DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW, UTTAR PRADESH

EVALUATION SCHEME & SYLLABUS

FOR

B. TECH. 4TH YEAR

CSE-Artificial Intelligence & Machine Learning

Based On

AICTE Model Curriculum & NEP2020

(Effective from the Session: 2025-26)

B. TECH (COMPUTER SCIENCE & ENGINEERING- ARTIFICIAL INTELLIGENCE MACHINE LEARNING CURRICULUM STRUCTURE

SEMESTER- VII														
Sl. No.	**Subject Code**	**Subject**	**Learning Mode**	**Periods**			**Evaluation Scheme**				**End Semester**		**Total**	**Credit**
				L	**T**	**P**	**CT**	**TA**	**Total**	**PS**	**TE**	**PE**		
1	BAI701	Deep Learning	Offline	3	-	-	20	10	30		70		100	3
2	B**07*	Deptt.- Elective-IV	Offline	3	-	-	20	10	30		70		100	3
3	BOEM**	Open Elective-II	Offline/ MOOC's	3	0	0	20	10	30		70		100	3
4	BAI751	Deep Learning Lab	Offline	0	0	2				50		50	100	1
5	BCS752	Mini Projects or Internship Assessment*		0	0	4	-	-	-	100	-	-	100	2
6	BCS753	Project-1		0	0	10				150		-	150	5
7	BCS754	Startup and Entrepreneurial Activity Assessment#		0	0	4				100			100	2
		Total		**9**	**0**	**20**							**750**	**19**

*The Mini Project or internship (5-6 weeks) conducted during summer break after VI semester will be assessed during VII semester. *#The Startup and Entrepreneurial Activity Assessment will be done in the 7th semester, under which a student will have to undergo a startup/entrepreneurship activity of at least 60 hours till the 6th semester*

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Sl. No.	**Subject Code**	**Subject**	**Learning Mode**	**Periods**			**Evaluation Scheme**				**End Semester**		**Total**	**Credit**
				L	**T**	**P**	**CT**	**TA**	**Total**	**PS**	**TE**	**PE**		
1	BOENM**	Open Elective-III	MOOC'S	3	0	0	20	10	30		70		100	3
2	BOENM**	Open Elective-IV	MOOC'S	3	0	0	20	10	30		70		100	3
4	BCS851	Project-II		0	0	18				100		350	450	10
		Total		**6**	**0**	**18**							**650**	**16**

The Internal Assessment of MOOCs will be done by the respective institute, and the External Assessment (End Semester Examination) will be done by the University.

Departmental Elective-IV

1. BCS070- Internet of Things
2. BCS072- Cryptography & Network Security
3. BAI070- Principles of Generative AI
4. BAI071- Blockchain Architecture Design

**B. TECH (COMPUTER SCIENCE & ENGINEERING-
ARTIFICIAL INTELLIGENCE MACHINE LEARNING)
SEVENTH SEMESTER (DETAILED SYLLABUS)**

BAI701	**Deep Learning**	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able:		
CO 1	To present the mathematical, statistical and computational challenges of building neural networks	K_2
CO 2	To study the concepts of deep learning	K_2
CO 3	To introduce dimensionality reduction techniques	K_2
CO 4	To enable the students to know deep learning techniques to support real-time applications	K_3
CO 5	To examine the case studies of deep learning techniques	K_6
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	INTRODUCTION : Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates	**08**
II	DEEP NETWORKS : History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks-Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning	**08**
III	DIMENTIONALITY REDUCTION 9 Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyper parameter optimization	**08**
IV	OPTIMIZATION AND GENERALIZATION : Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience	**08**
V	CASE STUDY AND APPLICATIONS : Image net- Detection-Audio Wave Net-Natural Language Processing Word2Vec - Joint Detection-Bioinformatics- Face Recognition- Scene Understanding- Gathering Image Captions	**08**

Text books:

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

SWAYAM/NPTEL/MOOCs Certification: https://onlinecourses.nptel.ac.in/noc18_cs41/preview

BCS070 Internet of Things

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to understand		
CO 1	Demonstrate basic concepts, principles and challenges in IoT.	K1,K2
CO 2	Illustrate functioning of hardware devices and sensors used for IoT.	K2
CO 3	Analyze network communication aspects and protocols used in IoT.	K4
CO 4	Apply IoT for developing real life applications using Ardunio programming.	K3
CP 5	To develop IoT infrastructure for popular applications	K_2, K_3

DETAILED SYLLABUS		3-1-0
Unit	**Topic**	**Proposed Lecture**
I	**Internet of Things (IoT):** Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability	**08**
II	**Hardware for IoT:** Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	**08**
III	**Network & Communication aspects in IoT:** Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination	**08**
IV	**Programming the Ardunio:** Ardunio Platform Boards Anatomy, Ardunio IDE, coding, using emulator, using libraries, additions in ardunio, programming the ardunio for IoT.	**08**
V	**Challenges in IoT Design challenges:** Development Challenges, Security Challenges, Other challenges IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.	**08**

Text books:

1. Olivier Hersent,David Boswarthick, Omar Elloumi "The Internet of Things key applications and protocols", wiley
2. Jeeva Jose, Internet of Things, Khanna Publishing House
3. Michael Miller "The Internet of Things" by Pearson
4. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016
5. ArshdeepBahga, Vijay Madisetti "Internet of Things (A hands on approach)" 1ST edition, VPI publications,2014
6. Adrian McEwen,Hakin Cassimally "Designing the Internet of Things" Wiley India

BCS072	**Cryptography & Network Security**	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	Classify the symmetric encryption techniques and Illustrate various Public key cryptographic techniques.	K_3
CO 2	Understand security protocols for protecting data on networks and be able to digitally sign emails and files.	K_2
CO 3	Understand vulnerability assessments and the weakness of using passwords for authentication	K_4
CO 4	Be able to perform simple vulnerability assessments and password audits	K_3
CO 5	Summarize the intrusion detection and its solutions to overcome the attacks.	K_2
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	Introduction to security attacks, services and mechanism, Classical encryption techniques-substitution ciphers and transposition ciphers, cryptanalysis, steganography, Stream and block ciphers. Modern Block Ciphers: Block ciphers principles, Shannon's theory of confusion and diffusion, fiestal structure, Data encryption standard(DES), Strength of DES, Idea of differential cryptanalysis, block cipher modes of operations, Triple DES	**08**
II	Introduction to group, field, finite field of the form GF(p), modular arithmetic, prime and relative prime numbers, Extended Euclidean Algorithm, Advanced Encryption Standard (AES) encryption and decryptionFermat's and Euler's theorem, Primarily testing, Chinese Remainder theorem, Discrete Logarithmic Problem,Principals of public key crypto systems, RSA algorithm, security of RSA	**08**
III	Message Authentication Codes: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions, Secure hash algorithm (SHA) Digital Signatures: Digital Signatures, Elgamal Digital Signature Techniques, Digital signature standards (DSS), proof of digital signature algorithm,	**08**
IV	Key Management and distribution: Symmetric key distribution, Diffie-Hellman Key Exchange, Public key distribution, X.509 Certificates, Public key Infrastructure. Authentication Applications: Kerberos, Electronic mail security: pretty good privacy (PGP), S/MIME.	**08**
V	IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. Introduction to Secure Socket Layer, Secure electronic, transaction (SET) System Security: Introductory idea of Intrusion, Intrusion detection, Viruses and related threats, firewalls	**08**

Text books:

1. William Stallings, "Cryptography and Network Security: Principals and Practice", Pearson Education.
2. Behrouz A. Frouzan: Cryptography and Network Security, McGraw Hill .
3. C K Shyamala, N Harini, Dr. T.R.Padmnabhan Cryptography and Security ,Wiley
4. Bruce Schiener, "Applied Cryptography". John Wiley & Sons
5. Bernard Menezes," Network Security and Cryptography", Cengage Learning.
6. AtulKahate, "Cryptography and Network Security", McGraw Hill

BAI070 Principles of Generative AI

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to		
CO 1	Understand the fundamental concepts and real-world applications of Artificial Intelligence and Generative AI tools and platforms.	K_2
CO 2	Apply prompt engineering techniques to design optimized and context-aware prompts for generative tasks in various AI platforms.	K_3
CO 3	Analyze the effectiveness of generative AI in domains such as education, office automation, marketing, and healthcare through specific use cases.	K_4
CO 4	Evaluate and compare various generative AI tools for content generation, code assistance, media creation, and automation.	K_5
CO5	Design AI-based workflows for real-world applications using tools like ChatGPT, GitHub Copilot, Jasper, and others	K_5
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Foundations and Fundamentals of Generative AI:** Introduction to Artificial Intelligence: Definitions, Foundations, Scope, and Applications, Implications of AI across industries, Fundamentals of Generative AI: Concept, Evolution, Capabilities, Applications of Generative AI in various domains, Introduction to Generative AI platforms: ChatGPT (OpenAI), Gemini (Google), GitHub Copilot (Microsoft)	**08**
II	**Prompt Engineering and Prompt Optimization Techniques:**Basics of Prompt Engineering, Types of Prompts: Declarative, Interrogative, Instructional, Advanced Prompt Engineering: Chain-of-Thought Prompting, Zero-shot and Few-shot Prompting, Prompt Optimization Techniques, Use Cases and Practical Examples in Coding, Writing, and Customer Interaction	**08**
III	**Generative AI Applications in Workplace and Education:** AI in Office Productivity: Email Writing, Report Drafting, Minutes of Meeting (MoM), Proposal Writing, Summarization, and Task Automation:, Generative AI in Education: AI for Content Creation, Summarization, and Explanation, Curriculum Design using AI Tools, AI in Assessment, Feedback, and Visualization (e.g., Mindmaps, Infographics)	**08**
IV	**Domain-Specific Applications of Generative AI:** Generative AI in Digital Marketing: Content Strategy for YouTube, Facebook, Instagram, X (Twitter), LinkedIn and AI in Professional Branding, Email Marketing Automation and AI in E-Commerce; Generative AI in Healthcare and Agriculture: Diagnosis Assistance, Patient Data Summarisation, Crop Monitoring, Yield Prediction using AI	**08**
V	**Creative and Technical Aspects of Generative AI:** AI-Assisted Programming (e.g., Code Generation, Auto Debugging using Copilot, GPT-4), Generative AI in Creative Domains: Image & Design Generation (DALL·E, Midjourney), Music Composition with AI Tools; AI in Gaming & Animation (e.g., Scenario Generation, NPC Scripting), Customer Interaction Automation: Chatbots, Virtual Assistants, and Voice AI; Exploration of Popular AI Tools & Platforms: RunwayML, Jasper, Synthesia, Lumen5, Bard, etc.	**08**

Text Book (s)

1. Emerson, J, *Ripples of generative AI: Navigating AI's impact on society*. AI Press (2023).

Reference Book (s)

1. Pandit, R., *Generative AI* (Hardcover), Notion Press (2024).
2. OpenAI. (n.d.). *OpenAI*, from https://openai.com/
3. Google. (n.d.). *Gemini*, from https://gemini.google.com/
4. Microsoft. (n.d.). *Copilot*, from https://copilot.microsoft.com/chats/VkLP7TbPcVtu4dDjpDVTv

SWAYAM/NPTEL/MOOCs Certification:

1. https://onlinecourses.swayam2.ac.in/imb25_mg135/preview
2. https://onlinecourses.swayam2.ac.in/nou25_ge85/preview

BAI071 Blockchain Architecture Design

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of the course, the student will be able to		
CO 1	Describe the basic understanding of Blockchain architecture along with its primitives.	K_2
CO 2	Explain the requirements for basic protocol along with scalability aspects.	K_3
CO 3	Design and deploy the consensus process using frontend and backend.	K_4
CO 4	Apply Blockchain techniques for different use cases like Finance, Trade/Supply and Government activities.	K_5

DETAILED SYLLABUS		3-0-0
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Blockchain**: Digital Money to Distributed Ledgers , Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. Blockchain Architecture and Design: Basic crypto primitives: Hash, Signature,) Hashchain to Blockchain, Basic consensus mechanisms	**08**
II	**Consensus:** Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols Permissioned Blockchains:Design goals, Consensus protocols for Permissioned Blockchains	**08**
III	**Hyperledger Fabric (A):** Decomposing the consensus process , Hyperledger fabric components, Chaincode Design and Implementation **Hyperledger Fabric (B):** Beyond Chaincode: fabric SDK and Front End (b) Hyperledger composer tool	**08**
IV	**Use case 1 :** Blockchain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv) Insurance **Use case 2:** Blockchain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management, discounting, etc	**08**
V	**Use case 3**: Blockchain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system, social welfare systems Blockchain Cryptography, Privacy and Security on Blockchain	**08**

Text books:

1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos
2. Blockchain by Melanie Swa, O'Reilly
3. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
4. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

BAI751 DEEP LEARNING LAB

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to		
CO 1	Understand the fundamentals of neural networks and activation functions	K2
CO 2	Implement and visualize basic feedforward and convolutional neural networks	K4
CO 3	Train, validate, and evaluate deep learning models on standard datasets	K5
CO 4	Use popular deep learning libraries such as TensorFlow/Keras or PyTorch	K3
CO 5	Apply deep learning concepts to real-world use cases like image classification and digit recognition	K5

DETAILED SYLLABUS

1. Write a python program to Implement Perceptron for understanding single-layer neural network?
2. Write a program to Visualize Activation Functions (Sigmoid, ReLU, Tanh)?
3. Write a program to Build a Simple Feedforward Neural Network?
4. Write a program to MNIST Digit Classification using Keras?
5. Write a program to Create and Visualize CNN Layers .
6. Write a program to CIFAR-10 Image Classification for understanding Multiclass image classification using CNN.
7. Write a program to implement Image Augmentation Techniques for application of preprocessing & transformation?
8. Write a program by Use of Dropout for Regularization to Improve model generalization?
9. Write a program to Build Model Using PyTorch?
10. Write a program to Compare Training with and without Batch Normalization for Analyzing performance and convergence?

Note: The Instructor may add/delete/modify/tune experiments

BCS752	**Mini Project or Internship Assessment**	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of the course, the student will be able to understand		
CO 1	Developing a technical artefact requires new technical skills and effectively utilizing a new software tool to complete a task	K_5
CO 2	Writing requirements documentation, selecting appropriate technologies, identifying and creating appropriate test cases for systems.	K_6
CO 3	Demonstrating understanding of professional customs & practices and working with professional standards.	K_5
CO 4	Improving problem-solving, critical thinking skills and report writing.	K_5
CO 5	Learning professional skills like exercising leadership, behaving professionally, behaving ethically, listening effectively, participating as a member of a team, and developing appropriate workplace attitudes.	K_4

BCS753/ BCS851	**Project**	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of the course, the student will be able to understand		
CO 1	Analyse and understand the real-life problem and apply their knowledge to get a programming solution.	K_5
CO 2	Engage in the creative design process through the integration and application of diverse technical knowledge and expertise to meet customer needs and address social issues.	K_5
CO 3	Use the various tools and techniques, coding practices for developing real real-life solution to the problem.	K_6
CO 4	Find out the errors in software solutions and establish the process to design maintainable software applications	K_5
CO 5	Write the report about what they are doing in the project and learning the team working skills	K_6