Course Name: Data Communication & Computer Network

Course Code: CS601

(Semester- VI)

Category: Major

Course Broad Category: Professional Core Course

[For Computer Science and Engineering]

……..

1. **Course Prerequisite:**
   - Computer Organization
   - Architecture, Operating Systems

2. **Course Learning Objectives:**
   i. To develop an understanding of modern network architectures from a design and performance perspective.
   ii. To understand the concept of layered network models and the functions of each layer (physical, data link, network, transport, application)
   iii. To become familiar with common network devices (e.g., routers, switches, firewalls) and their functionalities.
   iv. To understand fundamental protocols that enable data communication and resource sharing between devices.

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.

4. **Course Content**
   Course Name: Data Communication & Computer Network
   Course Code: CS601
   Hours per Week: 3L:0T:0P
   Credits: 3

Module	Topics	Lectures
Unit 1	Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.	9
Unit 2	Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA,CSMA/CD,CDMA/CA	8
Unit 3	Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.	14
Unit 4	Datagram Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.	8
Unit 5	Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.	8

5. References:

Text & References Books:

- B. A. Forouzan – "Data Communications and Networking (3rd Ed.) " – TMH
- A. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI
- W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education
- Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP

6. Course Outcomes:

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Describe the fundamental concepts of Computer Networking, Data Communications System and learn its components.	Describe	L1
CO2	Explain the concept of function(s) of each layer of the OSI model and learn about TCP/IP.	Explain	L2
CO3	Identify the different types of network topologies, protocols, and networking devices and make concepts about their functions within a network.	Identify	L3
CO4	Simplify building the skills of sub netting and routing mechanisms.		
CO5	Justify the different system component parts of the network.	Simplify	L4
CO6	Develop an expertise in some specific areas of networking such as the design and learn about maintenance of individual network.	Justify	L5

7. Mapping of course outcomes to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	-	-	-	-	-
2	-	3	-	-	-	-
3	-	-	3	3	-	-
4	-	-	-	3	3	-
5	-	-	-	-	-	3

8. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	-	2	2	-	-	-	3	3	2
CO2	3	2	1	2	2	-	-	-	3	3	2
CO3	3	2	-	2	2	-	-	-	3	2	2
CO4	3	3	2	2	3	-	-	1	3	2	3
CO5	2	3	2	2	3	-	-	2	3	2	2
CO6	2	3	2	2	3	-	-	2	3	2	2
AVG.	**2.66**	**2.33**	**1.75**	**2**	**2.5**	**0**	**0**	**0**	**0**	**1.67**	**3.0**

9. Mapping to PSO

Course Outcome	PSO1	PSO2	PSO3
CS601.CO1	2	1	-
CS601.CO2	2	1	-
CS601.CO3	2	2	1
CS601.CO4	3	2	1
CS601.CO5	2	1	1
CS601.CO6	3	3	2

***** End of Syllabus***<CS601>**

Course Name: Machine Learning
Course Code: CS602
(Semester- VI)
Category: Major
Course Broad Category: Professional Core Course
[For Computer Science and Engineering]

I. **Course Prerequisite:**
   A. Mathematics: (Linear Algebra, Probability and Statistics, Calculus)
   B. Data Structures and Algorithms
   C. Programming (Python, R, or MATLAB)
   D. Optimization Techniques

II. **Course Learning Objectives:**

This course aims to introduce students to the fundamental concepts of machine learning, focusing on how patterns and concepts can be learned from data without explicit programming. It provides a comprehensive understanding of various machine learning algorithms and techniques, with an emphasis on recent advancements in the field. Students will explore both supervised and unsupervised learning paradigms, gaining practical insights into their applications. Additionally, the course covers deep learning techniques and various feature extraction strategies, enabling students to develop advanced models for real-world problems.

III. **Teaching methodology and evaluation system for the course:**
Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies.
Evaluation System –
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.

IV. **Course Content:**
Course Name: Machine Learning
Course Code: CS 602
Hours per Week: 3L: 0T: 0P
Credits: 3

Module	Topics	Lectures
1	Supervised Learning (Regression/Classification) Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes Linear models: Linear Regression, Logistic Regression, Generalized Linear Models Support Vector Machines, Nonlinearity and Kernel Methods Beyond Binary Classification: Multi-class/Structured Outputs, Ranking	10
2	Unsupervised Learning Clustering: K-means/Kernel K-means Dimensionality Reduction: PCA and kernel PCA Matrix Factorization and Matrix Completion Generative Models (mixture models and latent factor models)	7
3	Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)	6
4	Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning	9
5	Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference	9

6	Recent Trends in Classification and Federated Learning **Recent Trends:** Evolution of modern classification techniques, multi-task learning, and meta-learning. **Federated Learning (FL) Foundations:** Decentralized data paradigms, privacy requirements, and the FL ecosystem (client-server architecture).**Algorithms & Aggregation:** Local training, model updates, and the Federated Averaging (FedAvg) algorithm. **Industry Applications & Challenges:** Cross-device and cross-silo FL deployments in healthcare, finance, and IoT. **System Bottlenecks:** Communication efficiency, non-IID (Independent and Identically Distributed) data challenges, and security risks.	5

6. References:

Text & References Books:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007
4. Dr. Rajiv Chopra, Machine Learning, Khanna Publishing House, 2018

7. Course Outcomes:

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PCC-CS602.CO1	Understand the concept of how to learn patterns and concepts from data without being explicitly programmed.	Understand	L2
PCC-CS602.CO2	Characterize, design and analyze the machine learning algorithms as supervised, unsupervised and reinforcement learning paradigms of machine learning.	Design and Analyze	L4
PCC-CS602.CO3	Evaluate, select and apply the appropriate ML model/s for real life problems.	Evaluate	L5
PCC-CS602.CO4	Understand the scalable ML like Semi-supervised learning and Bayesian Inference learning..		L2
PCC-CS602.CO5	Explore, and learn Deep learning techniques and various feature extraction strategies.	Explore & Learn	L2

8. Mapping of course outcomes to module / course content

Module	CO2	CO3	CO4	CO1	CO5
1	3	3	-	3	-
2	3	3	-	3	-
3	3	3	-		-
4	-	-	-	-	3
5	-	-	3	-	-
6	-	3	-	3	-

9. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	-	-	-	-	3
CO2	-	3	2	-	-	-	-	-	-	-	3
CO3	-		2	2	2	-	-	-	-	-	3
CO4	2	2	-	-	-	-	-	-	-	-	3
CO5	2	-	-	-	-	-	-	-	-	-	3
AVG.	**2.3**	**2.5**	**2**	**2**	**2**	-	-	-	-	-	**3**

10. Mapping to PSO

Course Outcome	PSO1	PSO2	PSO3
CS602.CO1	2	1	2
CS602.CO2	3	3	2
CS602.CO3	3	2	3
CS602.CO4	2	1	2
CS602.CO5	2	2	3

***** End of Syllabus***<CS602>**

Course Name: Internet of Things& Applications
Course Code: CS603
(Semester- VI)
Category: Major
Course Broad Category:
[For Computer Science and Engineering]

1. **Course Prerequisite:**

2. **Course Learning Objectives:**
   i. Able to understand the application areas of IOT
   ii. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
   iii. Able to understand building blocks of Internet of Things and characteristics

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology –Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.

4. **Course Content:**
   Course Name: Internet of Things
   Course Code: CS603
   Hours per Week: 3L:0T:0P
   Credits: 3

Module	Topics	Lectures
Unit1	Environmental Parameters Measurement and Monitoring: Why measurement and monitoring are important, effects of adverse parameters for the living being for IOT	7
Unit2	Sensors: Working Principles: Different types; Selection of Sensors for Practical Applications Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc	8
Unit3	Important Characteristics of Sensors: Determination of the Characteristics Fractional order element: Constant Phase Impedance for sensing applications such as humidity, water quality, milk quality Impedance Spectroscopy: Equivalent circuit of Sensors and Modelling of Sensors Importance and Adoption of Smart Sensors	11
Unit4	Architecture of Smart Sensors: Important components, their features Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel	10
Unit5	5: Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor And Future scope of research in smart sensor	7
Unit6	Recent trends in smart sensor for day to day life, evolving sensors and their architecture.	5

5. **References:**
   Text & References Books:

6. **Course Outcomes:**
After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level

7. **Mapping of course outcomes to module / course content**

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-

8. **Mapping of the Course outcomes to Program Outcomes**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-
AVG.	-	-	-	-	-	-	-	-	-	-	-

9. **Mapping to PSO**

	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-
CO2	-	-	-	-
CO3	-	-	-	-
CO4	-	-	-	-
CO5	-	-	-	-
CO6	-	-	-	-

***** End of Syllabus***<CS603>**

Course Name: Web & Internet Technology
Course Code: CS604

(Semester-VI)
Category: Major
Course Broad Category:
[For Computer Science and Engineering]

1. **Course Prerequisite:**
   - Programming Fundamentals (e.g., C, Java, Python)
   - Data Structures and Algorithms
   - Database Management Systems (DBMS)
   - Computer Networks
   - Operating Systems
   - Software Engineering

2. **Course Learning Objectives:**
   i. Understand the fundamentals of networking and the Internet.
   ii. Analyze TCP/IP and IP addressing schemes.
   iii. Explore Internet routing and electronic communication protocols.
   iv. Develop structured web pages using HTML and XML.
   v. Implement dynamic web applications.
   vi. Understand client-server communication in Java.
   vii. Identify and mitigate network security threats.
   viii. Understand emerging technologies and applications.

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.

4. **Course Content:**
   Course Name: Web and Internet Technology
   Course Code: CS604
   Hours per Week: 3L: 0T: 0P
   Credits: 3

Module	Topics	Lectures
Unit 1	Overview, Network of Networks, Intranet, Extranet and Internet. Domain and Subdomain, Address Resolution, DNS, Telnet, FTP, HTTP. Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion Control, IP Datagram, IPv4 and IPv6. Classful and Classless Addressing, Subnetting, NAT, IP Masquerading, IPtables. Routing – Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. POP3, SMTP.	6
Unit2	Introduction, Editors, Elements, Attributes, Heading, Paragraph, Formatting, Link, Head, Table, List, Block, Layout, CSS, Form, Iframe, Colors, Color Name, Color Value. Map, area, attributes of image area. Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing, XHTML in brief. Introduction, Environment Variable, GET and POST Methods.	9

Unit3	Introduction, Variable, Condition, Loop, Array, Implementing Data Structure, Hash, String, Regular Expression, File Handling, I/O Handling. Basics, Statements, Comments, Variable, Comparison, Condition, Switch, Loop, Break, Object – String, Array, Boolean, Reg-Ex, Function, Errors, Validation. Definition of cookies, Create and Store a cookie with example. Container Class, Components, Applet Life Cycle, Update Method, Parameter Passing to Applet, Applications.	10
Unit4	Java Socket, Java RMI. Malicious code – viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks. Password and Authentication; VPN, IP Security, Security in Electronic Transaction, Secure Socket Layer (SSL), Secure Shell (SSH). Introduction, Packet Filtering, Stateful, Application Layer, Proxy.	4
Unit5	Introduction, VoIP. Multimedia over IP: RSVP, RTP, RTCP and RTSP. Streaming media, Codec and Plugins, IPTV. Definition, Metadata, Web Crawler, Indexing, Page Rank, Overview of SEO.	5

5. References:

Text & References Books:

- Web Technology: A Developer's Perspective, N. P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013. (Chapters 1–5, 7, 8, 9)
- Internetworking Technologies: An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011. (Chapters 5, 6, 12)

6. Course Outcomes:

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Understand the fundamentals of networking and the Internet	Understand	L2
CO2	Demonstrate knowledge of IP addressing and routing	Demonstrate	L3
CO3	Develop web-based applications using HTML, XML, and CGI scripting	Develop	L6
CO4	Apply scripting languages for web development	Apply	L3
CO5	Implement client-server communication and security mechanisms	Implement	L3

7. Mapping of course outcomes to module / course content

Module	CO1	CO2	CO3	CO4	CO5
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

8. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	3	1	-	-	-	-	-
CO2	3	3	2	-	3	1	-	-	-	-	-
CO3	2	1	3	-	3	-	-	-	2	-	-
CO4	2	1	3	-	3	-	-	-	2	-	-
CO5	2	3	3	-	2	3	-	-	2	-	-
AVG.	**2.4**	**2.0**	**2.4**	**0.0**	**2.8**	**1.66**	**0.0**	**0.0**	**2.0**	**0.0**	**0.0**

9. Mapping to PSO

Course Outcome	PSO1	PSO2	PSO3
CS604.CO1	2	1	-
CS604.CO2	2	2	-
CS604.CO3	3	3	2
CS604.CO4	2	3	2
CS604.CO5	3	3	2

***** End of Syllabus***<CS604>**

Course Name: Image Processing
Course Code: CS605
(Semester-VI)
Category: Major
Course Broad Category: Professional Elective Course
[For Computer Science and Engineering]

1. **Course Prerequisite:**
   - Basics of linear algebra
   - Basics of calculus
   - Fundamentals of computer programming
   - Basic understanding of signals and systems.

2. **Course Learning Objectives:**
   i. Focuses on building a strong theoretical foundation.
   ii. Emphasizes image analysis and enhancement techniques.
   iii. Covers advanced methods for solving complex problems.
   iv. Highlights hands-on experience and real-world application.

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.

4. **Course Content:**
   Course Name: Image Processing
   Course Code: CS605
   Hours per Week: 3L: 0T: 0P
   Credits: 3

Module	Topics	Lectures
1	Introduction, Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.	9
2	Digital Image Formation, A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.	4
3	Mathematical Preliminaries, Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & Sine Transform.	9
4	Image Enhancement, Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. Highpass Filtering, High- boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.	8
5	Image Restoration, Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation.	7
6	Image Segmentation, Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.	7

5. **References:**

Text & References Books:

- Digital Image Processing by Rafael C. Gonzalez & Richard E. Woods, Pearson Education
- Fundamentals of Digital Image Processing by Anil K. Jain, Prentice-Hall
- Digital Image Processing by William K. Pratt, John Wiley & Sons
- Image Processing: Analysis and Machine Vision by Milan Sonka, Vaclav Hlavac, and Roger Boyle, Cengage Engineering

6. **Course Outcomes:**

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Understand the fundamental concepts and techniques of digital image processing, including image acquisition, representation, and basic image operations.	Understand	L2
CO2	Apply image enhancement techniques in the spatial domain to improve image quality and contrast.	Apply	L3
CO3	Analyze and implement various image transformation techniques, including histogram processing and spatial filtering.	Analyzing, Applying	L4, L3
CO4	Utilize frequency domain techniques for image processing, enabling analysis and manipulation of images in the frequency domain.	Applying	L3
CO5	Implement image restoration and segmentation techniques to address image degradation and extract meaningful regions from images.	Applying	L3
CO6	Develop practical skills in digital image processing through hands-on implementation of algorithms and techniques.	Applying/Creating	L3,L6

7. **Mapping of course outcomes to module / course content**

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	-	-	-	-	-
2	3	-	-	-	-	-
3	3		3	2	-	-
4	2	3	2	3	-	3
5	2	-	2	2	3	3
6	2	-	2	-	3	3

8. **Mapping of the Course outcomes to Program Outcomes**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	-	3	-	2	-	-	-	-	-	-	-
CO3	3	-	2	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	2	-	-	-	-	-
CO5	-	3	-	-	3	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	-	-	3
AVG.	**1.0**	**1.33**	**0.33**	**0.33**	**0.5**	**0.33**	**0.0**	**0.5**	**0.0**	**0.0**	**0.5**

9. **Mapping to PSO**

Course Outcome	PSO1	PSO2	PSO3
CS605.CO1	2	1	1
CS605.CO2	2	2	1
CS605.CO3	3	2	2
CS605.CO4	2	2	2
CS605.CO5	3	2	2
CS605.CO6	3	3	3

***** End of Syllabus***<CS605>**

Course Name: Human Computer Interaction
Course Code: CS606

(Semester-VI)

Category: Major

Course Broad Category: Engineering Science Course

[For Computer Science and Engineering]

1. **Course Prerequisite:**

2. **Course Learning Objectives:**

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.

4. **Course Content:**
   Course Name: Human Computer Interaction
   Course Code: CS606
   Hours per Week: 3L: 0T: 0P
   Credits: 3

Module	Topics	Lectures
Unit 1	Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; 9Interaction: Models – frameworks – Ergonomics – styles – elements –interactivity- Paradigms.	9
Unit 2	Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.	11
Unit 3	Cognitive models –Socio-Organizational issues and stake holder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.	8
Unit 4	Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.	8
Unit 5	Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.	8
Unit 6	Recent Trends: Speech Recognition and Translation, Multimodal System	3

5. **References:**
   Text & References Books:

- Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett
- Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley.

6. **Course Outcomes:**
After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Understand the core concepts, theories, and principles of HCI, including usability, user experience, and user-centered design	Understand	L2
CO2	Learn about different types of user interfaces, design principles, and best practices for creating effective and usable interfaces	Remember	L1
CO3	Understand the cognitive, perceptual, and behavioral aspects of human interaction with technology	Understand	L2
CO4	Become familiar with various methods for evaluating the usability and user experience of interactive systems, including usability testing, heuristic evaluation, and surveys	Analyze	L4
CO5	Understand the lifecycle model of interaction design	Understand	L2
CO6	Understand the social and ethical implications of technology design	Understand	L2

7. **Mapping of course outcomes to module / course content**

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-

8. **Mapping of the Course outcomes to Program Outcomes**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-
AVG	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

9. **Mapping to PSO**

Course Outcome	PSO1	PSO2	PSO3
CS606.CO1	-	-	-
CS606.CO2	-	-	-
CS606.CO3	-	-	-
CS606.CO4	-	-	-
CS606.CO5	-	-	-
CS606.CO6	-	-	-

***** End of Syllabus***<CS606>**

Course Name: Blockchain Technology
Course Code: CS607
(Semester-VI)
Category: Major
Course Broad Category: Professional Elective Course
[For Computer Science and Engineering]

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1. **Course Prerequisite:**
2. **Course Learning Objectives:**
3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology –Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.
4. **Course Content:**
   Course Name: Blockchain Technology
   Course Code: CS607
   Hours per Week: 3L:0T:0P
   Credits: 3

Module	Topics	Lectures
1	Definition, characteristics, and evolution of Blockchain Blockchain architecture and working principles Blocks, transactions, Distributed Ledger Technology (DLT) Concept of distributed ledgers Centralized vs. decentralized vs. distributed systems, Blockchain Consensus Mechanisms, Concept and working of PoW &PoS, Mining in Blockchain	3
2	Attacks on Computers & Computer Security Introduction, Need for Security, Security approaches, Principles of Security, Types of attack Cryptography: 2 Concepts & Techniques- Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size	10
3	Symmetric Key Algorithm - Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES (Data Encryption Standard) algorithm, IDEA (International Data Encryption Algorithm) algorithm, RC5 (Rivest Cipher 5) algorithm.	7

4	Asymmetric Key Algorithm, Digital Signature and RSA - Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required).	5
5	Internet Security Protocols, User Authentication - Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication.	5
6	Electronic Mail Security - Basics of mail security, Pretty Good Privacy, S/MIME Firewall - Introduction, Types of firewall, Firewall Configurations, DMZ Network	4
7	Basic wallet security practices, Decentralized Applications (DApps), Concept and characteristics of DApps, Smart contracts and DApp architecture, Blockchain-based application development	2

6. References:

Text & References Books:

1. "Cryptography and Network Security", William Stallings, 2nd Edition, Pearson Education Asia
2. "Cryptography and Network Security" by V.K. Jain, Khanna Publishing House,
3. "Network Security private communication in a public world", C. Kaufman, R. Perlman and M. Speciner, Pearson
4. Cryptography & Network Security: Atul Kahate, TMH.
5. "Network Security Essentials: Applications and Standards" by William Stallings, Pearson.
6. "Designing Network Security", Merike Kaeo, 2nd Edition, Pearson Book
7. "Building Internet Firewalls", Elizabeth D. Zwicky, Simon Cooper, D. Brent Chapman, 2nd Edition, Oreilly .
8. "Practical Unix & Internet Security", Simson Garfinkel, Gene Spafford, Alan Schwartz, 3rd Edition, Oreilly

7. Course Outcomes:

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CS607.CO1	Explain the fundamental concepts, architecture, working principles and consensus mechanisms of Blockchain and Distributed Ledger Technology.	Explain concept	Understand
CS607.CO2	Analyze computer security principles, security requirements and different types of attacks. Apply fundamental cryptographic techniques for encryption, decryption and secure communication.	Break down and examine	Analyze
CS607.CO3	Apply and analyze symmetric-key cryptographic algorithms including DES, IDEA and RC5.	Using knowledge	Apply

CS607.CO4	Analyze and apply asymmetric cryptography, RSA, digital signatures, message digests and hash functions.	Break down and examine	Analyze
CS607.CO5	Evaluate internet security, authentication mechanisms, email security, firewalls and DMZ configurations.	Make an evidence-based judgment	Evaluate
CS607.CO6	Design and develop basic blockchain applications using wallets, DApps and smart contracts.	Blueprint of the problem	Design

8. Mapping of course outcomes to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	-	-	-	-	-
2	-	3	-	-	-	-
3	-	-	3	-	-	-
4	-	-	-	3	-	-
5	-	-	-	-	3	-
6	-	3	-	-	-	-
7	-	-	-	-	-	3

9. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	2	-	-	-	-	-	-	-	-
CO3	3	-	2	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	2	2	-	-	-	-	-
CO5	-	3	-	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	3
AVG.	**3.0**	**2.67**	**2.0**	**2.0**	**3.0**	**2.0**	**2.0**	**0.0**	**3.0**	**0.0**	**0.0**	**3.0**

10. Mapping to PSO

Course Outcome	PSO1	PSO2	PSO3
CS607.CO1	2	1	3
CS607.CO2	3	2	2
CS607.CO3	2	2	1
CS607.CO4	3	2	2
CS607.CO5	2	2	2
CS607.CO6	3	3	3

***** End of Syllabus***<CS607>**

Course Name: Data Science
Course Code: CS613
(Semester-VI)
Category: Core Elective III
Course Broad Category: Professional Elective Course
[For Computer Science and Engineering]

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1. **Course Prerequisite:**
   - Probability and statistics
   - Data structure
   - Calculus
   - Linear algebra

2. **Course Learning Objectives:**
   i. Be able to perform statistical analysis and exploratory data analysis.
   ii. Be able to gain experience in supervised and unsupervised learning techniques.
   iii. Be able to form works with regression models, clustering, and network analysis.
   iv. Be able to analyze and interpret large datasets for real-world applications.

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.

4. **Course Content:**
   Course Name: Data Science
   Course Code: CS613
   Hours per Week: 3L: 0T: 0P
   Credits: 3

Module	Topics	Lectures
Unit 1	Introduction: Objective, scope, and outcome of the course, Types of data: textual, numeric, audio/visual	3
Unit 2	Python, fundamental libraries for Data Scientists. Integrated development environment (IDE). Data operations: Reading, selecting, filtering, manipulating, sorting, grouping, rearranging, ranking, and plotting.	7
Unit 3	Univariate, bivariate analysis, correlation analysis, rank correlation Pre-processing: i) imputing missing values, ii) identify anomalies Time-series data: extraction of trends, periodicity etc. Decomposition techniques: PCA, etc.	8
Unit 4	Image data analysis, Text data analysis, Speech data analysis	5
Unit 5	Introduction, learning curves, training-validation, and test. Learning models generalities, K-Nearest-Neighbor, support vector machines, random forest. Examples	7
Unit 6	Regression analysis, simple linear regression, multiple & Polynomial regression, logistic regression, Sparse model.	5
Unit 7	Unsupervised learning, clustering, K-Means, DB-Scan, similarity and distances, quality measures of clustering, case study	5

6. **References:**
   Text & References Books:

   - "Data Science from Scratch" by Joel Grus.
   - Essential Math for Data Science by Thomas Nield, O'Reilly Media, Inc. (May 2022)
   - Practical Statistics for Data Scientists by Peter Bruce, Andrew Bruce, O'Reilly Media, Inc (May 2017)
   - The Art of Data Science by Roger D. Peng and Elizabeth Matsui, lulu.com (2016)

- "Python for Data Analysis" by Wes McKinney.

7. Course Outcomes:

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Understand the fundamental concepts, scope, and applications of Data Science.	Understand	K2
CO2	Utilize Python and essential libraries for data manipulation and visualization.	Apply	K3
CO3	Perform descriptive statistics, data preparation, and exploratory data analysis.	Analyze	K4
CO4	Perform multi-modal data analysis.	Apply, Evaluate	K3, K5
CO5	Implement supervised learning models, including SVMs and Random Forests, Conduct regression analysis.	Apply, Analyze	K3, K4
CO6	Implement Un-supervised learning models, including K-Means, DB-Scan, etc., apply clustering techniques for unsupervised learning.	Analyze, Evaluate	K4, K5

8. Mapping of course outcomes to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	-	-	-	-	-
2	-	3	-	-	-	-
3	-	-	3	-	-	-
4	-	-	-	3	-	-
5	-	-	-	-	3	3
6	-	-	-	-	3	3
7	-	-	-	-	-	3

9. Mapping of the Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	-	-	-	-	-	-	-
CO2	3	3	3	2	2	1	-	-	-	-	-
CO3	2	3	3	3	3	2	-	-	-	-	-
CO4	1	2	3	3	3	3	1	1	-	-	-
CO5	1	2	3	3	3	3	2	1	-	-	-
CO6	1	2	3	3	3	3	3	3	2	1	1
AVG.	**1.83**	**2.66**	**2.66**	**2.8**	**2.8**	**2.4**	**2**	**1.66**	**2**	**1**	**1**

10. Mapping to PSO

Course Outcome	PSO1	PSO2	PSO3
CS613.CO1	2	1	2
CS613.CO2	2	3	2
CS613.CO3	3	2	2
CS613.CO4	3	2	3
CS613.CO5	3	2	2
CS613.CO6	3	2	2

***** End of Syllabus***<CS613>**

Course Name: Cryptography & Network Security

Course Code: CS614

(Semester-VI)

Category: Major

Course Broad Category:

[For Computer Science and Engineering]

1. **Course Prerequisite:**

2. **Course Learning Objectives:**

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology –Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.

4. **Course Content:**
   Course Name: Cryptography & Network Security
   Course Code: CS614
   Hours per Week: 3L:0T:0P
   Credits: 3

Module	Topics	Lectures
Unit 1	Attacks on Computers & Computer Security Introduction, Need for Security, Security approaches, Principles of Security, Types of attack	5
Unit 2	Cryptography: 2 Concepts & Techniques- Introduction, Plaintext & Cipher text, ubstitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size	7
Unit 3	Symmetric Key Algorithm - Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES(Data Encryption Standard) algorithm, IDEA(International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) algorithm.	8
Unit 4	Asymmetric Key Algorithm, Digital Signature and RSA - Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required).	5
Unit 5	Internet Security Protocols, User Authentication - Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication.	6
Unit 6	Electronic Mail Security - Basics of mail security, Pretty Good Privacy, S/MIME.	4
Unit 6	Firewall - Introduction, Types of firewall, Firewall Configurations, DMZ Network	3

5. **References:**
   Text & References Books:

- "Cryptography and Network Security", William Stallings, 2nd Edition, Pearson Education Asia
- "Cryptography and Network Security" by V.K. Jain, Khanna Publishing House,
- "Network Security private communication in a public world", C. Kaufman, R. Perlman and M. Speciner, Pearson
- Cryptography & Network Security: Atul Kahate, TMH.
- "Network Security Essentials: Applications and Standards" by William Stallings, Pearson.
- "Designing Network Security", Merike Kaeo, 2nd Edition, Pearson Book
- "Building Internet Firewalls", Elizabeth D. Zwicky, Simon Cooper, D. Brent Chapman, 2nd Edition, Oreilly .
- "Practical Unix & Internet Security", Simson Garfinkel, Gene Spafford, Alan Schwartz, 3rd Edition, Oreilly

6. **Course Outcomes:**

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level

7. Mapping of course outcomes to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-

8. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-
AVG.	-	-	-	-	-	-	-	-	-	-	-

9. Mapping to PSO

	PSO1	PSO2	PSO3
CO1	-	-	-
CO2	-	-	-
CO3	-	-	-
CO4	-	-	-
CO5	-	-	-
CO6	-	-	-

***** End of Syllabus***<CS614>**

Course Name: Soft Computing
Course Code: CS615
(Semester – VI)
Category: Major
Course Broad Category: Engineering Science Course
[For Computer Science and Engineering]

1. **Course Prerequisite:**
   - A strong mathematical background.
   - Proficiency with algorithms.
   - Programming skills in C, C++, or Java, MATLAB, etc.
   - Fundamental knowledge of Artificial Intelligence

2. **Course Learning Objectives:**
   i. Artificial neural networks and its applications.
   ii. Solving single-objective optimization problems using GAs.
   iii. Solving multi-objective optimization problems using Evolutionary algorithms (MOEAs).
   Applications of Soft computing to solve problems in varieties of application domains.

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.

4. **Course Content:**
   Course Name: Soft Computing
   Course Code: CS615
   Hours per Week: 3L: 0T: 0P
   Credits: 3

Module	Topics	Lectures
Unit 1	Introduction: Introduction to soft computing; introduction to fuzzy sets and fuzzy logic systems; introduction to biological and artificial neural network; introduction Genetic Algorithm	8
Unit 2	Fuzzy sets and Fuzzy logic systems: Classical Sets and Fuzzy Sets and Fuzzy relations: Operations on Classical sets, properties of classical sets, fuzzy operations, properties of fuzzy sets, cardinality, operations, and properties of fuzzy relations. Membership Functions: Features Of membership functions, standard forms and boundaries, different fuzzification methods. Fuzzy To Crisp conversions: Lambda Cuts for fuzzy sets, fuzzy Relations, Defuzzification Methods. Classical Logic and Fuzzy Logic: Classical Predicate Logic, Fuzzy Logic, Approximate Reasoning and Fuzzy Implication Fuzzy Rule based Systems: Linguistic Hedges, Fuzzy Rule base system- Aggregation of fuzzy Rules, Fuzzy Inference System- Mamdani Fuzzy Models– Sugeno Fuzzy Models. Applications of Fuzzy Logic: How Fuzzy Logic is applied in Home Appliances, General Fuzzy Logic controllers, Basic Medical Diagnostic systems and Weather forecasting	10

Unit 3	Neural Network Introduction to Neural Networks: Advent of Modern Neuroscience, Classical AI and Neural Networks, Biological Neurons and Artificial neural network; model of artificial neuron. Learning Methods: Hebbian, competitive, Boltzman etc., Neural Network models: Perceptron, Adaline and Madaline networks; single layer network; Backpropagation and multilayer networks. Competitive learning networks: Kohonen self organizing networks, Hebbian learning; Hopfield Networks. Neuro-Fuzzy modelling: Applications of Neural Networks: Pattern Recognition and classification	10
Unit 4	Genetic Algorithms: Simple GA, crossover and mutation, Multi-objective Genetic Algorithm (MOGA). Applications of Genetic Algorithm: genetic algorithms in search and optimization, GA based clustering Algorithm, Image processing and pattern Recognition	10
Unit 5	Other Soft Computing techniques: Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).	4

5. References:

Text & References Books:

- S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI
- Principles of Soft Computing, S N Sivanandam, S. Sumathi, John Wiley & Sons
- Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg
- Neuro-Fuzzy and Soft computing, Jang, Sun, Mizutani, PHI
- Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg, Pearson/PHI
- Fuzzy Sets and Fuzzy Logic: Theory and Applications, George J. Klir and Bo Yuan, Prentice Hall

6. Course Outcomes:

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Describe The Basic Concepts of Soft Computing; fuzzys sets and fuzzy logic systems, artificial neural network and Genetic Algorithm.	Remember	L1
CO2	Explain Fuzzy sets and Fuzzy logic systems including relationship between the Classical Sets and Fuzzy Sets, Membership functions, fuzzification and defuzzification methods, Fuzzy Inference System and Applications of Fuzzy Logic.	Understand	L2
CO3	Analyze the different Learning Methods and Neural Network models and Competitive Learning Networks	Analyze	L4
CO4	Understand the components of GA, crossover and mutation, Multi-objective Genetic Algorithm (MOGA).	Understand	L2
CO5	Apply the soft computing techniques such as fuzzy logic, neural network and genetic algorithm in different problem domains.	Apply	L3
CO6	Evaluate other popular soft computing techniques such as Simulated Annealing, Tabu Search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).	Evaluate	L5

7. Mapping of course outcomes to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	1	–	-	-	-
2	1	3	1	-	1	1
3	1	2	3	-	2	2
4	-	-	1	3	-	-
5	-	-	1	-	3	3

8. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	3	2	-	-	-	-	-	2
CO2	3	3	2	3	2	-	-	-	-	-	1
CO3	3	3	2	3	2	-		-		-	2
CO4	3	3	2	3	2	-	-	-	-	-	2
CO5	3	3	2	3	2	-	-	-	-	-	1
CO6	3	3	2	3	2	-	-	-	-	-	1
AVG.	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**1.5**

9. Mapping to PSO

Course Outcome	PSO1	PSO2	PSO3
CS615.CO1	2	1	2
CS615.CO2	2	1	2
CS615.CO3	3	2	2
CS615.CO4	2	1	2
CS615.CO5	3	2	3
CS615.CO6	2	1	3

***** End of Syllabus***<CS615>**

Course Name: Pattern Recognition
Course Code: CS616
(Semester – VI)
Category: Core Elective III
Course Broad Category: Engineering Science Course
[For Computer Science and Engineering]

1. **Course Prerequisite:**
   - Machine Learning

2. **Course Learning Objectives:**

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.

4. **Course Content:**
   Course Name: Core Elective III: Pattern Recognition
   Course Code: CS616
   Hours per Week: 3L: 0T: 0P
   Credits: 3

Module	Topics	Lectures
Unit 1	Basics of pattern recognition	2
Unit 2	Classifiers, Discriminant functions, Decision surfaces Normal density and discriminant functions Discrete features	8
Unit 3	Maximum-Likelihood estimation Gaussian mixture models Expectation-maximization method Bayesian estimation	6
Unit 4	4.1. Discrete hidden Markov models, Continuous density hidden Markov models	8
Unit 5	Fisher discriminant analysis, Principal component analysis . Parzen-window method K-Nearest Neighbour method	3
Unit 6	Non-parametric techniques for density estimation	2
Unit 7	Perceptron Support vector machines	5
Unit 8	Non-numeric data or nominal data, Decision trees	4
Unit 9	Criterion functions for clustering, Algorithms for clustering: K-means, Hierarchical and other methods	2

5. **References:**
   Text & References Books:

- R. O. Duda, P. E. Hart and D. G. Stork: Pattern Classification, John Wiley, 2001.
- S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.
- M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

6. Course Outcomes:

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Understand the Fundamentals of Pattern Recognition	Understand	L2
CO2	Implement and Evaluate Classification Models	Analyze	L4
CO3	Analyze feature selection algorithms in pattern recognition	Analyze	L4
CO4	Apply Hierarchical and Partition clustering techniques in pattern recognition applications	Apply	L3
CO5	Discuss the applications of pattern recognition in various applications	Analyze	L4

7. Mapping of course outcomes to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-

8. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-
AVG.	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

9. Mapping to PSO

Course Outcome	PSO1	PSO2	PSO3
CS616.CO1	-	-	-
CS616.CO2	-	-	-
CS616.CO3	-	-	-
CS616.CO4	-	-	-
CS616.CO5	-	-	-

***** End of Syllabus***<CS616>**

Course Name: Optimization Techniques & Operational Research

Course Code: CS623

(Semester VI)

Category: Major

Course Broad Category: B. Tech CSE

[For Computer Science and Engineering]

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1. **Course Prerequisite:**
   - Concept of Mathematics in the previous semesters of B. Tech curriculum.

2. **Course Learning Objectives:**
   i. Introduce students to the fundamental concepts, techniques, and applications of optimization in engineering and decision-making.
   ii. Equip students with the knowledge and skills to model, analyze, and solve complex optimization problems in various domains.
   iii. Cover both classical and advanced optimization methods for a comprehensive understanding of the subject.
   iv. Provide a strong foundation in theoretical principles as well as practical, real-world applications of optimization.

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies, Guest Lectures.
   Evaluation System –
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.

4. **Course Content:**
   Course Name: Optimization Techniques & Operational Research
   Course Code: CS623
   Hours per Week: 3L: 0T: 0P
   Credits: 3

Module	Topics	Lectures
Unit 1	Introduction: Historical Development, Engineering applications of optimization, Statement of an optimization problem, Classification of optimization problems.	4
Unit 2	Linear Programming: Standard form of a linear programming problem, Graphical Method, Simplex method, Charnes' Big-M Method, Duality in linear programming, Quadratic programming, Transportation Problems and Assignment Problems, Stochastic linear programming, Relevant applications. Nonlinear Programming: Unimodal function, Interpolation methods, Direct and indirect methods, Relevant applications	15
Unit 3	Geometric Programming: Unconstrained and constrained geometric programming problems, Geometric programming with mixed inequality. Integer Programming: Integer linear programming, Integer nonlinear programming, Relevant applications	8
Unit 4	Game Theory: Introduction, Characteristics of Game Theory, Two Person, zero sum games, Pure strategy. Dominance theory. Genetic Algorithms: Introduction, Representation methods, Selection methods, Operators, Replacement methods, Relevant applications.	8

Unit 5	Network Analysis: Critical Path analysis- PERT-CPM. Inventory Control: Introduction to EOQ Models of Deterministic and Probabilistic. Queuing Theory: Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1) and problems.	10

5. References:

Text & References Books:

- J.K. Sharma- Operations Research: Theory and Applications, Macmillan India Limited
- H. A. Taha- Operations Research, Pearson Education India.
- P. M. Karak – Linear Programming and Theory of Games, ABS Publishing House
- Ghosh and Chakraborty- Linear Programming and Theory of Games, Central Book Agency
- Hira, Gupta- Operations Research
- Rao, S. S., & Rao, S. S., Engineering optimization: theory and practice. John Wiley & Sons.
- Hadley, G., Linear programming, Narosa Publishing house.
- Deb. K, Optimization for engineering design: Algorithms and examples. PHI Learning Pvt. Ltd.
- Kumar, D. N., Multicriteria analysis in engineering and management. PHI Learning Pvt. Ltd.
- Ravindran, Philips and Solberg - Operations Research, Wiley India

5. Course Outcomes (CO):

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Understand optimization fundamentals, problem classification in relation with real life problems of engineering and applied sciences.	Identify	L1
CO2	Solve optimization problems using linear and nonlinear programming techniques and their applications.	Explain	L2
CO3	Apply geometric and integer programming methods to solve constrained and unconstrained linear and non- linear problems.	Implement	L3
CO4	Utilize game theory and genetic algorithms for strategic decision-making and complex problem-solving.	Organize	
CO5	Analyze and optimize networks, inventory systems, and queuing models in practical scenarios.	Assess	L4
CO6	Build up logical and analytical skills to create a new idea appreciated by academics, research & emerging trends in industry.	Construct	L5

7. Mapping of course outcomes to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	2	-	-	-	1
2	3	3	2	-	-	1
3	2	3	3	1	-	1
4	1	1	2	3	-	1
5	1	-	-	1	3	1

8. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	1	2	-	-	-	-	-	1
CO2	1	2	3	1	-	-	-	-	-	-	1
CO3	1	2	2	1	1	-	-	-	-	-	1
CO4	1	2	1	1	2	-	-	-	-	-	2
CO5	2	2	2	2	3	-	-	-	-	-	1
CO6	1	1	1	1	-	-	-	-	-	-	1

9. Mapping to PSO

Course Outcome	PSO1	PSO2	PSO3
CS623.CO1	2	1	1
CS623.CO2	3	2	1
CS623.CO3	3	2	2
CS623.CO4	3	1	2
CS623.CO5	3	2	3
CS623.CO6	3	2	3

***** End of Syllabus***<CS623>**

Course Name: AD-HOC & SENSOR NETWORKS
Code: CS626
(Semester – VI)
Category: Major
Course Broad Category: Engineering Science Course
[For Computer Science and Engineering]

1. **Course Prerequisite:**

2. **Course Learning Objectives:**
   i. Learn Ad hoc network and Sensor Network fundamentals
   ii. Understand the different routing protocols
   iii. Have an in-depth knowledge on sensor network architecture and design issues
   iv. Understand the transport layer and security issues possible in Ad hoc and Sensor networks
   v. Have an exposure to mote programming platforms and tools

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.

4. **Course Content**
   Course Name: AD-HOC & SENSOR NETWORKS
   Course Code: CS262
   Hours per Week: 3L: 0T: 0P
   Credits: 3

Module	Topics	Lectures
Unit 1	AD HOC NETWORKS – INTRODUCTION AND ROUTING PROTOCOLS: Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example commercial applications of Ad hoc networking, Ad hoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing (AODV).	8
Unit 2	SENSOR NETWORKS – INTRODUCTION & ARCHITECTURES: Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture – Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture – Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.	6
Unit 3	WSN NETWORKING CONCEPTS AND PROTOCOLS: MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts – S-MAC, The Mediation Device Protocol, Contention based protocols – PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols, Energy Efficient Routing, Challenges and Issues in Transport layer protocol.	10
Unit 4	SENSOR NETWORK SECURITY: Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layerwise attacks in wireless sensor networks, possible solutions for jamming tampering, blackhole attack, flooding attack. Key Distribution and Management, Secure Routing – SPINS, reliability requirements in sensor networks.	5
Unit 5	SENSOR NETWORK PLATFORMS AND TOOLS: Node-level Simulators – NS2 and its extension to sensor networks, COOJA.	5

5. References:

Text & References Books:

- Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks Architectures and Protocols", Prentice Hall, PTR, 2004.
- Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, and Applications", John Wiley, 2007.
- Carlos De Morais Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.
- Holger Karl, Andreas Willig "Protocols and Architecture for Wireless Sensor Networks" John Wiley and Sons, Ltd.

6. Course Outcomes:

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	ActionVerb	Knowledge Level
CO1	Introduction to Adhoc network and demonstration	Explain and Demonstrate	L2
CO2	Sensor Architecture	Discuss	L4
CO3	Wireless Network Protocol	Discuss Implement	L2
CO4	Sensor network Security	Explain	L1
CO5	Sensor network platform and tools	Implement	L2

7. Mapping of the Course outcomes to Program Outcomes

Module	CO1	CO2	CO3	CO4	CO5	CO6
1						
2						
3						
4						

8. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	1	-	-	-	-	-	-	-	-	1
CO2	1	1	-	-	-	-	-	-	-	-	1
CO3	1	1	-	-	-	–	-	-	-	-	1
CO4	1	1	-	-	-	-	-	-	-	-	1
C05	1	1	-	-	-	-	-	-	-	-	1
AVG	1	1	-	-	-	-	-	-	-	-	1

9. Mapping to PSO

Course Outcome	PSO1	PSO2	PSO3
CS626.CO1	2	1	2
CS626.CO2	2	2	1
CS626.CO3	2	2	2
CS626.CO4	2	1	2
CS626.CO5	2	3	3

***** End of Syllabus*** <CS626>**

Course Name: Robotics
Course Code: CS627
Category: Major
Course Broad Category: Engineering Science Course
[For Computer Science and Engineering]

1. **Course Prerequisite:**

2. **Course Learning Objectives:**

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology –Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.

4. **Course Content:**
   Course Name: Robotics
   Course Code: CS627
   Hours per Week: 3L: 0T:0P
   Credits: 3

Module	Topics	Lectures
Unit 1	Introduction: Basic concepts- Robot anatomy- Manipulators kinematics: Forward and inverse kinematics- Precision movement, robot specifications and Work volume, Types of Robot drives Basic robot motions- Point to point control, continuous path contour	8
Unit 2	End Effectors: End effectors- classification- mechanical, magnetic, vacuum and adhesive gripper- gripper force analysis and design. Robot control- Unit control system concept- servo and non-servo control of robot joints, adaptive and optimal control.	7
Unit 3	Sensors: Sensor devices, Types of sensors- contact, position and displacement sensors, Force and torque sensors- Proximity and range sensors- acoustic sensors- Robot vision systems- Sensing and digitizing- Image processing and analysis.	6
Unit 4	Robot Programming: Robot language classification- programming methods- off and on line programming- Lead through method Teach pendent method- VAL systems and language, simple program.	8
Unit 5	Industrial Application: Application of robots- Material handling Machine loading and unloading, Assembly, Inspection, Welding, Spray painting, Mobile robot, Microbots- Recent developments in robotics- safety consideration.	7

5. **References:**
   Text & References Books:

- S.R. Deb, Robotics technology and flexible automation, McGraw Hill publishing company limited, New Delhi, 1994.
- M.P. Groover. Industrial Robotics Technology Programming and Applications, McGraw Hill Book Co, Singapore, 1987.

6. **Course Outcomes:**
After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level

7. **Mapping of course outcomes to module / course content**

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-

8. **Mapping of the Course outcomes to Program Outcomes**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-
AVG.	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

9. **Mapping to PSO**

	PSO1	PSO2	PSO3
CO1	-	-	-
CO2	-	-	-
CO3	-	-	-
CO4	-	-	-
CO5	-	-	-
CO6	-	-	-

***** End of Syllabus***<CS627>**

Course Name: Entrepreneurship Development: Theory & Practice

Course Code: OE CS624

(Semester-VI)

Category: Major

Course Broad Category: Engineering Science Course

[For Computer Science and Engineering]

1. **Course Prerequisite:**

2.

3. **Course Learning Objectives:**
   i. To learn what is entrepreneurship, different types of entrepreneurs.
   ii. To learn the mechanisms major motives influencing an entrepreneur.
   iii. To gain knowledge about business.
   iv. To learn about financing and accounting, support to entrepreneurs.

4. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions, and Case Studies.
   Evaluation System –
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.

5. **Course Content**
   Course Name: Entrepreneurship Development: Theory & Practice
   Course Code: CS624
   Hours per Week:3L
   Credits: 3

Module	Topics	Lectures
Unit 1	Entrepreneurship: Types of Entrepreneurs– Difference between Entrepreneur and Intraprenerur, Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.	3
Unit 2	Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test– Stress Management, Entrepreneurship Development Programs– Need, Objectives.	10
Unit 3	Characteristics, Ownership Structures– Project Formulation– Steps involved in setting up a Business– identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment– Preparation of Preliminary Project Reports– Project Appraisal– Sources of Information– Classification of Needs and Agencies.	5
Unit 4	Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation– Income Tax, Excise Duty– Sales Tax.	5
Unit 5	Magnitude, Causes and Consequences, Corrective Measures– Business Incubators– Government Policy for Small Scale Enterprises– Growth Strategies in small industry– Expansion, Diversification, Joint Venture, Merger and Sub Contracting. Replacement algorithms: Optimal, First in First Out (FIFO), Least Recently Used (LRU)	8

6. **References:**
   Text & References Books:

- S.S Khanka EnterpreneurialDevelopment,S.Chand&CoLtd,New Delhi,2013
- D.F. Kuratko, Entrepreneurship– Theory, Process and Practice, 9th Edition, Cengage Learning 2014
- R.D. Hisrich and M.P. Peters, Entrepreneurship, 8th Edition, McGraw Hill, 2013.
  M.J. Manimala, Enterprenuership Theory at Cross Roads: Paradigms and Praxis, 2nd Edition, Dream Tech, 2005
- R. Roy, Entrepreneurship, 2nd Edition, Oxford University Press, 2011.

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Understand the necessity, development, numerous classification, and design issues of the operating system.	Understand	L2
CO2	Apply different methods for implementing processes and threads as well as the various process scheduling algorithms.	Apply	L3
CO3	Identify different challenges associated with deadlock, concurrency, and different synchronization mechanisms	Identify	L1
CO4	Analyze several memory management strategies for memory allocations and implementation of virtual	Analyze	L4
CO5	Understand I/O management, disc management, and file system structure.	Understand	L2
CO6	Understand I/O management, disc management, and file system structure.	Understand	L2

7. Mapping of course outcomes to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6

8. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												
AVG.												

9. Mapping to PSO

Course Outcome	PSO1	PSO2	PSO3
CS624.CO1	-	-	-
CS624.CO2	-	-	-
CS624.CO3	-	-	-
CS624.CO4	-	-	-
CS624.CO5	-	-	-
CS624.CO6	-	-	-

***** End of Syllabus***<CS624>**

Course Name: Mobile Application Development

Course Code: OE CS625

(Semester-VI)

Category: Major

Course Broad Category: Engineering Science Course

[For Computer Science and Engineering]

1. **Course Prerequisite:** Core Java and object oriented programming

2.

3. **Course Learning Objectives:**
   i. To learn and understand the fundamental concepts of Android Architecture.
   ii. Understand the application concept of SQL and AVD and Emulator.
   iii. To be able to design GUI of Android App using Android Studio.
   iv. To apply the learned concepts to design moderate to large Android Application.

4. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions, and Case Studies.
   Evaluation System –
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.

5. **Course Content**
   Course Name: Mobile Application Development
   Course Code: CS625
   Hours per Week:3L
   Credits: 3

Module	Topics	Lectures
Unit 1	In this section, you have to study the core concepts of Java and its essential functions.	2
Unit 2	Stands for the Structured Query Language. In this section, you have to study the basics of database management.	2
Unit 3	The basics of Android are covered in this section. The basic structure of an Android app is covered in this section. The emulator is testing tools in which you can test the app you have developed. Its interface is just like an Android phone. UI stands for user interface means how the application will be represented in front of the user.	5
Unit 4	Preference group in XML is studied in this section. Types of the menu to be created in the Android app and how to create it. Type of Intents and their examples are covered in this section. Here you will learn to design the user interface in detail. Different types of Tabs with example. Different types of Styles in UI design, for example.	8
Unit 5	The Backend support needed for the Android app is covered in this section. This tool helps in communicating with a device. It is a very important part of Android development. Linkify is a tool used for the filter. Different types of adaptors and their use in Android app development. How Notifications appear in the Android app. Custom Components includes the Tab and Popup. Threads is a very important part of Android app development. The types of threads for example are covered in this part.	8
Unit 6	The advanced features in an Android application, like creating a new folder, are covered in this section. How to implement any service in the Android application. Multimedia in Android covers the types of audio and video formats supported and its coding. It is an essential feature in an Android application. How to integrate Location-Based Services and Google Map in the Android application is covered in this section.	5
Unit 7	There are multiple sensors in smartphones that have to be coordinated with the operating	5

	system. How to monitor and manage the internet connectivity (Wi-Fi) in the Android device and its integration with the application software. Making a phone call and managing the detailed call log. Coordination of camera application software with the hardware of the phone. Controlling and managing Bluetooth connections.	

6. References:

Text & References Books:

- John Horton, "Android Programming with Kotlin for Beginners"
- Dawn Griffiths and David Griffiths, "Head First Android Development-A Brain-Friendly Guide"
- Michael Burton, "Android App Development for Dummies"
  Bill Phillips & Chris Stewart, "Android Programming: The Big Nerd Ranch Guide"
- Neil Smith, "Android Studio 3.0 Development Essentials"
- Ian Darwin, "Android Cookbook: Problems and Solutions for Android Developers"

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Learn and understand the fundamental concepts of Android Architecture.		
CO2	Understand the application concept of SQL and AVD and Emulator.		
CO3	Be able to design GUI of Android App using Android Studio.		
CO4	Apply the learned concepts to design moderate to large Android Application.		
CO5	Understand and apply smartphone services like Wifi, Bluetooth, Notification Handle, Camera and different types of sensors, etc.		
CO6	Be able to build Android apps and hosting procedures to Google Play Store.		

7. Mapping of course outcomes to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6

8. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												
AVG.												

9. Mapping to PSO

	PSO1	PSO2	PSO3	PSO4
CO1				
CO2				
CO3				
CO4				
CO5				
CO6				

***** End of Syllabus***<CS625>**

Course Name: Data Communication & Computer Networks Lab
Course Code: CS691
(Semester- VI)
Category: Major
Course Broad Category: Professional Core Courses
[For Computer Science and Engineering]

1. **Course Prerequisite:**
   Concepts of C Programming, Concepts of Linux Operating System
2. **Course Learning Objectives:**
   1. **Network Configuration: Install and configure NICs, understand IP addressing, subnetting, and manage network devices (cables, connectors, hubs, switches).**
   2. **Socket Programming: Implement TCP/UDP socket-based applications, multicast, broadcast, and design a multithreaded server.**
   3. **Data Link Layer Mechanisms: Apply flow control (Stop & Wait, Sliding Window) and error handling (CRC, Selective Repeat, Go-Back-N) at the Data Link layer.**
   4. **Server Setup & Security: Configure network services (FTP, Telnet, NFS, DNS) and firewalls, and manage server security.**
3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System – For each laboratory course there shall be a CIA during the semester for 60 marks and 40 marks for ESE.
   - ❖ Continuous Internal Assessment of laboratory courses (PCIA) [60 Marks]
     - Regular Laboratory Performance (20 Marks)
     - Experiment Execution and Results (15 Marks)
     - Laboratory Record/Report (10 Marks)
     - Viva Voce/Quiz (5 Marks)
     - Attendance (10 Marks)
   - ❖ End Semester Examination of Laboratory Course (PESE) [40 marks]
     - Write-Up about the given Experiment/Program [10 marks]
     - Execution of the Experiment/Program [10 marks]
     - Evaluation of the outcome or results of the Experiment/Program [10 marks]
     - Viva-Voce (on the concerned Experiment/Programming) [10 marks]
4. **Course Content:**
   Course Name: Computer Networks Lab
   Course Code: CS691
   Hours per Week: 4P: 0T: 0P
   Credits: 2

Module	Topics	Lab Hour
	Laboratory Experiments:	
1	NIC Installation & Configuration (Windows/Linux)	4
2	Understanding IP address, subnet etc Familiarization with Networking cables (CAT5, UTP) Connectors (RJ45, T-connector) Hubs, Switches	4
3	TCP/UDP Socket Programming Simple, TCP based, UDP based Multicast & Broadcast Sockets Implementation of a Prototype Multithreaded Server	10
4	Implementation of Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window i.e. Go-Back-N, and Selective Repeat ARQ protocols under varying packet-loss, propagation-delay and window-size conditions) Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check) Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)	8
5	Server Setup/Configuration FTP, TelNet, NFS, DNS, Firewall; Demonstration of LoRa setup	4
		30

6. References:

1. **Lab Manual and content as provided in lab hour.**

7. Course Outcomes:

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Knowledge Level
CS691.1	Understand different networking cables, connectors and networking devices.	L2
CS691.2	Understand IP addressing, subnetting	L2
CS691.3	Implement UDP and TCP based socket programming in Linux environment.	L3
CS691.4	Implement data link layer flow control and error control mechanisms.	L3
CS691.5	Apply server setup and configuration of FTP, TELNET, DNS etc.	L3

8. Mapping of course outcomes to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3					
2		3				
3			3			
4				3		
5					3	

9. Mapping of the Course outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CS691.1	2	2	2	3	3	2	-	-	-	-	3
CS691.2	2	2	3	2	3	2	-	-	-	-	3
CS691.3	2	2	2	3	3	2	-	-	-	-	3
CS691.4	3	3	3	2	3	3	-	-	-	-	3
CS691.5	2	2	3	3	3	2	-	-	-	-	3
AVG.	**2.2**	**2.2**	**2.6**	**2.6**	**3**	**2.2**	**0**	**0**	**0**	**0**	**3**

10. Mapping to PSO

Course Outcome	PSO1	PSO2	PSO3
CS691.CO1	1	2	1
CS691.CO2	2	2	1
CS691.CO3	3	3	2
CS691.CO4	3	3	1
CS691.CO5	2	3	2

***** End of Syllabus < CS691> *****

Course Name: Machine Learning Lab
Course Code: CS692
(Semester-VI)
Category: Major
Course Broad Category:
[For Computer Science and Engineering]

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1. **Course Prerequisite:**
   Linear Algebra and Probability, Programming Fundamentals, Data Structures and Algorithms, Basic Statistics

2. **Course Learning Objectives:**
   I. To implement supervised learning algorithms like Decision Trees, Logistic Regression, SVM, and Multilayer Perceptron for classification tasks.
   II. To explore ensemble methods (AdaBoost, Random Forest) and unsupervised learning techniques (K-Means, Hierarchical, and K-Mode Clustering) for data analysis.
   III. To apply association rule mining (FP Growth) and compare ML models using evaluation techniques for balanced and unbalanced datasets.
   IV. To develop and experiment with instance-based learning techniques like K-Nearest Neighbors (KNN) and Gaussian Mixture Models (GMM) for real-world applications.

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Interactive practical laboratory based.
   Evaluation System –

For each laboratory course there shall be a CIA during the semester for 60 marks and 40 marks for ESE.

- Continuous Internal Assessment of laboratory courses (PCIA) [60 Marks]
  - Regular Laboratory Performance (20 Marks)
  - Experiment Execution and Results (15 Marks)
  - Laboratory Record/Report (10 Marks)
  - Viva Voce/Quiz (5 Marks)
  - Attendance (10 Marks)
- End Semester Examination of Laboratory Course (PESE) [40 marks]
  - Write-Up about the given Experiment/Program [10 marks]
  - Execution of the Experiment/Program [10 marks]
  - Evaluation of the outcome or results of the Experiment/Program [10 marks]
  - Viva-Voce (on the concerned Experiment/Programming) [10 marks]

4.
   Course Name: Machine Learning Lab
   Course Code: CS692
   Hours per Week: 0L: 0T: 4P
   Credits: 3

5. **Course Content:**

Module	Topics	Lectures
1	Implement Decision Tree learning	2 hours
2	Implement Logistic Regression	2 hours
3	Implement classification using Multilayer perceptron	2 hours
4	Implement classification using SVM	2 hours
5	Implement Adaboost	2 hours
6	Implement Bagging using Random Forests	2 hours
7	Implement K-means Clustering to Find Natural Patterns in Data	2 hours
8	Implement Hierarchical clustering	2 hours
9	Implement K-mode clustering	2 hours
10	Implement Association Rule Mining using FP Growth	2 hours
11	Classification based on association rules	2 hours
12	Implement Gaussian Mixture Model Using the Expectation Maximization	2 hours
13	Evaluating ML algorithm with balanced and unbalanced datasets	2 hours
14	Comparison of Machine Learning algorithms	2 hours
15	Implement k-nearest neighbour algorithm	2 hours
16	Presentation-Based TinyML / Mini-Projects:**Data Curation & Annotation:** Custom dataset creation, proper labeling workflows, data cleaning, and preprocessing strategies.**TinyML & Resource-Constrained Modeling:** Implementation of lightweight machine learning models for edge devices and resource-constrained environments.**Project Deployment & Evaluation:** Structuring mini-projects aligned with the Smart India Hackathon and final-year project frameworks.**Technical Presentation:** Project demonstrations, documentation, and defense of dataset validity and model choice.	4 hours
	Total lecture hours	34hours

6. **References:**

Text & References Books:

7. Course Outcomes:

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	**Implement** various **classification** algorithms such as Decision Trees, Logistic Regression, SVM, and Multilayer Perceptron to **analyze** real-world datasets.	**Implement, Analyze**	**L3, L4**
CO2	**Apply** ensemble learning techniques like AdaBoost and Random Forest to **enhance** classification accuracy in machine learning models.	**Apply, Enhance**	**L3, L5**
CO3	**Demonstrate** clustering techniques, including K-means, Hierarchical Clustering, and K-mode Clustering, to **identify** natural data patterns.	**Demonstrate, Identify**	**L2, L3**
CO4	**Utilize** association rule mining techniques like FP Growth and **evaluate** classification based on association rules for pattern discovery.	**Utilize, Evaluate**	**L3, L5**
CO5	**Compare** and **analyze** different machine learning models using evaluation metrics for both balanced and unbalanced datasets.	**Compare, Analyze**	**L4, L5**
CO6	**Develop** and **experiment** with instance-based learning algorithms like K-Nearest Neighbors and Gaussian Mixture Models using Expectation Maximization for real-world applications.	**Develop, Experiment**	**L6, L3**

8. Mapping of course outcomes to module / course content

Module No.	Module Name	CO1	CO2	CO3	CO4	CO5	CO6
1	Implement Decision Tree Learning	**3**				**3**	
2	Implement Logistic Regression	**3**					
3	Implement classification using Multilayer Perceptron	**3**				**3**	
4	Implement classification using SVM	**3**				**3**	
5	Implement AdaBoost		**3**			**3**	
6	Implement Bagging using Random Forests		**3**			**3**	

7	Implement K-means Clustering to Find Natural Patterns in Data			**3**		**3**	
8	Implement Hierarchical Clustering			**3**		**3**	
9	Implement K-mode Clustering			**3**		**3**	
10	Implement Association Rule Mining using FP Growth				**3**		
11	Classification based on Association Rules				**3**		
12	Implement Gaussian Mixture Model using Expectation Maximization			**3**		**3**	**3**
13	Evaluating ML algorithms with balanced and unbalanced datasets					**3**	
14	Comparison of Machine Learning Algorithms	**3**	**3**	**3**	**3**	**3**	
15	Implement k-nearest neighbor algorithm					**3**	**3**

9. Mapping of the Course outcomes to Program Outcomes

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	3	3	2	1	-	-	1	2	2
CO2	3	2	3	3	3	1	-	-	1	2	2
CO3	3	3	2	3	3	2	-	-	1	2	2
CO4	3	2	3	3	3	2	-	-	1	2	2
CO5	3	3	3	3	3	2	-	-	1	2	3
CO6	3	2	3	3	3	2	-	-	1	2	3
Avg	**3**	**2.33**	**2.83**	**3**	**2.83**	**1.67**	**-**	**-**	**1**	**2**	**2.33**

10. Mapping to PSO

Course Outcome	**PSO1**	**PSO2**	**PSO3**
CS692.CO1	3	3	2
CS692.CO2	3	3	2
CS692.CO3	2	2	2
CS692.CO4	3	2	2
CS692.CO5	2	2	2
CS692.CO6	3	3	3

***** End of Syllabus***<CS692>**

Course Name: Research Methodology (Project I)
Code: CS681
(Semester – VI)
Category: Major
Course Broad Category: Engineering Science Course
[For Computer Science and Engineering]

1. **Course Prerequisite:**
   - Fundamental knowledge on English language and technical communication.
   - Fundamental knowledge on recent scientific, technology and engineering developments.

2. **Course Learning Objectives:**
   i. Create a detailed literature review on a selected topic.
   ii. Identify the gap and the scope to work on the defined topic.
   iii. Learn the ethical issues involved in the work.
   iv. Students will come out with a detailed report and a presentation.

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Cumulative Presentation (at least 3 times for each group) (40 Marks)- Summative Assessment.
   B. Final Term Presentation (60 Marks)- Summative Assessment.

4. **Course Content:**
   Course Name: Introduction to Computer Hardware and Software Course
   Course Code: CS681
   Hours per Week: 0L: 0T:4P
   Credits: 2

Module	Topics	Lectures
Unit 1	RESEARCH FORMULATION AND DESIGN - Motivation and objectives– Research methods vs. Methodology. Types of research–Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research. Defining And Formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review-primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature and research database, development of working hypothesis.	10
Unit 2	RESEARCH ETHICS, IPR AND SCHOLARLY PUBLISHING Ethics-ethical issues, ethical committees (human & animal); IPR- intellectual property rights and patent law, commercialization, copyright, royalty, trade related aspects of intellectual property rights (TRIPS); scholarly publishing- IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability	8
Unit 3	INTERPRETATION AND REPORT WRITING - Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Project Report, Layout of the Project/Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Project/Research Report, Precautions for Writing Research Reports, Conclusions.	8
Unit 4	DOCUMENT PREPARATION SYSTEM AND IDEs- Necessities of documents preparation system. Identify various online and offline document preparation systems (Overleaf, LaTex, etc). Needs of Integrated Development Environment, Identify different IDEs for various languages like Visual Studio Code, etc.	10

5. **References:**

Text & References Books:

- Research Methodology and Scientific Writing, C. George Thomas, Springer
- Research Methodology: A Step by Step Guide for Beginners, 4th Edn, Ranjit Kumar, SAGE Publications Pvt. Ltd.

6. **Course Outcomes:**

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Define and understand the motivation and objectives of research work	Remember	L1
CO2	Explain how to define and formulate a research problem	Apply	L3
CO3	Identify the importance of literature review in a research work	Analyze	L4
CO4	Explain the ethical issues involved while undertaking research	Apply	L3
CO5	Develop the skill set to correctly present a research work by following the protocols of writing standard research reports.	Create	L6
CO6	Identify the appropriate tools to write a report, create project and presentation	Apply	L3

7. **Mapping of course outcomes to module / course content**

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	3	3	1	1	-
2	1	1	1	3	1	-
3	-	1	2	2	3	3
4	-	-	-	1	3	3

8. **Mapping of the Course outcomes to Program Outcomes**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	1	-	-	-	-	3
CO2	3	3	-	3	-	2	-	-	-	-	3
CO3	3	3	3	3	3	2	-	-	3	-	3
CO4	3	-	-	-	-	2	3	-	-	-	3
CO5	3	-	-	-	-	2	-	-	3	-	3
CO6	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**3**
AVG.	**3**	**3**	**3**	**3**	**3**	**1.83**	**3**	**-**	**3**	**-**	**3**

9. **Mapping to PSO**

Course Outcome	PSO1	PSO2	PSO3
CS681.CO1	2	1	2
CS681.CO2	3	2	2
CS681.CO3	2	1	2
CS681.CO4	1	1	2
CS681.CO5	2	2	3
CS681.CO6	2	3	2

***** End of Syllabus***<681>**