Jabalpur Engineering College, Jabalpur

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

w.e.f. July 2024

S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical						
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work		L	T	P	
1	CS701M	PCC	Computer Vision	70	20	10	30	20	150	3	-	2	4
2	CS702M	PCC	Compiler Design	70	20	10	30	20	150	3	-	2	4
3	CS703M	PCC	Cryptography & Network Security	70	20	10	30	20	150	3	-	2	4
4	CS704M	PEC	Professional Elective Course-II	70	20	10	-	-	100	3	1	-	4
5	CS705M	OEC	Open Elective Course-III	70	20	10	-	-	100	3	1	-	4
6	CS706M	MC	Industrial Training Evaluation	-	-	-	60	40	100	-	-	4	2
7	CS707M	DLC	Self-Learning Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	-	-	-	-	8
			Total	**350**	**100**	**50**	**150**	**100**	**750**	**15**	**2**	**10**	**22**
8	CS708M	MC	NSS/NCC/Swachhata Abhiyan/Rural Outreach	Qualifier									
Additional Course for Honours or Minor Specialization				Permitted to opt for maximum three additional courses in subject code CS707M 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-II

S.No.	Subject Code	Subject Name
1	CS704M A	Information Retrieval
2	CS704M B	Natural Language Processing
3	CS704M C	Data Center Management

Open Elective Course-III

S.No.	Subject Code	Subject Name
1	CS705M A	Computational Intelligence
2	CS705M B	Optimization Techniques
3	CS705M C	Internet of Things

PEC: Professional Elective Course (Branch Specific), OEC: Open Elective Course (Interdisciplinary), PCC: Professional Core Course, DLC: Distance Learning Course, MC: Mandatory Course

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

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS 701M	Computer Vision	70	20	10	30	20	150	3	-	2	4

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(CS701M)

Course Outcome: after completion of the course, student 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.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS 702M	Compiler Design	70	20	10	30	20	150	3	-	2	4

Module-I: 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 a parser, Context free grammars, Writing a grammar, Top down Parsing: Recursive decent 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 run-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 variable, eliminating common sub-expression, loop unrolling, loop jamming etc. Peephole optimization, Issues in the design of code generator, a simple code generator, Register allocation & assignment.

Suggested Book:

1. Michael T. Simpson, Kent Backman, James E. "Corley, Hands-On Ethical Hacking and Network Defense", Second Edition, CENGAGE Learning.
2. 1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, 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. Steven S. Muchnick, Advanced Compiler Design and Implementation‖, Morgan Kaufmann Publishers Elsevier Science, India, Indian Reprint.
5. Keith D Cooper and Linda Torczon, Engineering aCompiler, Morgan Kaufmann Publishers Elsevier Science, 2004.
6. V. Raghavan, Principles of Compiler Design, TataMcGraw Hill Education Publishers.

Compiler Design (CS702M)
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				
CS 703M	Cryptography & Network Security	70	20	10	30	20	150	3	-	2	4

Module-I: Overview: Services, Mechanisms and attacks, OSI security architecture, Model for network security. Classical Encryption Techniques: Symmetric cipher model, Substitution techniques, Transposition techniques, Steganography, Problems. Block Ciphers and DES (Data Encryption Standards): Simplified DES, Block cipher principles, DES, Strength of DES, Block cipher design principles, Block cipher modes of operation, Problems.

Module-II: Public Key Cryptography and RSA: Principles of public key crypto systems, RSA algorithm, Problems. Other Public Key Crypto Systems and Key Management: Key management, Diffie-Hellman key exchange, Elliptic curve arithmetic, Elliptic curve cryptography, Problems. Message Authentication and Hash Functions: Authentication requirements, Authentication functions, Message authentication codes, Hash functions, Security of hash functions and MAC, Problems.

Module-III: Digital Signature and Authentication Protocol: Digital signature, Authentication protocols, Digital signature standard. Authentication Applications: Kerberos, X.509 authentication service, Kerberos encryption technique, Problems.

Module-IV: Electronic Mail Security: Pretty good privacy, S/MIME, Data compression using ZIP, Radix-64 conversion, PGP random number generator. IP Security: Overview, IP security architecture, Authentication header, ESP (encapsulating security pay load), Security associations, Key management, Problems.). Firewalls: Firewall design principles; Trusted systems, Problems.

Module-V: Intruders and Viruses: Intruders, Viruses, Worms, Trojan horses, Distributed Denial-Of-Service (DDoS), Firewalls, IDS, Honey nets, Honey pots.

Suggested Books:

1. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education.
2. B. Forouzan, "Cryptography & Network Security", Tata McGraw-Hill.
3. AtulKahate, "Cryptography and Network Security," Tata McGraw-Hill.
4. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India.
5. Eric Maiwald, "Fundamentals of Network Security," McGraw-Hill.

Cryptography & Network Security (CS703M)

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

CO1: Understanding of the basics of network security and cryptographic techniques.
CO2: Illustrate various symmetric key cryptographic techniques'
CO3: Evaluate the asymmetric and hash algorithms.
CO4: Discuss Internet-Security Protocols.
CO5: Discuss and design the concepts of EMail and Network Security.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS704M A	Information Retrieval	70	20	10	-	-	100	3	1	-	4

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, Page Rank 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 neighbour, 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 (CS704M A)

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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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS704M B	Natural Language Processing	70	20	10	-	-	100	3	1	-	4

Module-1:Introduction: Origins and challenges of NLP, Language Modelling: Grammar-based LM, Statistical LM, Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

Module-II:Word Level Analysis: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff, Words and Vectors Cosine for measuring similarity TF-IDF: Weighing terms in the vector, Applications of the tf-idf vector model – Word Classes, Part-of-Speech (POS) Tagging, The Penn Treebank POS Tagset, Rule-based, Stochastic and Transformation-based tagging, Issues in POS tagging – Hidden Markov and Maximum Entropy models.

Module-III: Syntactic Analysis: Context-Free Grammars, Grammar rules for English, Treebanks, Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Dependency Parsing – Dependency Relation, Transition-based dependency parsing, Graph-based dependency parsing.

Module-IV: Semantics and Pragmatics: Logical representation of sentence meaning - First-Order Logic, Event State Representation, Description Logics; Word Sense Disambiguation; Semantic Role Labelling; Co-reference Resolution.

Module-V: Application of NLP: Sentiment Analysis, Information Retrieval, Question Answering System, Dialog System and Chatbots, Machine translation, Document or Text Summarization.

Suggested Books:

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, OReilly Media.
3. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher.
4. Richard M Reese, —Natural Language Processing with Java, OReilly Media.
5. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press.
6. Tanveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval, Oxford University Press

Natural Language Processing (CS704M B)
Course Outcomes: Upon completion of the course, the students will be able to

CO1: Tag a giver text with basic Language features.
CO2: Design an innovative application using NLP components.
CO3: Implement a rule based system to tackle morphology/syntax of a language.
CO4: Design a tag set to be used for statistical processing for real-time applications.
CO5: Compare and contrast the use of different statistical approaches for different types of NLP applications.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS704M C	Data Center Management	70	20	10	-	-	100	3	1	-	4

Module-I: Introduction to Data Center: History of data centre, Role of data center in digitalization, Carbon footprints of data center, Energy Optimization in data center, Policies resulting into need of localization (Data centers to be hosted in the Country), Design for: flexibility, scalability, environmental control, network infrastructure, modern data centers, high availability and service oriented Infrastructure(SOI).

Module-II: Data Center Architectures: Network connectivity optimization evolution: Top of rack (ToR), end of row (EOR), solutions that reduce power and cabling. Data Centre standards; TIA/EIA-42, Structured cabling standards, fiber and. and copper cabling characteristics, cable management, bandwidth requirements, I/o connectivity.

Module-III: Server Architectures: Stand-alone, blades. Stateless. Clustering. Scaling. Optimization. Virtualization. Limitation of traditional server deployments; modern solutions. Applications; database. Finance etc. Redundant Layer 2 and Layer 3 designs. Case studies

Module-IV: Enterprise-Level Virtualization: Provision, monitoring and management of a virtual data center and virtual machines through software management interfaces; Networking and Storage in enterprise Virtualized Environments - Connectivity to storage area and Ip networks from within virtualized environments using industry standard protocols. Virtual machine deployment, modification, management; monitoring and migration methodologies.

Module-V: Resource Management and Monitoring: Physical and virtual machine memory, CPU management and abstraction techniques using a Hypervisor, DNS, LDAP, Load balancing, Terminology, Advantages, Types of load balancing, Implementing a Network with Load-Balancing Switches. Case Studies: Linux (Kali/Fedora), Network Simulators. VM Ware Workstation.

Suggested Books:

1. Administering Data centers: servers, Storage and voice over IP, Kailas Jayaswal.
2. IT Virtualization Best Practices: A Lean, Green Virtualized Data Center Approach by Mickey Iqbal (Author), Mithkal Smadi (Author), Chris Molloy (Author), Jim Rymarczyk MC Press [ISBN: 978-15 8347-3542).
3. VMware vSphere 4 Administration Instant Reference by Jason W' McCarty, Scott Lowe. Matthew K. Johnson, sybex I edition [ISBN-13: 978-0470520727].
4. VCP VMware Certified Professional on vSphere 4 Study Guide by Brian Perry, Chris Huss, Jeantet Fietds Sybex; I edition, ISBN-13: 978-0470569610.
5. Microsoft Virtualization with Hyper-v by Jason Kappel, Anthony Velte, Toby velte (Network Professional's Library), McGraw-Hill Education; 1 edition [ISBN-13: 978-0071614030].
6. Data Center Handbook by Hwaiyu Geng, Wiley; 1 edition, [ISBN-13: 978-1118436639].

D..ta Center Management (CS704M C)
Course Outcomes: After completion of course, students will be able to:

CO1 : Explain data Center, carbon footprint of data center, energy optimization and understand - Virtual data Centre.
CO2: Evaluate load balancing, virtual memory management and resource monitoring.
CO3: Examine Server architectures of blade, tower and rack server
CO4: Create a basic plan for establishing virtual data centres and virtual machines.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS705M A	Computational Intelligence	70	20	10	-	-	100	3	1	-	4

Module-I: Introduction to Computational Intelligence; types of Computational Intelligence, components of Computational Intelligence. Concept of Learning/Training model. Parametric Models, Nonparametric Models. Multilayer Networks: Feed Forward network, Feedback network.

Module-II: Fuzzy Systems: Fuzzy set theory: Fuzzy sets and operations, Membership Functions, Concept of Fuzzy relations and their composition, Concept of Fuzzy Measures; Fuzzy Logic: Fuzzy Rules, Inferencing; Fuzzy Control - Selection of Membership Functions, Fuzzyfication, Rule Based Design & Inferencing, Defuzzyfication.

Module-III: Genetic Algorithms: Basic Genetics, Concepts, Working Principle, Creation of Offsprings, Encoding, Fitness Function, Selection Functions, Genetic Operators-Reproduction, Crossover, Mutation; Genetic Modeling, Benefits.

Module-IV: Rough Set Theory - Introduction, Fundamental Concepts, Set approximation, Rough membership, Attributes, Optimization. Hidden Markov Models, Decision tree model.

Module-V: Introduction to Swarm Intelligence, Swarm Intelligence Techniques: Ant Colony Optimization, Particle Swarm Optimization, Bee Colony Optimization etc. Applications of Computational Intelligence.

Suggested Books:

1. Russell C. Eberhart and Yuhui Shi, Computational Intelligence: Concepts to Implementations, Morgan Kaufmann Publishers.
2. Andries P. Engelbrecht, Computational Intelligence: An Introduction, Wiley Publishing.
3. Simon Haykin, Neural Networks: A Comprehensive Foundation, Prentice Hall.
4. David E. Goldberg, Genetic Algorithm in Search Optimization and Machine Learning, Pearson Education.
5. Jagdish Chand Bansal, Pramod Kumar Singh, Nikhil R. Pal, Evolutionary and Swarm Intelligence Algorithms, Springer Publishing, 2019.
6. S. Rajeskaran, G.A. VijaylakshmiPai, "Neural Networks, Fuzzy Logic, GeneticAlgorithms Synthesis and Applications".
7. J.S. Roger Jang, C.T.Sun, E. Mizutani, "Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning & Machine Intelligence", PHI, 2002.

Computational intelligence(CS705M A)
Course Outcomes: After completion of the course, Students will be able to:

CO1: Describe in depth theories, methods,algorithms and learning models in Computational Intelligence.

CO2: Compare and contrast traditional algorithms with nature inspired algorithms.

CO3: Examine the nature of a problem and determine whether a computation intelligent technique/ algorithm can solve it efficiently enough.

CO4: Design and implement Computational Intelligence algorithms and approaches for solving real life problems.

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CS705M B	Optimization Techniques	70	20	10	-	-	100	3	1	-	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 (CS705M B)

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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		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS705M C	Internet of Things	70	20	10	-	-	100	3	1	-	4

Module-I: IoT definition, Characteristics, IoT conceptual and architectural framework, Physical and logical design of IoT, IoT enablers, Modern day IoT applications, M2M communications, IoT vs M2M, IoT vs WoT, IoT reference architecture, IoT Network configurations, IoT LAN, IoT WAN, IoT Node, IoT Gateway, IoT Proxy, IPv4 vs IPV6

Module-II: Sensor, Basic components and challenges of a sensor node, Sensor features, Sensor resolution; Sensor classes: Analog, Digital, Scalar, Vector Sensors; Sensor Types, bias, drift, Hysteresis error, quantization error; Actuator; Actuator types: Hydraulic, Pneumatic, electrical, thermal/magnetic, mechanical actuators, soft actuators

Module-III: Basics of IoT Networking, IoT Components, Functional components of IoT, IoT service oriented architecture, IoT challenges, 6LowPAN, IEEE 802.15.4, ZigBee and its types, RFID Features, RFID working principle and applications, NFC (Near Field communication), Bluetooth, Wireless Sensor Networks and its Applications

Module-IV: MQTT, MQTT methods and components, MQTT communication, topics and applications, SMQTT, CoAP, CoAP message types, CoAP Request-Response model, XMPP, AMQP features and components, AMQP frame types

Module-V: IoT Platforms, Arduino, Raspberry Pi Board, Other IoT Platforms; Data Analytics for IoT, Cloud for IoT, Cloud storage models & communication APIs, IoT case studies

Suggested Books:

1. Vijay Madisetti, Arshdeep Bahga, "Ïnternet of Things, A Hands on Approach", University Press
2. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
4. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi
5. Adrian McEwen, "Designing the Internet of Things", Wiley
6. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill
7. Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media

Internet of Things (CS705M C)

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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