification of business objectives, Types of business

UNIT-II(9)

Foreign Trade: Introduction of international trade, Reasons for external trade, Special problems of foreign trade, EXIM-objectives, roles of EXIM in foreign trade, Stages in import procedure, Stages in export procedure-bill of lading, Mate's receipt, Certificate of origin.

Corporations Assisting Foreign Trade: State trading corporation of India, Export credit and guarantee corporation, Minerals and metals trading corporation of India

UNIT–III (9)

Foreign Exchange Rate: Meaning and importance of Foreign exchange rate, Methods of foreign payments; Exchange rates-Spot, Forward and Cross Rates, Demand and supply of foreign exchange rate, Equilibrium rate of foreign exchange, Theories of determining foreign exchange rate, International Parity condition - Balance of payments

Foreign Exchange Markets: Functions of exchange markets, Components and Players in Exchange Markets, FEMA-objectives and its role in Foreign Trade

UNIT–IV (9)

Foreign Exchange Control: Objectives, Characteristics, Advantages and disadvantages, Methods - intervention, Exchange restriction, Multiple exchange rates, Exchange clearing agreements, Method of operation, Exchange clearing agreements in practice, Payments agreements, Transfer moratoria, Indirect methods

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Text Books:

[1] C.B. Guptha, *Business Organization & Management*, 15th ed., New Delhi: Sultan Chand& Sons,2015.

[2] M.L. Seth, *Macro Economics*, 22nd ed., New Delhi: Lakshmi Narayan Agarwal Publishers, 2014.

[3] M.C. Vaish, Ratan Prakashan Mandir, *Monetary Theory*, 16th ed., New Delhi: Vikas Publications, 2016.

Reference Books:

[1] Y.K.Bhushan, Business Organization and Modern Management, 19th ed., New Delhi:

Sultan & Sons Publishers, 2014.
[2] S.A. Sherlekhar, Business Organization and Management, 1st ed., New Delhi: Himalaya Publishing House, 2000.
[3] K.P.M. Sundaram, Money Banking, Trade & Finance, 1st ed., New Delhi: Sultan & Sons Publishers, 2015.
[4] P.N.Chopra, Macro Economics, 1st ed., New Delhi: Kalyani Publishers, 2014.

Course Research Paper: Research paper (indexed Journals/conference papers) relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Patent: Patent relevant to the course content will be posted by the course faculty in CourseWeb page.
Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course project titles in CourseWeb page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On completion of the course, the student will be able to…

CO1: evaluate the objectives and types of industries and companies.
CO2: assess the procedure in imports and exports
CO3: analyse the foreign exchange rate and methods of foreign payments
CO4: adapt the methods of exchange control

Course Articulation Matrix (CAM): U18OE803D FOREX AND FOREIGN TRADE																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18OE803D.1**	-	-	-	-	-	-	-	-	-	2	2	1	1	-	-
CO2	**U18OE803D.2**	-	-	-	-	-	-	-	-	-	2	2	1	1	-	-
CO3	**U18OE803D.3**	-	-	-	-	-	-	-	-	-	2	2	1	1	-	-
CO4	**U18OE803D.4**	-	-	-	-	-	-	-	--	-	2	2	1	1	-	-
U18OE803D			**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**1**	**1**	**-**	**-**

U18AI804 MAJOR PROJECT WORK PHASE-II

Class: B. Tech. VIII-Semester **Branch:** Computer Science and Engineering(AI&ML)

Teaching Scheme :

L	T	P	C
-	-	6	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

The major project work will develop students' knowledge on /in…

LO1: real-world complex engineering problems, literature review, problem formulation; and experimental and data analysis techniques

LO2: design/development of solutions to real-world engineering problems; conduct of investigations of complex problems; modern tool usage to design, build and test a prototype; impact of solution in society, environment and sustainability contexts

LO3: ethics, team work and project management skills such as budgeting, scheduling

LO4: oral, written and multimedia communication skills; self-directed independent learning

1. **Major project work shall be continued in 8th semester as major project *phase-II*:** All the major project teams shall take the *phase -I* work forward and complete the remaining work as *Phase-II* in the 8th semester.
2. Final Year Major Project work represents the culmination of study towards B.Tech degree. **Major project offers an opportunity to integrate the knowledge acquired from various courses and apply it to solve real-world complex engineering problems**. The **student learning assessment process** (SLAP) shall include good number of presentations, demonstration of work undertaken, submission of a project report, writing project paper in scientific journal style & format, preparing project poster and creating video pitch on the complete project
3. Activities of major project SLAP shall be planned in such a way to ensure that the students acquire the essential knowledge, skills and qualities (KSQ) of a professional engineer.
4. **Team work:** Major project work is a team work

i. The students of a project team shall work together to achieve a common objective.

ii. Every student of a project team is expected to function effectively as an individual, and also with others as a team member in an ecosystem of team having knowledge diversity, gender diversity, social and cultural diversity among its members.

5. Every student is expected to put approximately **168 hours of work** into the major project *phase-II* course over the 12 weeks of 8th semester.
6. **Major project work *Phase-II*: 8th semester**

xii. The convener DPEC shall release complete schedule of *phase-II* CIE during last week of 7th semester (*well in advance before start of 8th semester*), immediately after completion of progress presentation-I, so that student teams would complete the scheduled works during inter-semester break and get ready with informative, confident and comfortable presentation for progress presentation-II.

xiii. The project supervisors: The project supervisors are expected to guide the students to systematically continue the *phase-I* work, useful work during inter-

semester break, meeting the deadlines as proposed in project timeline. The project supervisors shall ensure students focus on the project objectives and expected **deliverables**

xiv. The project supervisors shall ensure students have sufficient resources for successful projectcompletion.

xv. The project supervisors shall continue guiding students on

n. *Knowledge, skills and qualities (KSQ) of a professional engineer to be acquired* to propose solutions and design the systems to the identified real-world problems.

o. *Problem analysis* - to identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

p. *Applying engineering knowledge* - to apply the knowledge of mathematics, science,engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

q. *Design/development of solutions* - to design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental Considerations

r. *Conduct investigations of complex problems* - to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

s. *Modern tool usage* – to create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

t. *Engineering and society* – to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

u. *Environment and sustainability* – to understand the impact of the professional engineering solutions in societal and environmental contexts, demonstrate the knowledge of, and need forsustainable development

v. *Ethics* – to apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice

w. *Individual and team work* – to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

x. *Communication* – to communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and writeeffective reports and design documentation, make effective presentations, and give and receive clear instructions

y. *Project management and finance* – to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

z. *Life-long learning* – to recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

xi. **The project supervisors are also expected to continuously emphasize and guide the studentson**

o.Following project timeline: completing the tasks as planned in project timeline

p. Meeting Cadence:

i. Regular meetings with supervisor: Short and frequent meetings increase a team's work momentum. Regular meetings with supervisor to review the status of project are very essential. All students of the team shall participate in discussions and take notes.

ii. Meeting Frequency: Semi-weekly cadence, i.e., the meeting frequency shall be **twice a week.** Due weightage will be given to meeting cadence and considered for evaluation during presentations, i.e., number of planned meetings and number attended by students

q. Project Log Book: The activity journaling in project log book is veryimportant for a successful project.

vi. Project log book is a written record showing the daily project activity on projec goals from the very first thing like starting the project (an introduction statement what the project is all about), to the completion of the work (including the final results, and whether project met the core objectives / outcomes, etc.).

vii.In project log book, the activities like regular meetings with project supervisor, and work carried out on daily/weekly basis are to be recorded. This ensures that the student progress is being monitored well.

viii.The project supervisor shall regularly check the log book of every student of project team and endorse each and every activity by affixing his signature with date. With this, the number of planned meetings and number attended by the students will be also monitored.

ix. Log books are to be shown during all presentations and will be graded along with the project.

x. At the conclusion of the project work *phase-II*, the supervisor shall specifically comment, in the project log book, on whether the project team met each of the projectwork outcomes and to give evidence which describes the quality of work. For project teams, this also serves as self-assessment.

r. Writing down whatever is done and making notes of whatever is read. Writing down theprocedures / models followed, designs made, experiments conducted, simulations carried out, intermediate results obtained, ***difficulties faced and how they were fixed*** are very important. This kind of documenting the whole process as we go with project implementation is a very effective way and will help preparing a well documented report having original content. Note down and include information about all the resources that you used, magazines, Journals, patents, books, and so on. This information will be needed for the bibliography in your project report. On the other hand, documenting a report ***on the spur of the moment*** would end up copying things from other sources resulting in a plagiarized document.

s. The relevant knowledge, skills and qualities (**KSQ**) an engineering graduate should possess, which can be specially acquired by participating in major project work

t. Good and sufficient literature review: Literature review is a description and analysis of information related to the topic of project work. Reading good number of review articles, research articles published in recent issues of peer reviewed journals, technical magazines, patents, reference books on the topics of potential interest, will help one understand what has already been discovered and what questions remain to identify gaps in the literature.

u. Completing the proposed work by the end of *phase-II*

v. Right conduct of research to promote academic integrity, honesty and time management

w. Preparing a well-documented overall project report in proper format,covering the complete work carried out during both the phases (*phase-I and phase-II*).

x. Consequences of plagiarism, and use of anti-plagiarism software to detect plagiarismin the report

y. Submission of major project work report within acceptable plagiarismlevels, as per the Anti-plagiarism policy-2020 of our institute

z. Video pitch on complete project work: Capturing short videos, photos, screenshots on experiments conducted, simulations carried out, prototype / working model / process / software package / system developed during course of project execution photos showing interaction with supervisor for creating a short video pitch on the complete work done during both phases (phase-I and phase-II).

a. Project Paper: Writing a technical paper at the end of *phase-II* based on the solution(s) proposed, results obtained and prototype / working model /process / software package / system developed, for submission to a reputed non-predatory conference/non-paid peer reviewed journal.

b.Project poster: At the end of phase-II, the project teams shall have to present their project in the form of posters, at the time of demonstration of complete prototype/ working model / software package / system developed.

xviii. Phase – II evaluation: There shall be only Continuous Internal Evaluation (CIE) for major project work *phase-I* with following components

a. Progress Presentation -II *(during third / fourth week of 8^{th} semester):* The progress presentation-IIshall include the identified problem, objective(s), literature review, expected outcome(s), results of work done as per project plan timeline.

i. **Following project timeline**: The project timeline shall be meticulously followed and the tasks shall be completed as planned in project timeline.

ii. 80-85% of work is expected to be completed

iii. Project teams shall compulsorily show the following as part of their progress presentation-II

1. The slides on project timeline and

2. A table showing targeted tasks as per timeline and status – whether tasks accomplished?

Iv. Project log book: Every student of the Project team shall compulsorily show the activity journaling in the log book (with due signatures of project supervisor) during presentations

b. Final Presentation *(during penultimate week of 8^{th} semester):* **Project supervisor shall ensure thatthe project team has accomplished 100% of work proposed**. The project team shall

i. Follow project timeline: The project timeline shall be meticulously followed and the tasks shall be completed as planned in project timeline.

ii. compulsorily show the following as part of their final presentation

1. *The slides on project timeline and*

2. *A table showing targeted tasks as per timeline and whether all the identified tasks accomplished?*

iii. show project log book: Every student of the Project team shall compulsorily show

the complete activity journaling in the log book (*with due signatures of project supervisor*

iv. present complete results & analysis

v. demonstrate the completed project: working model / process / software package / system developed

vi. demonstrate the completed project with the **project poster presentation**

xix. Evaluation for Major project phase-II:

There shall be continuous internal evaluation (CIE) and end semester examination (ESE).

The evaluationfor *phase-II* shall be as given below:

Assessment	Weightage
A. CIE **(i) Supervisor Assessment (10%)** **(ii) DPEC Assessment (50%)** *(a) Progress presentation-II (10%)* *(b) Final presentation (10%)* *(c) Working model / process / software package / system developed (20%)* *(d) Project video pitch (5%)* *(e) Project paper (5%)*	**60%**
B. ESE *(i) Well-documented project report (15%)* *(DPEC shall evaluate the project reports, as per the rubrics, well before the ESE. At the time of ESE, evaluated project report marks shall be posted in the award list, along with the ESE oral presentation marks. Students shall appear for Viva-Voce with project report)* *(ii) Oral presentation with PPTs and viva-voce (15%)* *(iii) Project poster (5%)* *(DPEC shall evaluate the project poster, as per the rubrics, well before the ESE. At the time of ESE, evaluated project poster marks shall be posted in the award list. Students shall appear for Viva-Voce with project poster)*	**40%**
Total Weightage	**100%**

(a) **Working Model:** Every project team shall be required to develop a working model/ process/software package/system, on the chosen work. The completed working model/ process/software package/system shall be demonstrated during final presentation at the end of *phase-II*.

(b) **Video pitch**: Every project team shall be required to create a pitch video, which is a video presentation on their major project work *phase-I & phase-II*. The project team shall present the produced video pitch during Final presentation. The produced video pitch Should

(i) be 3 to 5-minute-long video (no longer than 5 minutes)

(ii) be concise and to the point, on the problem, proposed solution and its salient features.

(iii) show project timeline and sample page of log book
(iv) highlight the various stages during project implementation with the help of short videos / photos / screenshots on experiments conducted, simulations carried out, prototype / working model / process / software package / system developed as part of proposed solution and also photos showing team interactions with supervisor and the team working in the lab on project.
(v) discuss the impact of proposed solution in *ethical, environmental, societal and sustainable development contexts.*
(vi) emphasize key points about *business idea, potential market for the proposed solution*

(f) Project poster: At the end, the project teams shall present their project in the form of posters (A2 size). The teams shall have to present their work during the poster presentation session scheduled at the end of the 8th semester, at the time of demonstration of complete porotype / working model / software package / system developed.

(g) Well-documented plagiarism-cleared project report: Every project team shall be required to submit a well-documented project report on the work carried out, as per the format specified by the DPEC.The report should clear plagiarism check as per the anti-plagiarism policy-2020 of the institute. The following shall compulsorily be included in the Results-Chapter of the project report
(i) Photos / screen shots taken at various stages during the development of working model/ process/software package/system as part of Results-Chapter
(ii) Snapshot of final working model/ process/software package/system developed
(iii) Pictures of the team working in the lab, the team discussing with the project supervisor, working on creative project, or an event they are attending for work.
(iv) All these photos / screen shots shall be properly referred in the project report by assigning figure numbers

(h) Tangible outcomes of project work in Conclusions - Chapter: These are the lessons learnt from doinga project work. The students have to describe in their own words what they learnt from the project work experience. They have to describe what specific KSQs are acquired by them, with reference to the expected COs, after successful completion of major project work. Finally, a table depicting systematic mapping of what they have learnt and the expected major project work COs, is to be shown in the conclusions chapter.

(i) **Student feedback on major project in Conclusions - Chapter:** To gather information on whether project work was useful and gave practical experience on chosen field of interest, and other learning, a well-defined feedback questionnaire (*made available by the dept*) with closed and open questions shall be kept in the conclusions chapter of the project report.
(xx) It is mandatory for

a) every student of the team to appear for ESE oral presentation and viva- voce, to qualify for course evaluation
b) every project team to write a technical paper based on the solution(s) proposed, results obtained and prototype / working model / process / software package / system developed,for submission to a reputed non-predatory conference/non-paid

peer reviewed journal

c) every project team shall be required to create a pitch video, which is a video presentation on their major project work *phase-I & phase-II*

d) every project team shall present their project in the form of a poster, during the demonstration of complete porotype / working model / software package / system developed

(xi) he student has to register for the Major project work *phase-II* as supplementary examination in the following cases:

(a) he/she is absent for oral presentation and viva-voce as part of ESE presentation

(b) he/she fails to fulfill the requirements of Major project work *phase-II* evaluation as perspecified guidelines

(xii) Supplementary examination for Major project work *phase-II*

a) The CoE shall send the list of students, registered for supplementary examination, to the HoDs concerned

b) The DPEC, duly constituted by the HoD, shall conduct Major project *phase-II* supplementary exam and send the award list to the CoE within the stipulated time

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Course Learning Outcomes (COs):

Upon completion of the major project work, students will be able to…

CO1: review research literature, formulate problem, apply knowledge of mathematics, sciences, engineering fundamentals, experimental and data analysis techniques; synthesize technical knowledge and innovative approaches to generate suitable solutions for real-world complex engineering problems **(Technical skills)**

CO2: design a system or product based on product/customer specifications; develop, analyze, and critically evaluate the design alternatives in order to justify the solutions to a real-world problem guided by ethical, environmental, societal and sustainable development considerations; use modern engineering and IT tools to design, build and test a prototype within specified project timeline and budget **(Problem solving and critical thinking skills)**

CO3: apply project management and organizational skills; demonstrate integrity, leadership, creativity, professional and ethical responsibilities as an individual and as a member or leader to produce time- sensitive deliverables in a multi-disciplinary team **(Ethics and teamwork)**

CO4: collate the results, compare performance of prototype to design specifications and present clearly and effectively the proposed solution, conclusions and/or recommendations in written (report, poster, technical paper), oral (presentations) and multimedia formats (video pitch) and engage in self-directed independent learning and ife-long learning demonstrating the KSQ of a professional engineer **(Communication skills and life-long learning)**

Course Articulation Matrix (CAM): U18AI804 MAJOR PROJECT WORK PHASE-II																
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**U18AI804.1**	2	2	2	2	-	-	-	3	-	2	-	3	3	3	3
CO2	**U18AI804.2**	1	2	2	-	2	2	2	3	-	-	-	3	3	3	3
CO3	**U18AI804.3**	-	-	-	-	-	-	-	3	2	-	2	3	3	3	3
CO4	**U18AI804.4**	-	-	2	2	-	-	-	3	-	2	-	3	3	3	3
U18AI804		**1.5**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**3**