B.TECH. MINOR IN AIML (2021-22)

S. No.	Year/Semester	# Theory (Credits)	# Labs (Credits)	Total Credits
1.	III - I Semester	Foundations of AI (3 credits)	AI Lab (1.5 credits)	4.5
2.	III - II Semester	AI Applications (3 credits)	---	4.0
3.	IV - I Semester	Machine Learning/ Deep Learning/MOOCS (3 credits)	Machine Learning/ Deep Learning Lab (1.5 credits)	4.5
4.	IV - II Semester	**Electives** (3 credits) 1. Robotics Process Automation 2. NLP 3. Game theory 4. Computer Vision & Robotics 5. Speech & Video Processing 6. Soft Computing	---	3.0
5.	IV-II semester	Mini Project	---	2.0
			Total credits	**18.0**

AI APPLICATIONS

L	T	P	C
4	0	0	4

Course Objective: To give deep knowledge of AI and how AI can be applied in variousfields to make the life easy.

Course Outcomes: After completion of course, students would:

1. To correlate the AI and solutions to modern problem.
2. To decide when to use which type of AI technique.

UNIT - I

Linguistic aspects of natural language processing, A.I. And Quantum Computing,Applications of Artificial Intelligence (AI) in business.

UNIT - II

Emotion Recognition using human face and body language, AI based system to predictthe diseases early, Smart Investment analysis, AI in Sales and Customer Support.

UNIT - III

Robotic Processes Automation for supply chain management.

UNIT - IV

AI-Optimized Hardware, Digital Twin i.e. AI Modelling, Information Technology &Security using AI.

UNIT - V

Recent Topics in AI/ML: AI/ML in Smart solutions, AI/ML in Social Problems handling,Block chain and AI.

TEXT BOOKS:

1. Sameer Dhanrajani, AI and Analytics, Accelerating Business Decisions, John Wiley &Sons.
2. Artificial Intelligence in Practice: How 50 Successful Companies Used AI andMachine Learning to Solve Problems, Bernard Marr, Matt Ward, Wiley.

REFERENCE BOOKS:

1. Life 3.0: Being Human in the Age of Artificial Intelligence by Max Tegmark, 2018.
2. Homo Deus: A Brief History of Tomorrow by Yuval Noah Harari, 2017

B.TECH. MINOR IN CYBER SECURITY (2021-22)

S. No.	Year/Semester	# Theory (Credits)	# Labs (Credits)	Total Credits
1.	III - I Semester	Principles of Information Security (3 credits)	Principles of Information Security Lab (1.5 credits)	4.5
2.	III - II Semester	Foundations of Cyber Security (4 credits)	---	4.0
3.	IV - I Semester	Ethical Hacking/ Digital Forensics (Through MOOCS) (3 credits)	Ethical Hacking Lab/ Digital Forensics Lab (1.5 credits)	4.5
4.	IV - II Semester	**Electives** (3 credits) 1. Security Incident & Response Management 2. Mobile Security 3. IoT Security 4. Blockchain Technologies 5. Authentication Techniques 6. Cloud Security	---	3.0
5.	IV-II semester	Mini Project	---	2.0
			Total credits	**18.0**

FOUNDATIONS OF CYBER SECURITY

L	T	P	C
4	0	0	4

Pre-requisites:

- Knowledge in information security and applied cryptography.
- Knowledge in Operating Systems.

Course Objectives:

1. To introduce security attacks.
2. To get an exposure to malwares.
3. To gain knowledge on Intrusion detection & prevention systems.

Course Outcomes: Students will learn the fundamental concepts required in the field of cyber security.

UNIT - I

Overview: Computer Security Concepts, Threats, Attacks, and Assets, Security Functional Requirements, Fundamental Security Design Principles, Attack Surfaces and Attack Trees, Computer Security Strategy.

Access Control: Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, Example: UNIX File Access Control, Role-Based Access Control, Attribute-Based Access Control, Identity, Credential, and Access Management, Trust Frameworks, Case Study: RBAC System for a Bank.

UNIT - II

Malicious Software: Types of Malicious Software (Malware), Advanced Persistent Threat, Propagation—Infected Content—Viruses, Propagation—Vulnerability Exploit—Worms, Propagation—Social Engineering—Spam E-Mail,Trojans , Payload—System Corruption, Payload—Attack Agent—Zombie, Bots, Payload—Information Theft—Keyloggers, Phishing, Spyware, Payload—Stealthing—Backdoors, Rootkits, Counter measures .

Denial-of-Service Attacks: Denial-of-Service Attacks, Flooding Attacks, Distributed Denial-of-Service Attacks, Application-Based Bandwidth Attacks, Reflector and Amplifier Attacks, Defenses Against Denial-of-Service Attacks, Responding to a Denial-of-Service Attack.

Buffer Overflow: Stack Overflows, Defending Against Buffer Overflows, Other Forms of Overflow Attacks.

UNIT - III

Intrusion Detection: Intruders, Intrusion Detection, Analysis Approaches, Host-Based Intrusion Detection, Network-Based Intrusion Detection, Distributed or Hybrid Intrusion Detection, Intrusion Detection Exchange Format, Honeypots, Example System: Snort.

Firewalls and Intrusion Prevention Systems: The Need for Firewalls, Firewall Characteristics and Access Policy, Types of Firewalls, Firewall Basing, Firewall Location and Configurations, Intrusion Prevention Systems, Example: Unified Threat Management Products.

UNIT - IV

Software Security: Software Security Issues, Handling Program Input, Writing Safe Program Code, Interacting with the Operating System and Other Programs, Handling Program Output.

Physical and Infrastructure Security: Overview, Physical Security Threats, Physical Security Prevention and Mitigation Measures, Recovery from Physical Security Breaches, Example: A Corporate Physical Security Policy, Integration of Physical and Logical Security.

UNIT - V

Human Resources Security: Security Awareness, Training, and Education, Employment Practices and Policies, E-Mail and Internet Use Policies, Computer Security Incident Response Teams.
Legal and Ethical Aspects: Cybercrime and Computer Crime, Intellectual Property, Privacy, Ethical Issues.

TEXT BOOK:

1. William Stallings, “Computer Security: Principles and Practice”, Prentice Hall. Prentice Hall; 2014.

REFERENCE BOOKS:

1. Ankit Fadia, “The ethical hacking guide to corporate security”, McMillan India.
2. G. McGraw, “Software Security: Building Security In”, Addison Wesley, 2006.

B.TECH. MINOR IN DATA SCIENCE (2021-22)

S. No.	Year/Semester	# Theory (Credits-3)	# Labs (Credits-1.5)	Total Credits
1.	III - I Semester	Introduction to Data Science	R Programming Lab	4.5
2.	III - II Semester	Data Science Applications	-----	4.0
3.	IV - I Semester	Data Wrangling and Visualization/ Big Data Analytics/MOOCS	Data Wrangling and Visualization/ Big Data Analytics	4.5
4.	IV - II Semester	Electives 1.Exploratory Data Analysis 2.Mining Massive Databases 3.Social Network Analysis 4.Predictive Analytics 5.Web & Social Media Analytics 6.Video Analytics		3.0
5.	IV-II semester	Mini Project	---	2.0
			Total credits	**18.0**

DATA SCIENCE APPLICATIONS

L	T	P	C
4	0	0	4

Course Objective: To give deep knowledge of data science and how it can be applied in various fields to make the life easy.

Course Outcomes: After completion of course, students would:

3. To correlate the data science and solutions to modern problem.
4. To decide when to use which type of technique in data science.

UNIT - I

Data Science Applications in various domains, Challenges and opportunities, tools for data scientists Recommender systems – Introduction, methods, application, challenges.

UNIT - II

Time series data – stock market index movement forecasting.
Supply Chain Management – Real world case study in logistics

UNIT - III

Data Science in Education, Social media

UNIT - IV

Data Science in Healthcare, Bioinformatics

UNIT - V

Case studies in data optimization using Python.

TEXT BOOKS:

1. Aakanksha Sharaff, G.K.Sinha , “Data Science and its applications “, CRC Press, 2021.
2. Q.A.Menon, S.A.Khoja, “Data Science: Theory, Analysis and Applications”, CRC Press, 2020.

B.TECH. MINOR IN INTERNET OF THINGS (2021-22)

S. No.	Year/Semester	# Theory (Credits)	# Labs (Credits)	Total Credits
1.	III - I Semester	Python Programming (3 credits)	Python Programming Lab for 3 Hrs (1.5 credit)	4.5
2.	III - II Semester	Introduction to Internet of Things (3 credits) Smart Technologies (3 credits)	-----	6.0
3.	IV - I Semester	Programming Languages for IoT (3 credits)	IoT Automation with Raspberry PI Lab for 3 Hrs (1.5 credit)	4.5
4.	IV - II Semester	Fog & Edge Computing for IoT (3 credits)	----	3.0
			Total credits	**18.0**

INTRODUCTION TO INTERNET OF THINGS

L	T	P	C
3	0	0	3

Course Objectives:

- To introduce Terminology, Technology and its applications
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of web-based services on IoT devices Course Outcomes, Understanding of IoT value chain structure (device, data cloud), application areas and technologies involved
- Understand IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, and sensing modules

UNIT-I: Introduction to Internet of Things

Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

UNIT-II: IoT and M2M- Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

UNIT-III: IoT Physical Devices and Endpoints- Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins.

UNIT-IV: Controlling Hardware- Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, unipolar and bipolar Stepper motors Sensors- Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor

UNIT-V: IoT Physical Servers and Cloud Offerings– Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API

TEXT BOOKS:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759 3. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895 REFERENCE BOOKS: 1. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015
3. Editors Ovidiu Vermesan 2. Peter Friess,'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014 3. N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014.

SMART TECHNOLOGIES

L	T	P	C
3	0	0	3

Course Objectives:

- Provides a detailed description of the integral aspects of 'smart technologies' and their evolution to their current state.
- Discusses the potential use of Internet of things (IoT) in reducing counterproductive work behaviours and identifying some of the challenges that organizations might face while implementing IoT in its systems.
- Presents case studies using easy-to-understand language to explain the breadth and scope of application areas.

UNIT - I

Smart Technologies—Scope and Applications, Cutting-Edge Digitization Challenges in Vehicle Cyber-Physical Systems and Cybersecurity, Big Data Analytics as an Enabler in Smart Governance for the Future Smart Cities

UNIT - II

Digital Masters: Blueprinting Digital Transformation, UAVs/Drones-Based IoT Services, Role of Cyber Security in Drone Technology

UNIT - III

Bitcoins as an Implementation of Blockchain and Its Convergence with Internet of Things, Tomorrow's AI-Enabled Banking, Exploring Connected Cars

UNIT - IV

Vehicular Cybersecurity Through Intrusion Detection and Prevention Architecture, Mechanism Protecting Vehicle-to-Vehicle Communication, Advanced Driver Assistance Systems

UNIT - V

Cybercare—Role of Cyber Security in Healthcare Industry, Smart Agriculture: A Tango Between Modern IoT-Based Technologies and Traditional Agriculture Techniques, Importance of Being 'NICE' While Developing IoT-Based Smart Farming Solutions: A Case Study About 'NICE' Labs

TEXT BOOK:

1. Smart Technologies-Scope and Applications by K. B. Akhilesh, Dietmar P. F. Möller, Springer publications, 2020

B.TECH. MINOR IN INNOVATION AND ENTREPRENEURSHIP (I&E) (2021-22)

S. No.	Year/Semester	Theory (3 Hours, 3 Credits)	Laboratory (3 Hours 1.5 Credits)	Total Credits
1.	III - I Semester	Innovation and Design Thinking	Design thinking and Ideation Laboratory	4.5
2.	III - II Semester	Foundations of Entrepreneurship	---	4.0
3.	IV - I Semester	Business Ideation and Lean Startup	B-Plan Development Laboratory	4.5
4.	IV - II Semester	**Any ONE of the following subjects:** 1. Product Development 2. Market Research 3. Engineering Design Process 4. Financial and Legal Aspects of Business 5. Start-up Management 6. Entrepreneurial Marketing 7. Technology Entrepreneurship 8. Small Business Development 9. Intellectual Property Rights (*if not studied in regular course*)		3.0
5.	IV-II semester	Mini Project (Either on New Venture Establishment **OR** Launch of Marketable product **OR** Patent Publishing)		2.0
			Total Credits	**18.0**

FOUNDATIONS OF ENTREPRENEURSHIP

L	T	P	C
4	0	0	4

Course Objective: To make students understand the Entrepreneurial process and also inspire them to be Entrepreneurs.

Learning Outcomes: Students will be able to understand a) mindset of the entrepreneurs, b) identify ventures for launching, c) develop an idea on the legal framework and d) strategic perspectives in entrepreneurship.

UNIT - I: Understanding Entrepreneurial Mindset: The revolution impact of entrepreneurship- The evolution of entrepreneurship - Functions of Entrepreneurs – types of entrepreneurs -Approaches to entrepreneurship- Process approach- Role of entrepreneurship in economic development- Twenty first century trends in entrepreneurship.

UNIT - II: The individual entrepreneurial mind-set and Personality: The entrepreneurial journey- Stress and the entrepreneur - the entrepreneurial ego - Entrepreneurial motivations- Motivational cycle – Entrepreneurial motivational behavior – Entrepreneurial competencies.
Corporate Entrepreneurial Mindset, the nature of corporate entrepreneur- conceptualization of corporate entrepreneurship Strategy-sustaining corporate entrepreneurship.

UNIT - III: Launching Entrepreneurial Ventures: Creativity and Business Idea, opportunities identification- Finding gaps in the market place – techniques for generating ideas- entrepreneurial Imagination and Creativity- the nature of the creativity process - Innovation and entrepreneurship. Methods to initiate Ventures- Creating new ventures-Acquiring an Established entrepreneurial venture- Franchising- advantage and disadvantages of Franchising.

UNIT - IV: Legal challenges of Entrepreneurship: Intellectual property protection - Patents, Copyrights - Trademarks and Trade secrets - Avoiding trademark pitfalls.
Feasibility Analysis - Industry and competitor analysis - Formulation of the entrepreneurial Plan- The challenges of new venture start-ups, developing an effective business model – Sources of finance - Critical factors for new venture development - The Evaluation process.

UNIT - V: Strategic perspectives in entrepreneurship: Strategic planning - Strategic actions- strategic positioning- Business stabilization - Building the adaptive firms - Understanding the growth stage – Internal growth strategies and external growth strategies, Unique managerial concern of growing ventures.
Initiatives by the Government of India to promote entrepreneurship, Social and women entrepreneurship.

TEXT / REFERENCE BOOKS:

- D F Kuratko and T V Rao, Entrepreneurship- A South-Asian Perspective, Cengage Learning, 2012.
- Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Entrepreneurship, Mc Graw Hill, 2018.
- Bruce R. Barringer/ R.Duane Ireland, Entrepreneurship Successfully launching new ventures, 4e, Pearson, 2015.
- Stuart Read, Effectual Entrepreneurship, Routledge, 2013.
- Rajeev Roy, Entrepreneurship, 2e, Oxford publications, 2012.
- Nandan .H, Fundamentals of Entrepreneurship, PHI, 2013