Jabalpur Engineering College, Jabalpur
(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)
(AICTE Model Curriculum Based Scheme)
Bachelor of Technology (B.Tech.) VII Semester (Computer Science & Engineering)

w.e.f. July 2023

S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical			L	T	P	
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work					
1	CS71	PEC	Professional Elective Course-III	70	20	10	-	-	100	3	1	-	4
2	CS72	OEC	Open Elective Course-II	70	20	10	-	-	100	3	1	-	4
3	CS73	PCC	Compiler Design	70	20	10	30	20	150	3	-	2	4
4	CS74	PCC	Internet of Things	70	20	10	30	20	150	3	-	2	4
5	CS75	PCC	Computer Vision	70	20	10	30	20	150	3	-	2	4
6	CS76	MC	Industrial Training Evaluation	-	-	-	60	40	100	-	-	4	2
			Total	**350**	**100**	**50**	**150**	**100**	**750**	**15**	2	**10**	**22**
7	CS77	DLC	Self-Learning Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	-	-	-	-	8
8	CS78	MC	NSS/NCC/Swatchhata Abhiyan/Rural Outreach	Qualifier									
Additional Course for Honours or Minor Specialization				Permitted to opt for maximum 8 credits against additional MOOC courses in subject code CS77 for the award of Honours (Minor Specialization).									

Note: 01. Departmental BOS will decide list of three/four elective subjects for each PEC and OEC.
02. MOOC/NPTEL subjects shall be taken with permission of HOD/Coordinator
03. Industrial training presentation & viva shall take place in VII Sem. which students have already done in VI Sem.

Professional Elective Course-III		
S.No.	**Subject Code**	**Subject Name**
1	CS71A	Distributed System and Cloud Computing
2	CS71B	Information Retrieval
3	CS71C	Wireless Sensor Networks

Open Elective Course-II		
S.No.	**Subject Code**	**Subject Name**
1	CS72A	Advance Mobile Communication
2	CS72B	Optimization Techniques
3	CS72C	Entrepreneurship Development & Management

1 hour lecture (L) = 1 credit | 1 hour Tutorial (T) = 1 credit | 2 hour Practical (P) = 1 credit

PEC: Professional Elective Course, OEC: Open Elective Course, PCC: Professional Core Course, DLC: Distance Learning Course, MC: Mandatory Course

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Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS71A	**Distributed System and Cloud Computing**	70	20	10	-	-	100	3	1	0	4

Course Contents:

Module I: Introduction to Distributed Computing Concepts: Basic concepts of distributed systems, distributed computing models, issues in designing distributed systems. Inter Process Communication: Fundamental concepts related to inter process communication including message passing mechanism, Concepts of group communication Remote Communication Remote Procedure Call (RPC), Remote Method Invocation (RMI).

Module II: Clock synchronization: Introduction of clock synchronization, Global state, Mutual Exclusion Algorithms, Election algorithms. Distributed mutual exclusion algorithms: Introduction, Preliminaries, Lamport's algorithm, Ricart Agrawala algorithm, Maekawa's algorithm, Suzuki–Kasami's broadcast algorithm. Deadlock detection in distributed systems: Introduction , System model , Preliminaries , Models of deadlocks – Knapp's classification – Algorithms for the single resource model, the AND model and the OR model.

Module III: Distributed Shared Memory: Fundamental concepts of DSM, types of DSM, various hardware DSM systems. Consistency models, issues in designing and implementing DSM systems.

Module IV: Distributed System Management: Resource Management Scheduling Algorithms. Task Assignment, Load balancing approach, Load sharing approach. Process Management: Process Migration Mechanism. Thread models, Distributed File System: Concepts of a Distributed File System (DFS), file models.

Module V: Introduction to Cloud Computing: Cloud Computing history and evolution, benefits of cloud computing Cloud Computing Architecture: Cloud Architecture model. Types of Clouds: Public Private & Hybrid Clouds, Cloud based services: Platform as a service (PaaS), Software as a service (SaaS), Infrastructure as a service (laaS). Classification of Cloud Implementations: Amazon Web Services, Microsoft Azure & Google Cloud-- Compute Services, Storage Services, Network Services, Database services.

Suggested Books:

1. Singhal & Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill
2. Ramakrishna,Gehrke," Database Management Systems", McGraw Hill
3. Vijay K.Garg Elements of Distributed Computing, Wiley
4. Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design", Pearson Education
5. Tanenbaum,Steen," Distributed Systems", PHI
5. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, .
6. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Security, CRC Press.

Distributed System & Cloud Computing (CS71A)

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

CO1: Explain fundamental concepts of Distributed System and Cloud Computing.

CO2: Classify various architectural and fundamental models of distributed system design.

CO3: Apply the election algorithms in a given scenario to select the coordinator.

CO4: Analyze different agreement protocols and communication protocols like RPC, RMI etc. in Distributed systems.

CO5: Examine various deadlock handling mechanisms in distributed environment.

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Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS71B	**Information Retrieval**	70	20	10			100	3	1	0	4

Course Content:

Module I: INTRODUCTION: Introduction, History of IR, Components of IR, Issues, Open source Search engine Frameworks, The impact of the web on IR, The role of artificial intelligence (AI) in IR, IR Versus Web Search, Components of a Search engine, Characterizing the web.

Module II: INFORMATION RETRIEVAL: Boolean and vector space retrieval models, Term weighting, TF-IDF, weighting- cosine similarity, Preprocessing, Inverted indices, efficient processing with sparse vectors, Language Model based IR, Probabilistic IR, Latent Semantic Indexing - Relevance feedback and query expansion.

Module III: WEB SEARCH ENGINE – INTRODUCTION AND CRAWLING:
Web search overview, web structure, paid placement, search engine optimization/ spam. Web size measurement, search engine optimization/spam, Web Search Architectures, crawling, meta-crawlers, Focused Crawling, web indexes, Near-duplicate detection, Index Compression, XML retrieval.

Module IV: WEB SEARCH – LINK ANALYSIS AND SPECIALIZED SEARCH: Link Analysis, hubs and authorities, Pagerank and HITS algorithms, Searching and Ranking, Relevance Scoring and ranking for Web, Similarity, Hadoop & Map Reduce Evaluation, Personalized search, Collaborative filtering and content-based recommendation of documents and products, handling "invisible" Web, Snippet generation, Summarization, Question Answering, Cross- Lingual Retrieval.

Module V: DOCUMENT TEXT MINING: Information filtering; organization and relevance feedback, Text Mining, Text classification and clustering, Categorization algorithms: naive Bayes; decision trees; and nearest neighbor, Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM).

Suggested Books:
1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval , Cambridge University Press.
2. Ricardo Baeza -Yates and Berthier Ribeiro - Neto, Modern Information Retrieval: The Concepts and Technology behind Search 2nd Edition, ACM Press Books.
3. Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, 1st Edition Addison Wesley.
4. Mark Levene, An Introduction to Search Engines and Web Navigation, 2nd Edition Wiley.

Information Retrieval (CS71B)

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

CO1: Apply information retrieval models.
CO2: Design Web Search Engine.
CO3: Use Link Analysis.
CO4: Use Hadoop and Map Reduce.
CO5: Apply document text mining techniques.

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Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS71C	**Wireless Sensor Networks**	70	20	10	0	0	100	3	1	0	4

Course Content:

Module I: Fundamentals: Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

Module II: Ad hoc networks: . Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

Module III: Routing: Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee

Module IV: Data dissemination: Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

Module V: Design : Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and internet to WSN Communication. Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

Suggested Books:

1. Waltenegus Dargie , Christian Poellabauer, "Fundamentals Of Wireless Sensor Networks Theory And Practice", By John Wiley & Sons Publications
2. Sabrie Soloman, "Sensors Handbook" by McGraw Hill publication.
3. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks", Elsevier Publications.
4. Kazem Sohrby, Daniel Minoli, "Wireless Sensor Networks": Technology, Protocols ard Applications, Wiley-Inter science.
5. Philip Levis, And David Gay "TinyOS Programming" by Cambridge University Press

Wireless Sensor Networks (CS71C)

Course Outcome: After completion of the course, Students will be able to:

CO1: Understand the basics, challenges, and applications of wireless sensor networks.

CO2: Explain the key technologies, issues, and challenges in MANETs and wireless sensor networks.

CO3: Describe routing protocols and MAC protocols, including IEEE 802.15.4 and ZigBee.

CO4: Analyze data dissemination and fusion techniques, focusing on real-time support and security in sensor networks.

CO5: Apply design principles for WSNs, including gateway concepts, communication methods, and operating systems like TinyOS.

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Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS72A	**Advance Mobile Communication**	70	20	10	-	-	100	3	1	-	4

Course Contents:

Module 1: Mobile Communications Overview: Evolution from 1G to 5G, Analog voice systems in 1G, digital radio systems in 2G, voice and messaging services, TDMA based GSM, CDMA, 2.5G (GPRS), 2.75G (EDGE); IMT2000, 3G UMTS, W-CDMA, HSPA, HSPA+, 3G services and data rates, IMT Advanced, 4G, LTE, VoLTE, OFDM, MIMO, LTE Advanced Pro (3GPP Release 13+), IMT2020, enhancements in comparison to IMT Advanced.

Module 2: Introduction to 5G Communication: 5G potential and applications, Usage scenarios, enhanced mobile broadband (eMBB), ultra reliable low latency communications (URLLC), massive machine type communications (MMTC), D2D communications, V2X communications.

Module 3: 5G Radio access technologies: Spectrum for 5G, spectrum access/sharing, millimeter Wave communication, channels and signals/waveforms in 5G, carrier aggregation, small cells, dual connectivity. New Radio (NR), Standalone and non-standalone mode, non-orthogonal multiple access (NOMA).

Module 4: 5G Network: Massive MIMO, beam formation, PHY API Specification, flexible frame structure, Service Data Adaptation Protocol (SDAP), centralized RAN, open RAN, multi-access edge computing (MEC); Introduction to software defined networking (SDN), network function virtualization (NFV), network slicing; restful API for service- based interface, private networks.

Module 5: Current state and Challenges ahead: 5G penetration in developed countries; deployment challenges in low-middle income countries, stronger backhaul requirements, dynamic spectrum access and usage of unlicensed spectrum, contrasting radio resource requirements, large cell usage, LMLC, possible solutions for connectivity in rural areas (BharatNet, TVWS, Long-range WiFi, FSO); non-terrestrial fronthaul / backhaul solutions: LEOs, HAP/UAV.

Suggested Reference Books :

1. 4G, LTE-Advanced Pro and The Road to 5G by Erik Dahlman
2. 5G NR: Architecture, Technology, Implementation, and Operation of 3GPP New Radio
3. Standards Hardcover – 1 June 2019 by Sassan Ahmadi Dr. (Author)
4. Hansmann, LotharMerk, Martin Niclous, Stober, "Principles Of Mobile Computing", Dreamtech Press.
5. WCY Lee, "Mobile Communications Design Fundamentals", Prentice Hall.
6. AJ Viterbi, "CDMA: Principles of Spread Spectrum Communications", Addison Wesley.
7. VK Garg&JE Wilkes, "Wireless & Personal Communication Systems", Prentice Hall.
8. Paolo Bellavista and Antonio Corradi (Eds.), "Handbook of Mobile Middleware", Auerbach Publication.
9. Reza B'Far (Ed), "Mobile Computing Principles", Cambridge University Press.
10. ZhiNing Chen &Kwai-Man Luk, "Antennas for Base Stations in wireless communications", TMH.

Advanced Mobile Communication (CS72A)

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

CO1: Understand the evolution of mobile communication standards developed over the years.

CO2: Evaluate the use of advanced techniques in cellular communications and understand D2D, MMTC,V2X
communication and standardization.

CO3: Study the in-depth functioning of 5G radio access technologies.

CO4: Draw and explain 5G architecture, its components and functional criteria.

CO5: Understand current issues and future challenges in 5G.

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Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS72B	**Optimization Techniques**	70	20	10	-	-	100	3	1	0	4

Module I: Introduction to Optimization: Engineering application of Optimization,Statement of an Optimization problem, Optimal Problem formulation, Classification of Optimization problem. Optimum design concepts: Definition of Global and Local optima – Optimality criteria - Review of basic calculus concepts – Global optimality

Module II: Linear Programming (LP): Introduction to LP and formulation of Linear Programming problems, Graphical solution method, alternative or multiple optimal solutions, Unbounded solutions, Infeasible solutions, Maximization – Simplex Algorithm, Minimization – Simplex Algorithm using BigM method, Two phase method, Duality in linear programming, Integer linear programming.

Module III: Unconstrained optimization problems: Optimization algorithms for solving unconstrained optimization problems – Gradient based method: Cauchy's steepest descent method, Newton's method, Conjugate gradient method.

Module IV: Constrained optimization problems: Optimization algorithms for solving constrained optimization problems – direct methods – Necessary and sufficient condition – equality constraints, inequality constraints - kuhu – tucker conditions – penalty function methods – steepest descent method - Engineering applications of constrained and unconstrained algorithms.

Module V: Modern methods of Optimization: Genetic Algorithms - Simulated Annealing - Ant colony optimization - Tabu search – Neural-Network based Optimization – Fuzzy optimization techniques – Applications.

Suggested Books:

1. Rao S.S,"Optimization – Theory and applications", Wiley Easter Ltd.
2. David G.Luerbeggan, "Introduction to Linear and NonLinear Programming", Addison Wesley Publishing Co.
3. E. K. P. Chong and S. Zak, An introduction to optimization, John Wiley and Sons (Asia) Pvt. Ltd., Singapore
4. R. Fletcher, Practical methods of optimization, 2nd Edition, Wiley, New York
5. D. Luenberger, Linear and nonlinear programming, Kluwer Academic Publisher, New YorkN D Vohra, Quantitative Techniques in management, Tata McGraw Hill.

Optimization Techniques (CS72B)

Course Outcomes: After completion of the course. students will be able to:

CO1: Comprehend the techniques and applications of Engineering optimization.
CO2: Analyze characteristics of a general linear programming problem.
CO3: Apply basic concepts of mathematics to formulate an optimization problem.
CO4: Analyse various methods of solving the unconstrained minimization problem.
CO5: Analyze and appreciate the variety of performance measures for various optimization problems.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS72C	**Entrepreneurship Development & Management**	70	20	10	-	-	100	3	1	0	4

Course Content:

Module I: Overview Of Entrepreneurship: Definitions, Roles and Functions/Values of Entrepreneurship, History of Entrepreneurship Development, Role of Entrepreneurship in the National Economy, Functions of an Entrepreneur, Entrepreneurship and Forms of Business Ownership Role of Money and Capital Markets in Entrepreneurial Development: Contribution of Government Agencies in Sourcing information for Entrepreneurship

Module II: Business Plans And Importance Of Capital To Entrepreneurship: Preliminary and Marketing Plans, Management and Personnel, Start-up Costs and Financing as well as Projected Financial Statements, Legal Section, Insurance, Suppliers and Risks, Assumptions and Conclusion, Capital and its Importance to the Entrepreneur Entrepreneurship And Business Development: Starting a New Business, Buying an Existing Business, New Product Development, Business Growth and the Entrepreneur Law and its Relevance to Business Operations.

Module III : Indian Environment for Entrepreneurship: key regulations and legal aspects , MSMED Act 2006 and its implications, schemes and policies of the Ministry of MSME, role and responsibilities of various government organizations, departments, banks etc., Role of State governments in terms of infrastructure developments and support etc., Public private partnerships, National Skill development Mission, Credit Guarantee Fund, PMEGP. Women's Entrepreneurship Development, Social entrepreneurship-role and need, EDP cell, role of sustainability and sustainable development for SMEs

Module IV: Effective Management of Business: Issues and problems faced by micro and small enterprises and effective management of M and S enterprises (risk management, credit availability, technology innovation, supply chain management, linkage with large industries), e-Marketing

Module V: Achieving Success In The Small Business: Stages of the small business life cycle, four types of firm-level growth strategies, Options – harvesting or closing small business Critical Success factors of small business.

Suggested Books:

1. Poornima Charantimath, Entrepreneurship development- Small Business Enterprise, Pearson
2. Education Robert D Hisrich, Michael P Peters, Dean A Shapherd, Entrepreneurship, latest edition, The McGrawHill Company
3. Dr TN Chhabra, Entrepreneurship Development, Sun India Publications, New Delhi
4. Dr CN Prasad, Small and Medium Enterprises in Global Perspective, New century Publications, New Delhi
5. Vasant Desai, Entrepreneurial development and management, Himalaya Publishing House
6. Maddhurima Lall, Shikah Sahai, Entrepreneurship, Excel Books
7. Law and Practice relating to Micro, Small and Medium enterprises, Taxmann Publication Ltd.
8. Kurakto, Entrepreneurship- Principles and Practices, Thomson Publication

Entrepreneurship Development & Management (CS72C)
Course Outcomes: After completion of the course, students will be able to:

CO1: Understand the concept of business plan and ownership

CO2: Interpret key regulations and legal aspects of entrepreneurship in India

CO3: Understand government policies for entrepreneurs

CO4: Apply business growth strategies.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS73	**Compiler Design**	70	20	10	30	20	150	3	-	2	4

Course contents:

Module l: Introduction: Compilers and Translators: The phases of the compiler - Lexical Analysis. Syntax Analysis, Intermediate Code Generation. Optimization, Code generation, Bookkeeping, Error handling.

Module II: Lexical Analysis: The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata: Regular expressions, NFA, DFA. Design of a lexical analyzer generator.

Module III : Syntax Analysis: The role of parser, context free grammars, writing a grammar, Top down Parsing: Recursive descent parser, Predictive parser. Bottom up Parsing: Handles. Viable prefixes, Operator precedence parsing. LR parsers: SLR, LALR, cLR. Parser generator (yACC).Error Recovery techniques for different Parsers. Syntax directed translation: Syntax directed definitions, Synthesized and inherited attributes, Construction of syntax trees.

Module IV: Run time environments: Source language issues (Activation trees, Control stack, scope of declaration, binding of names), Storage organization (Subdivision of mn-time memory, Activation records), Storage allocation strategies. Symbol tables: storage, data structures used.

Module V: Intermediate code generation: Intermediate languages, Graphical representation, Three Address code, Implementation of three address statements (Quadruples, Triples, indirect triples). Code optimization and code generation: introduction. Basic blocks & flow graphs, DAG, principle sources of optimization: loop optimization, eliminating induction variables, eliminating common sub-expression, loop unrolling, Ioop jamming etc. Peephole optimization, Issues in the design of code generator, a simple code generator, Register allocation & assignment.

Suggested Books:

1. Michael T. Simpson, Kent Backman, James E. "Corley, Hands-On Ethical Hacking and Network. Defense". Second Edition. CENGAGE Learning
2. Allied V. Aho. Monica S. Lam, Ravi Sethi. JefTiey D. Ultman, Compilers: P nciples, Techniques and Tools!, Second Edition. pearson Education
3. Randy Allen. Ken Kennedy. Optimizing Compilers for Modern Architectures: A Dependence based Approach,Morgan Kaufmann Publishers.
4. SteveD S. Muchnick Advanced Compiler DesigN and ImplemeNtation , Morgan Kauftnann Publishers Elsevier Science, India, Indian Reprint.
5. Keith D Cooper and Linda Torczon, Engineering aCompiler, Morgan Kaufinann Publishers Elsevier ScieDce. 2004.
6. V. Raghavan Principles of Compiler Design, Tata Mcgraw Hill Education Publishers.

Compiler Design (CS73)
Course Outcomes: After completion of the course, student will be able to:

CO1: Understand the key phases of a compiler and their roles in translating source code to machine code.

CO2: Apply lexical analysis techniques to implement a token recognizer using regular expressions and finite automata.

CO3: Analyze and implement parsing techniques for context-free grammars.

CO4: Evaluate storage allocation strategies and their impact on run-time efficiency.

CO5: Create optimized intermediate code and apply basic code optimization techniques.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS74	**Internet of Things**	70	20	10	30	20	150	3	-	2	4

Course Contents:

Module 1: Introduction to IoT, Historical Development of IoT, Characteristics of IoT, Sources of the IoT, Physical Design of IoT, Logical design of IoT, Functional blocks of IoT, IoT Ecosystem and Key Components, Three-layer and Five-layer model of IoT, Understanding packaging and power constraints for IoT implementation, M2M.

Module 2: IoT Communication Protocols, Architecture of IoT, IoT Communication Technologies (basics) MQTT, CoAP and HTTP in IoT (basics)

Intro to LPWAN Technologies (LoRa, Sigfox): Physical and MAC layers, topology and Security of IEEE802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah, Zigbee.
Intro to IoT Device-to-Cloud Communication: From 6LoWPAN to 6Lo, Routing over LowPower and Lossy Networks.

Module 3: IoT Device Selection and Configuration

Types of IoT Devices: sensors, sensor features, Sensor types, Mobile Phone Based Sensors,Medical Sensors, Neural Sensors. Actuator and its types.

Basic overview of IoT Device Selection Criteria Short brief on IoT Device Configuration and Management: Design challenges, Development challenges, Privacy and Security challenges.

Module 4: Data Management in IoT

Data Collection and Aggregation, Basic concepts Data Analytics and Edge Computing: IoT Middleware, Data analytics for IoT, Big Data analytics tools and technology, RESTful Web API, Web Services for IoT, Batch Data Analysis. Intro and basic knowledge of Data Security and Privacy in IoT.

Module 5: Industry Specific IoT Applications

Intro to Smart Cities and Urban IoT Basics of IoT in Healthcare , Agriculture, Manufacturing.
Smart Homes: Smart Appliances, Security and Safety,
Smart Energy: SmartMeters, Automatic Meter Reading (AMR), Advanced Metering Infrastructure (AMI), Real Time Pricing,

Suggested Books:

I . Introduction to IOT By Sudip Mishra, Anandarup Mukherjee, Arrit Roy & Kamal Kant Hiran.
2. Coco Blue / Amazon / IOT Alrandson approach By Arshdeep Bahga & Vijay Madisetti.
3. 21 IOT Experiments By Yashwan kanedkar & Shrirang Korde,
4. IOT By Er. Vk Jain, Khanna Publisher.

Internet of Things (CS74)

Course Outcome: after completion of the course, students will be able to:

CO1: Understand the various concepts, terminologies and architecture of IoT systems.
CO2: Implement the use of sensors for the design of IoT and apply various protocols for design of IoT systems
CO3: Evaluate various techniques of data storage and analytics in IoT
CO4: Understand various applications of IoT.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS75	**Computer Vision**	70	20	10	30	20	150	3	-	2	4

Course Content :

Module-I:Introduction to Computer Vision: Introduction to computer vision, Human visual system, Camera models, Image Formation and understanding, pixel and color transform, Image processing in computer vision, Application of computer vision. Image processing in computer vision: Spatial filtering operations, histogram operations, thresholding techniques, edge detection techniques, corner and interest points, 3D image processing.

Module-II: Feature Detection and Matching: Introduction to Feature Representation, Feature descriptors, GLCM, SIFT, and DWT. Image Matching, Feature distances, Accuracy Measurements (Precision, Recall, Sensitivity and Specificity) and Cross Validation Models, feature dimensionality reduction, principal component analysis.

Module-III: Shape and Region Analysis: Binary shape analysis, connectedness, object labeling and counting, size filtering, skeletons and thinning, deformable shape analysis, boundary tracking procedures, shape models and shape recognition, boundary length measures, boundary descriptors, chain codes, Fourier descriptors, region descriptors.

Module-IV: Image Classification: Introduction to Classification and learning techniques, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models. Introduction to 3D vision and motion, camera model, camera calibration, epipolar geometry. Motion Analysis: Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.

Module-V: Application and Research in Computer Vision: Object Recognition, Photo album, Face detection, Face recognition, Eigen faces, foreground-background separation, Medical image analysis, Security and Surveillance (Activity Recognition, Biometrics etc.), Document processing, image fusion, Super-resolution, Augmented Reality, Introduction to Deep learning in computer vision.

Suggested Books:

1. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press.
2. R. Szeliski, "Computer Vision: Algorithms and Applications", Springer.
3. Simon J.D.Prince "Computer Vision: Models, Learning, and Inference" Cambridge University Press
4. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", Third Edition, Academic Press.
5. D. L.Baggio et al., "Mastering OpenCV with Practical Computer Vision Projects", Packt Publishing.
6. Jan Erik Solem, "Programming Computer Vision with Python: Tools and algorithms for analyzing. images", O'Reilly Media.

Computer Vision (CS75)

Course Outcome: after completion of the course, students will be able to:

CO1: Understand the fundamental image processing techniques required for computer vision.
CO2: Analysis of the shape descriptors and boundary tracking techniques.
CO3: Apply chain codes and other region descriptors.
CO4: Design a content based image retrieval system and develop applications using computer vision techniques.

DEAN
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