Jabalpur Engineering College, Jabalpur

(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)

(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) VI Semester (Artificial Intelligence & Data Science)

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						
				End, Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work		L	T	P	
1	AI61	PEC	Professional Elective Course-II	70	20	10	-	-	100	3	1	-	4
2	AI62	OEC	Open Elective Course-I	70	20	10	-	-	100	3	1	-	4
3	AI63	PCC	Compiler Design	70	20	10	30	20	150	3	-	2	4
4	AI64	PCC	Internet of Things (I.O.T.)	70	20	10	30	20	150	3	-	2	4
5	AI65	PCC	Robotics Technology	70	20	10	30	20	150	3	-	2	4
6	AI66	PI	Minor Project	-	-	-	60	40	100	-	-	4	2
7		MC	Industrial Training	Minimum Four weeks Duration. Evaluation will be done in 7th semester.									
Total				**350**	**100**	**50**	**150**	**100**	**750**	**15**	2	**10**	**22**
8	AI67	DLC	Self-Learning Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	-	-	-		8
9	AI68	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 AI67 for the award of Honours (Minor Specialization).									

Note: 01. Departmental BOS will decide list of three/four optional subjects those are available in MOOC,OEC as well for PEC.

02. MOOC/NPTEL subjects shall be taken with permission of HOD/Coordinator.

03. Industrial training should be apart from laboratory work unertaken in the college rather it should have industrial orientation and practical aspects/field work. Report to be sbmitted at the beginning of 7th semester and students have to give a presentation in the Department. Evaluation will be done in 7th semester.

Professional Elective Course-II		
S.No.	**Subject Code**	**Subject Name**
1	AI61A	Application of AI
2	AI61B	Optimization Methods in AI
3	AI61C	Information Retrieval

Open Elective Course-I		
S.No.	**Subject Code**	**Subject Name**
1	AI62A	Economics & Social Issues
2	AI62B	Software Engineering
3	AI62C	Quantum Computing

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, PI: Project and Internship, DLC: Distance Learning Course, MC: Mandatory Course

DEAN
Academic
JEC, Jabalpur (M.P.)

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

COURSE CONTENTS **w. e. f. July 2023**

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI61A	Applications of AI	70	20	10	-	-	100	3	1	-	4

Module-I: AI and Humanity:
Introduction to human and artificial intelligence, Introduction to AI and Ethics, Understanding Artificial Intelligence: History, definitions, and applications, Ethical considerations in AI, development and deployment, Impact of AI on society and the need for ethical frameworks. AI and Social Implications, AI and workforce:, Reskilling and upskilling, Privacy, Data collection and surveillance, Individual rights and consent, Privacy-preserving AI..

Model-II: Applications of AI in Healthcare:
Overview of AI in healthcare: definitions, trends, and applications, Ethical considerations and challenges in AI adoption in healthcare, Introduction to healthcare data and AI technologies. machine learning algorithms used in healthcare, Supervised and unsupervised learning techniques for medical data analysis, Deep learning approaches for medical image analysis. Applications of natural language processing (NLP) in healthcare, Text mining and information extraction from clinical documents.AI applications in medical imaging for diagnosis and analysis, Genomic data analysis and personalized medicine, Ethical considerations and challenges in AI-enabled medical imaging and genomics.

Module-III: AI in Cyber Security
Basic Concept of cyber security, layers of security, vulnerability threat, harmful acts, Internet Governance-Challenges and Constraints, overview of attackers motives, active attacks, passive attacks, Software and hardware attacks, Methods of defence, Security Models, risk management, Cyber Threats, Application of AI algorithms in the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and case study of the algorithms required and implementations of AI in cyber security, etc.

DEAN
Academic
JEC, Jabalpur (M.P.)

Module-IV: AI In Surveillance:

Introduction to surveillance, overview of computer vision problems, various purposes- including tracking and monitoring, intelligent video analytics, Video Content Analytics (VCA), Surveillance Video Anomaly Detection, Radio-Frequency Identification (RFID), Adaptive Kalman Filter, Gaussian mixture model, Auto encoders AE, Recurrent Neural Network (RNN), Monte- Carlo Condensation Filters based techniques of tracking.

Module-V: Application of AI in Agriculture:

Crop yield predictions and price forecasts, Intelligent spraying, Disease diagnose, Crop and soil monitoring, Solar Refrigerators, Lifecycle of agriculture, Challenges faced in Agriculture with traditional farming techniques and brainstorming solutions using AI algorithm.

Reference Books:

1"Artificial Intelligence in Healthcare" by Adam Bohr, Martin Homola, and FilipŽelezný (Oxford University Press)

2."Artificial Intelligence for Healthcare: Domain Adaptation, Transfer Learning, and Representation Learning" by Zachary C. Lipton, Alexandra Chouldechova, and Julian McAuley (MIT Press)

3"Machine Learning for Healthcare" by ZiadObermeyer, Ezekiel J. Emanuel, and Isaac S. Kohane (Oxford University Press)

4."Clinical Decision Support Systems: Theory and Practice" by Eta S. Berner and Andrew S. Bindman (McGraw-Hill) "The Cambridge Handbook of Artificial Intelligence" edited by Keith Frankish and William M.

5Ramsey

6."The Ethics of Artificial Intelligence" edited by Nick Bostrom and EliezerYudkowsky

7.The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies" by

8.ErikBrynjolfsson and Andrew McAfee

9Human Compatible: Artificial Intelligence and the Problem of Control" by Stuart Russell

10."Natural Language Processing in Healthcare" by Wendy W. Chapman, OzlemUzuner, and ÖzlemÇetinoğlu (MIT Press)

Course outcomes: After completion of course, student will be able to:

CO1	Identifying and understanding AI applications techniques.
CO2	AI applications and implementations in Healthcare
CO3	Concept of Cyber security and its applied AI algorithms.
CO4	Design all kind of surveillance and computer vision AI algorithms
CO5	Analyze Empathy and problem design for regular problems in agriculture

DEAN
Academic
JEC, Jabalpur (M.P.)

Jabalpur Engineering College, Jabalpur
(Declared Autonomous by MP Govt.,Affiliated to RGPV, Bhopal)
(AICTE Model Curriculum Based Scheme)
Bachelor of Technology (B.Tech.) VI Semester (Artificial Intelligence & Data Science)
COURSE CONTENTS w. e. f. July 2023

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI61B	Optimization Methods in AI	70	20	10	-	-	100	3	1	-	4

Module I- Introduction to Optimization methods:
Need of optimization Methods, Classes of optimization problems, Problems solving using Graphs, Matrices, Optimization problems formulation in Machine Learning and Signal Processing.

Module II- Overview of applied modeling :
Basics of Linear Algebra and Calculus: Subspaces, Eigen Value, Decomposition, Singular Value Decomposition - Algorithms and Methods, PSD Matrices and Kernel Functions, Vector Calculus.

Module III- Linear and Integer Programming-
Introduction to linear programming, integer programming , related tricks , graphical methods of solving LP and IP .Solved problems on minimizing norms, max flow, solving IP using Branch & Bound and more examples on LP , IP formulations

Module VI Introduction to Optimization of Convex Function:
Introduction to Optimization, Convex Sets, Convex Functions, Lagrange Duality, Convex Optimization Algorithms, Second-order cone models, Semi-definite programming, Semi-infinite programming, Minimax, Sublinear algorithms, Interior Point Methods, Active set, Stochastic gradient, Coordinate descent, Cutting planes method, Applications to Image/Video/Multimedia Processing

Module V Optimization in Machine Learning:
Theory of Gradient Discent & Stochastic ,training a neural network, Newton Method for optimization, Pytorch – Tensor Flow Trainning a neural network & implementation.

DEAN
Academic
JEC, Jabalpur (M.P.)

Reference Books:

1.Convex optimization by Stephen Boid
2. Optimization for machine learning by SuvritSra , MIT Press
3. Linear Algebra and Learning from Data, Gilbert Strang

Course outcomes:

After completion of course, student will be able to:

CO1	Identifying and understanding Al Optimizing techniques.
CO2	Develop mathematical modeling and applications.
CO3	Understand the design algorithms for linear systems
CO4	Learn Concept of Convex optimization and its application
CO5	Design optimization in Machine learning algorithms

DEAN
Academic
JEC, Jabalpur (M.P.)

Jabalpur Engineering College, Jabalpur
(Declared Autonomous by MP Govt.,Affiliated to RGPV, Bhopal)
(AICTE Model Curriculum Based Scheme)
Bachelor of Technology (B.Tech.) VI Semester (Artificial Intelligence & Data Science)
COURSE CONTENTS w. e. f. July 2023

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI61C	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, 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 neighbor, Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM).

Reference Books:
1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval, Cambridge University Press.
2. Ricardo Barza-Yates and BerthierRibeiro- 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, Ist Edition Addison Wesley.
4. Mark Levene. An Introduction to Search Engines and Web Navigation, 2nd Edition Wiley.

DEAN
Academic
JEC, Jabalpur (M.P.)

Course outcomes:

After completion of course, student will be able to:

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

DEAN
Academic
JEC, Jabalpur (M.P.)

Jabalpur Engineering College, Jabalpur
(Declared Autonomous by MP Govt.,Affiliated to RGPV, Bhopal)
(AICTE Model Curriculum Based Scheme)
Bachelor of Technology (B.Tech.) VI Semester (Artificial Intelligence & Data Science)
COURSE CONTENTS w. e. f. July 2021

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks				
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work		L	T	P	
AI62 A	Economics & Social Issues	70	20	10	-	-	100	3	1	-	4

Module -I

Indian Economy on the eve of independence British Rule and its impact on economy, Population growth its pattern, genders rural urban literacy, Poverty and inequality agriculture and its productivity Green Revolution Industrial economy pattern, small scale industries

Module -II

Micro economics Theory of consumer behavior, Law of diminishing utility, demand and supply Demand curve elasticity of demand Theory of production, Theory of cast

Module -III

National income Measurement of national income Measurement of cost of living Consumption function investment function Economics fluctuations GDP, GVP

Module –IV

Concept of public and private goods public budget, optimum budget, plan budget, budget procedure of India Taxes in India.

Module-V

Indian economy policy. population policy anti-poverty programmes, NRECA Rishtto employment, MSME, growth, structure EXIM policies

DEAN
Academic
JEC, Jabalpur (M.P.)

Reference Books

1.Mishra&PuriIndian Economics

2. Rana&VermaMacro economics

3. NavendraJadhav Monetary Policy

4. J. Ray Chellaih Trends and Issues in Indian Finance

Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Understanding Indian Economy since independence
CO2	General information about micro Economics, Demand supply Losses
CO3	Compressive Knowledge about GDP and GNP, consumption
CO4	Compressive study of private public systems functioning and taxation systems
CO5	Knowledge about polices of Indian Economy and MSME

DEAN
Academic
JEC, Jabalpur (M.P.)

Jabalpur Engineering College, Jabalpur
(Declared Autonomous by MP Govt.,Affiliated to RGPV, Bhopal)
(AICTE Model Curriculum Based Scheme)
Bachelor of Technology (B.Tech.) VI Semester (Artificial Intelligence & Data Science)
COURSE CONTENTS w. e. f. July 2022

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks				
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work		L	T	P	
AI62 B	Software Engineering	70	20	10	-	-	100	3	1	-	4

Module I: Introduction:
Phases in Software development, Software Development Life Cycle (SDLC), software development process models Software process models (Linear Sequential Model, Prototyping Model, RAD Model, Incremental Model, Spiral Model, and Rational Unified Process), Agileprocess.

Module II: Software Requirement specification (SRS):
Role of SRS, Requirements gathering and problem analysis, requirement specification, validation of SRS document. Use cases: Use case modelling, Use case diagram and use case documents/specifications.

Module III: Object-Oriented Modeling (using UML):
Analysis Modeling, Developing Class Diagram, Sequence Diagram, Class Collaboration Diagram, Activity Diagram, State Transition Diagram. System and Subsystem Design, Design goals, Design Patterns.

Module IV: Software Testing:
Unit testing, Integration testing, System testing, Regression testing, Black-box and White-box techniques, Static Techniques like code inspections, static analysis and dynamic analysis.

Module V: Software Project Management:
Software Project Planning, Cost Estimation, Scheduling, Risk Management, Quality Management, Software Change Management, Software Configuration Management, Re-engineering, Reverse Engineering, Project Plan

Reference books:

1. RS. Pressman,"Software Engineering: A Practitioner's Approach", McGraw-Hill.
2. Rajib Mall, "Fundamentals of Software Engineering", PHI Learning.
3. Sommerville,"Software Enginerring", Pearson Education.

DEAN
Academic
JEC, Jabalpur (M.P.)

4. Grady Booch, RobartA. Maksimchuk, Michael W. Engle, BobbijYoung, Jim Conallen, and Kellia Houston, "Object Oriented Analysis &Design with Applications", Pearson Education India.
5. Pankaj Jalote. "An Integrated Approach to Software Engineering", Narosa.
6. Bernd Bruegge, Allen Dutoit: "Object-Oriented Software Engineering: Using UML, Patterns, and Java", Prentice Hall.
7. Blaha and Rumbaugh. "Object-Oriented Analysis and Modeling using UML",TMH.

Course Outcomes:

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

CO 1	Explain concepts of software engineering such as SDLC and software process models, SRS, models (or Software Artefacts), software testing and software project management.
CO 2	Analyze SRS/problem specifications to extract relevant domain elements such as domain class, Class attributes, operations and relationships between classes.
CO 3	The use case models, analysis level class diagram and sequence diagrams for the given usecase.
CO 4	UML models such as Class Diagram, Sequence Diagram. Class Collaboration Diagram, Diagram, State Transition Diagram and test cases for a given software problem.

DEAN
Academic
JEC, Jabalpur (M.P.)

Jabalpur Engineering College, Jabalpur
(Declared Autonomous by MP Govt.,Affiliated to RGPV, Bhopal)
(AICTE Model Curriculum Based Scheme)
Bachelor of Technology (B.Tech.) VI Semester (Artificial Intelligence & Data Science)
COURSE CONTENTS w. e. f. July 2021

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI62C	Quantum Computing	70	20	10	-	-	100	3	1	-	4

Module-I: Introduction
Introduction to quantum computing, fundamental concepts ,Global perspectives, quantum Bits, Computation, quantum Algorithm, Quantum Information, Assignment on experimental quantum information processing.

Module-II Quantum Algorithms
Super dense coding, quantum teleportation ,applications of teleportation, probabilistic versus quantum algorithms, phase kick-back, the Deutsch Algorithm, simon.s algorithm. Problem solving assignment for algorithms,

Module-III: Quantum Computations
Quantum circuits, Algorithm ,circuit model of computation and simulation, quantum Fourier Transform and applications, search algorithm. Assignment and tutorials based on quantum fourier transform and quantum search algorithm.

Module-IV: Quantum Estimation
Quantum algorithm for Order-finding problem, Eigen value Estimation, finding discrete algorithm hidden subgroups, search algorithm amplitude estimation ,algorithms without knowing the success probability.

Module-V: Quantum Information Theory
Quantum states and accessible information, Data compression, classical information over Noisy quantum channels, quantum box model, error correction and fault tolerant computations. Quantum cryptography .Assignment for quantum compression and noisy channels, problem solving exercises.

DEAN
Academic
JEC, Jabalpur (M.P.)

Reference Books-

1. V. Sahni, Quantum Computing, Tata Mcgra-Hill publication,2007
2. P. Kaye, R. Laflamme and M. Mosca, " An introduction to Quantum Computing", Oxford University press 1999.
3. Scott Aarnson, " Quantum Computing Since Democritus", Cambridge University press, 2013
4. Research papers review.

Course Outcomes:

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

CO1	Knowledge of basics of Quantum Computing
CO2	Learn computation techniques and algorithms
CO3	AnalyzAnalyze and design the estimation and error correction algorithms

DEAN
Academic
JEC, Jabalpur (M.P.)

Jabalpur Engineering College, Jabalpur
(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)
(AICTE Model Curriculum Based Scheme)
Bachelor of Technology (B.Tech.) VI Semester (Artificial Intelligence & Data Science)
COURSE CONTENTS w. e. f. July 2021

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI63	Compiler Design	70	20	10	30	20	150	3	-	2	4

Module-1: 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: SyntaxAnalysis:
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.

DEAN
Academic
JEC, Jabalpur (M.P.)

Reference Book:

1. Michael T. Simpson, Kent Backman, James E. "Corley, Hands-On Ethical Hacking and Network. Defense". Second Edition, CENGAGE Learning
2. 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, OptimizingCompilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers.
4. Steven S. Muchnick, Advanced Compiler Design and Implementationl, 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.

Course outcomes:

After completion of course, student will be able to:

CO1	Understand fundamentals of the compiler and identify the relationships among different phases of the complier
CO2	Understand the application of finite state machines, recursive descent, production rule parsing, and language semantics.
CO3	Analyze & implement required optimizations modules and apply for various optimization techniques for dataflow analysis.
CO4	Use modern tools and technologies for designing new compilers

List of Experiments AI63 Lab

1. Write a program to identify. Whether a given line is a comment or not.
2. Write a C program to recognize strings "a", a* b + ;abb
3. Write a C program to test whether a given identifier is valid or not
4. Write a c program to simulate lexical analyzer for validating operators.
5. Implement the lexical analyzer using 3 Lex, flex or other lexical analyzer generating tools.
6. Write a c programs for implementing the functionalities of predictive parser for the mini language.
7. Write a Program "C" program to implement LALR parsing
8. Write a program to check whether a string to the grammar or not.
9. Write a program to find the numbers of Whitespaces and new line characters.
10. Write a program to find loading terminal

DEAN
Academic
JEC, Jabalpur (M.P.)

Jabalpur Engineering College, Jabalpur
(Declared Autonomous by MP Govt.,Affiliated to RGPV, Bhopal)
(AICTE Model Curriculum Based Scheme)
Bachelor of Technology (B.Tech.) VI Semester (Artificial Intelligence & Data Science)
COURSE CONTENTS w. e. f. July 2021

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI64	Internet of Things (I.O.T)	70	20	10	30	20	150	3	-	2	4

Module I: IoT Introduction and Fundamentals:
Deciphering the term IoT, Applications where IoT can be deployed, Benefits/challenges of deploying an IoT, IoT components: Sensors, front-end electronics (amplifiers, filtering, digitization), digital signal processing, data transmission, choice of channel (wired/wireless), back-end data analysis. Understanding packaging and power constraints for IoT implementation.

Module II: Signals, Sensors, Actuators, Interfaces:
Sensors: types, signal types, shape and strength, Sensor non-idealities: Sensitivity and offset drift, noise, minimum detectable signal, nonlinearity, Read-out circuits: Instrumentation-amplifier, SNR definition, noise-bandwidth-power trade off, Circuit component mismatch and mitigation techniques (calibration, chopping, auto zeroing etc.), Power/energy considerations, Basic signal processing (filtering, quantization, computation, storage).

Module III: Networking in IoT:
Review of Communication Networks, Challenges in Networking of IoT Nodes, range, bandwidth, Machine-to-Machine (M2M) and IoT Technology Fundamentals, Medium Access Control(MAC) Protocols for M2M Communications, Standards for the IoT, Basics of 5G Cellular Networks and 5G IoT Communications, Low-Power Wide Area Networks (LPWAN), Wireless communication for IoT: channel models, power budgets, data rates, IoT Security and Privacy, MQTT Protocol, Publisher and Subscriber Model.

Module IV: Cloud Computing in IoT
Cloud computing platform (open source) and local setup of such environment, embedded software relevant to microcontroller and IoT platforms (enterprise or consumer), user interfaces.

Module V: Data Analysis for IoT applications
Statistics relevant to large data, linear regression, Basics of clustering, classification.

DEAN
Academic
JEC, Jabalpur (M.P.)

Reference BOOKS:

1. Introduction to IOT BySudip Mishra, Aandarup Mukherjee, Arijit Roy & Kamal Kant Hiran.
2. Coco Blue / Amazon / IOT Ahandson approach By ArshdeepBahga&Vijay Madisetti.
3. 21 IOT Experiments ByYashwankanedkar&ShrirangKorde, BPB Publication India.
4. IOT ByEr. Vk Jain, Khanna Publisher.

Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Understand the fundamentals of Internet of things
CO2	Knowledge of interfacing of signal, sensors and actuators in Internet of Things
CO3	Interpret networking in Internet of things
CO4	Implement on Cloud computing in Internet of things
CO5	Analyze the data for various Internet of things applications

List of Experiment:-AI64 Lab

1. Sense the available Networks using arduino.
2. Measuring the distance using ultrasonic Sensor and make led Blink using arduino.
3. Detect the vibration of an object using arduino.
4. Connect with the available Wifi using arduino.
5. Sense a finger when it is placed On Board using arduino.
6. Temperature notification using auduino.
7. LDR to vary the light intensity of LED using Arduino.
8. Switch light on and off Based on the User using Respberry Pi.
9. Application of circuit design using Respberry Pi 3& 4.
10. Study & application of thermal camera & circuit design,
11. AI based audio control operations.

DEAN
Academic
JEC, Jabalpur (M.P.)

Jabalpur Engineering College, Jabalpur
(Declared Autonomous by MP Govt.,Affiliated to RGPV, Bhopal)
(AICTE Model Curriculum Based Scheme)
Bachelor of Technology (B.Tech.) VI Semester (Artificial Intelligence & Data Science)
COURSE CONTENTS w. e. f. July 2021

Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI65	Robotics Technology	70	20	10	30	20	150	3	-	2	4

Module I: Introduction:
Classification of Robots, Basic Robot Components, Manipulator End Effectors, Controller, Power Unit, Sensing Devices, Specification of Robot System, Accuracy Precision and Repeatability. Coordinate Systems: Cartesian Coordinates, Transformation Matrices, Reference Frame Transformations, Orientation, Inverse Transformations, and Graphs.

Module II: Robotic Sensing Devices:
Position, Velocity and Acceleration Sensors, Proximity and Range Sensors, Touch and Slip Sensors, Tectile Sensors, Force and Torque Sensors. Robotic Vision System: Imaging Components Picture Coding, Object Recognition, Training and Vision Systems, Review of Existing System.

Module III: Robotics Programming:
Methods of Robotics Programming, Types of Programming, Robotics Programming Language, Artificial Intelligence Programming. Robot Processing Applications and Algorithms like Dijkstra, Rapidly Exploring Random Tree (RRT),Bellman-Ford, Floyd- warshall algorithm , Conversational AI Algorithm , Human Robot programming ,Future Robotic Application and Related Technologies Development and Algorithms.

Module IV: Image Identification:
Lenses, Camera and Videocon Tube, Image aquasition, Image Processing, Grey scale and Binary Image Analysis, Image enhancement, Object identification, face recognition, The Image Transforms, Concept of Moving Image processing . Applications for Robot vision.

Module V: Control:
Basic Concepts in Control Systems, Digital Control for Positions. System Integration: Mechanism, Actuators and Sensors. Power Transmission Trajectory Planning &Control: Manipulator Equations of Motion Manipulator Control, The Measure of the Robot. Robot tracking techniques. Robot operations.

DEAN
Academic
JEC, Jabalpur (M.P.)

Reference Books:

1. J.craig, "Introduction to Robotics" Addision Wesley.
2. Klafter, chemielwski and nagrin, "Robotics Engineering", Prenticehall.
3. Robert J. Schiling, "Fundamental of Robotics analysis and control", Pearson education.
4. K. S. Fu, R.c. Gonzalez, C.S.g lee, "Robotics" TMH.
5 Robotics Technology Khanna Publishers,2021.

Course outcomes:

After completion of course, student will be able to:

CO1	Define various fundamental concepts of robotics such as robot and its components, co-ordinate system, robotic sensing, image identification, 'vision system, control system, robot programming and applications.
CO2	Classify and compare various sensors, sensing devices, robot programming methods, transmission devices and control systems.
CO3	Experiment with programming samples, control rules and parameters with available hardware and software.
CO4	Evaluate mathematic and programming problems of various robotic concepts.

List of Experiment: (AI65Lab)

1. Demonstration of Cartesian / cylindrical/spherical robot.
2. Demonstration of articulated /SCARA robot
3. Design modeling and analysis of two different types of gripper
4. Study of Robotic system design.
5. Robot programming and simulation for pick place
6. Robot programming and simulation for color identification.
7 Robot programming & simulation for cutting and welding
8. Robot programming & Simulation for microprocess.

DEAN
Academic
JEC, Jabalpur (M.P.)