B.Tech (CSE), Course Structure NEP 2020

Semester VII

S. No.	Category	Course Code	Course Title	L	T	P	Contact Hrs./Week	Credits
1	Major Core Subjects	SET/CS/BT/C701	Artificial Intelligence	3	1	-	4	4
2		SET/CS/BT/C702	Wireless and Mobile Computing	3	1	-	4	4
3		SET/CS/BT/C703	Cloud Computing	3	1	-	4	4
4		SET/CS/SC/C704	Project Stage-1	-	-	1	8	4
5	Core Subjects Based Labs/Industrial Oriented Training	SET/CS/BT/C705	Artificial Intelligence Lab	-	-	1	3	1
6		SET/CS/BT/S701	Industrial Training Seminar	-	-	1	3	1
7	Minor	SET/CS/BT/M701	E-Commerce	3	1	-	4	4
Total				12	4	3	30	22

***L= Lectures, T=Tutorials , P= Practicals**

***** University will prepare a course with focus on essential management practices.

Semester VIII

S. No.	Category	Course Code	Course Title	L	T	P	Contact Hrs./Week	Credits
1	Major Core Subjects	SET/CS/BT/C801	UNIX Shell Programming	3	1		4	4
2		SET/CS/BT/C802	Machine Learning	3	1	-	4	4
3		SET/CS/SC/C803	Project and Dissertation	-	-	1	12	6
4	Minor (2)	SET/CS/BT/M801	Cyber Security and Ethical Hacking	3	1	-	4	4
5		SET/CS/BT/M802	Internet of Things (IoT)	3	1	-	4	4
		Total		12	4	1	28	22

***L= Lectures, T=Tutorials , P= Practicals**

Detailed Syllabi

Semester VII

ARTIFICIAL INTELLIGENCE (SET/CS/BT/C701)		
Course Objective	1. Understand Problem Solving Methods: Introduce various problem-solving techniques, including production systems, state space search, and control strategies. 2. Explore Heuristic Search Techniques: Teach heuristic search methods such as hill climbing, breadth-first search, depth-first search, and best search. 3. Knowledge Representation: Cover different knowledge representation methods, including predicate logic, semantic nets, and fuzzy logic. 4. AI Applications: Provide an overview of AI applications in neural networks, natural language processing, speech recognition, and robotics. 5. Expert Systems Design: Explain the structure and design of expert systems, including their interaction with experts and practical application.	
Course Outcome	1. Proficient in Problem Solving Techniques: Gain proficiency in applying various problemsolving methods and control strategies to complex problems. 2. Heuristic Search Skills: Develop skills in implementing and utilizing heuristic search techniques to find optimal solutions efficiently. 3. Knowledge Representation Competency: Understand and apply different knowledge representation methods for effective AI problem-solving. 4. AI Application Insights: Acquire knowledge of AI applications and their practical uses in fields such as neural networks, natural language understanding, and robotics. 5. Expert System Design: Learn how to design and implement expert systems, including understanding their structure, interaction, and applications in real-world scenarios.	
Module Name	**Content**	**No. of Hrs.**
Problem Solving Methods	Production systems ,State space search , Control strategies , Heuristic search, Forward and backward reasoning, Hill Climbing techniques, Breadth first search, Depth first search, Best search , Staged search., Predicate logic, Resolutionquestionanswering,Nonmonoticreasoning,Stasticalandprobalistic reasoning,	12
Knowledge Representation	Predicate logic, Resolution question answering, Nonmonoticreasoning , Stastical and probalistic reasoning, Fuzzy logic, Semantic Nets, Conceptual dependency, Frames, Scripts.	10
AI Application	Neural Networks, Natural language understanding, speech recognition and understanding, Learning, perception, AI robotics, satellite imaging and medical diagnosis.	10
Expert Systems	Structure of an expert system, interaction with an expert, Design of an expert system.	10
	Total No. of Hours	**42**
Textbooks	1. E. Rich & K. Knight : Artificial Intelligence.	
References	1. N. J. Nilsson : Principles of Artificial Intelligence 2. A. Barr, E. A. Fergenbaumand& P. R. Cohen : Artificial Intelligence. 3. 4. D. A. Waterman : A guide to Expert System.	

Wireless Network and Mobile Computing (SET/CS/BT/C702)

Course Objective	1. To provide an in-depth understanding of the protocol architecture, physical layer, and sub-layers of cellular communication systems. 2. To educate students on the structure, services, and protocols of GSM, including localization, handover, and security mechanisms. 3. To familiarize students with Mobile IP, including packet delivery, handover management, and various mobile transport layer protocols. 4. To explore the concepts, challenges, and benefits of mobile computing, including ad hoc networks, and to understand wireless LAN protocols and Bluetooth technology. 5. To study the taxonomy, applications, and challenges of Mobile Ad Hoc Networks (MANETs) and examine various routing protocols.
Course Outcome	1. Students will understand the detailed protocol architecture and physical layer of cellular communications, and differentiate between WLAN and Bluetooth technologies. 2. Students will gain comprehensive knowledge of GSM system architecture, including mobile services, radio interface, protocols, handover mechanisms, and security features. 3. Students will be proficient in the principles and functioning of Mobile IP, including packet delivery, handover management, and mobile-specific transport layer protocols. 4. Students will be able to explain the fundamental concepts, challenges, and benefits of mobile computing and ad hoc networks, including an understanding of wireless LAN and Bluetooth protocols. 5. Students will have an advanced understanding of MANETs, including their taxonomy, applications, and challenges, and will be able to implement and analyze various routing protocols such as DSR, AODV, DSDV, CBRP, and TORA.

Module Name	Content	No. of Hrs.
Introduction to Cellular Communications	Protocol Architecture, Physical Layer, Channel Access Control Sub-layer, MAC Sub-layer, WLAN: Infrared vs. Radio Transmission, Infrastructure and Ad Hoc Networks, IEEE 802.11. Bluetooth.: User Scenarios, Physical Layer, MAC layer, Networking, Security, Link Management.	8
GSM	Mobile Services, System Architecture, Radio Interface, Protocols, Localization and calling, Handover, Security, and New Data Services	8
Mobile IP	lP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunnelling and Encapsulation, Route Optimization, DHCP. Mobile Transport Layer: Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks.	8
Overview of Ad Hoc Networks:	Ad Hoc Networks, Challenges, and benefits of Mobile Computing, breakthrough Technology, Wireless Computing, Nomadic Computing, Mobile Computing, Ubiquitous Computing, Pervasive Computing, Invisible Computing, applications of mobile computing, Wireless and Mobile Computing Models, LAN Protocols: IEEE 802.11/a/g/n & Bluetooth, Data Management Issues. Sensor Networks- Challenges, Architecture, and Applications.	8
Mobile Ad hoc Networks (MANETs)	Taxonomy, Applications, Challenges in Mobile Environments, Hidden and exposed terminal problems, Routing Protocols- Proactive, Reactive, and Hybrid protocols, Dynamic State Routing (DSR), Ad hoc On-Demand Distance Vector (AODV), Destination Sequenced Distance – Vector Routing (DSDV), and Cluster Based Routing Protocol (CBRP), and Temporally Ordered Routing algorithm (TORA).	10
	Total No. of Hours	**42**

Textbooks	1. Jochen Schiller, “Mobile Communications”, Addison-Wesley, Second Edition, 2004 2. Charles E. Perkins, Ad hoc Networks, Addison Wesley, 2008.
References	1. KazemSohraby, Daniel Minoli, TaiebZnati, Wireless Sensor Networks: Technology, Protocols, and Applications, Wiley, 2007. 2. Raj Kamal, “Mobile Computing”, Oxford University Press, 2007,

Cloud Computing (SET/CS/BT/C703)

Course Objective	1. To provide an understanding of the evolution, system models, and reference architecture of cloud computing, including insights into various service models (IaaS, PaaS, SaaS) and deployment models (public, private, hybrid). 2. To educate on virtualization technology, its definition, benefits, and implementation levels, as well as its critical role in cloud computing infrastructure. 3. To impart knowledge on networking support for cloud computing, including cloud reference models, data center design, and interconnection networks, with a focus on the integration with the Internet of Things (IoT). 4. To address cloud security challenges comprehensively, covering software-as-a-service security, risk management, security monitoring, and implementing security measures for data, applications, and virtual machines. 5. To explore web-based cloud applications, examining the pros and cons of cloud service development, and utilizing major cloud platforms like Amazon EC2, Google App Engine, and IBM Clouds for practical application.
Course Outcome	1. Students will be able to explain the evolution and system models of cloud computing, describe the NIST cloud computing reference architecture, and identify examples of IaaS, PaaS, and SaaS providers. 2. Students will understand virtualization technologies, including hypervisors such as VMware, KVM, and Xen, and will be capable of implementing virtualization for CPU, memory, I/O devices, servers, desktops, networks, and data centers. 3. Students will grasp the necessary networking support for cloud computing, understand the cloud reference model, and design and interconnect data centers while integrating with IoT. 4. Students will identify and address cloud security challenges, develop security governance and risk management strategies, and implement robust security measures for data, applications, and virtual machines within the cloud environment. 5. Students will gain the ability to develop and deploy web-based cloud applications, evaluate different types of cloud services, and utilize development tools and services from major cloud providers, enhancing their practical skills in cloud service development.

Module Name	Content	No. of Hrs.
Introduction	Evolution of Cloud Computing –System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture -IaaS – On-demand Provisioning – Elasticity in Cloud – E.g. of IaaS Providers - PaaS – E.g. of PaaS Providers - SaaS – E.g. of SaaS Providers – Public ,Private and Hybrid Clouds..	8
Virtualization Technology	Definition, Understanding and Benefits of Virtualization. Implementation Level of Virtualization, Virtualization Structure/Tools and Mechanisms, Hypervisor, VMware, KVM, Xen. Virtualization of CPU, Memory, I/O Devices, Virtual Cluster and Resources Management, Virtualization of Server, Desktop, Network, and Virtualization of datacenter.	10
Networking Support for Cloud Computing	Ubiquitous Cloud and the Internet of Things. Cloud Computing Architecture: Cloud Reference Model, Layer and Types of Clouds, Services models, Data center Design and interconnection Network, Architectural design of Computer and Storage Clouds.	8
Security in the Cloud	Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security	8
Web-Based Cloud Application	Web-Based Application, Pros and Cons of Cloud Service Development, Types of Cloud Service Development, Software as a Service, Platform as a Service, Web Services, On-Demand Computing, Discovering Cloud Services, Development Services and Tools, Amazon Ec2, Google App Engine, IBM Clouds	8
	Total No. of Hours	**42**

Textbooks	1. Raj Kumar Buyya, "Cloud Computing: Principles and Paradigms, wiley 2. Barrie Sosinsky, "Cloud Computing Bible", Wiley Publishers
References	1. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, 2. Michael Miller, "Cloud Computing : Web-based Applications That Change The Way You Work and Collaborate Online", Pearson Education

PROJECT Stage - I (SET/CS/BT/S704)		
Course Objective	1. Literature Review and Research Skills: To enable students to conduct a thorough survey and study of published literature on a given topic, identifying key research papers, trends, and gaps. 2. Problem Identification and Definition: To teach students how to select and precisely define a relevant and feasible research problem within the scope of their assigned topic. 3. Preliminary Solution Development: To guide students in developing a preliminary approach to solving the identified problem, including conceptualizing models, simulations, experiments, and feasibility studies. 4. Analytical and Technical Proficiency: To enhance students' abilities to conduct preliminary analysis, modeling, or simulation, and to design experiments or feasibility studies related to their research problem. 5. Communication and Presentation Skills: To improve students' skills in preparing comprehensive written reports and delivering effective oral presentations to communicate their research findings and methodologies.	
Course Outcome	1. Enhanced Research Skills: Students will be proficient in conducting comprehensive literature reviews, identifying key research works, and understanding the current state of knowledge in their research area. 2. Clear Problem Definition: Students will be able to define a specific, relevant, and researchable problem within the context of their assigned topic. 3. Preliminary Solution Approaches: Students will develop the ability to conceptualize and formulate preliminary approaches to solving the identified problem, demonstrating initial feasibility and validity. 4. Technical Analysis and Design: Students will gain experience in performing preliminary analyses, designing models, simulations, or experiments, and evaluating the feasibility of their approaches. 5. Effective Communication: Students will be capable of preparing detailed written reports and delivering articulate oral presentations to effectively convey their research process, findings, and implications to a departmental committee.	
Module Name	**Content**	**No. of Hrs.**
	Project – I includes following assignments. • Survey and study of published literature on the assigned topic. • Select and define an appropriate problem. • Working out a preliminary approach to the Problem relating to the assigned topic. • Conducting Preliminary Analysis/ Modeling/ Experiment/ Simulation/ Experiment/ Design/Feasibility. • Preparing a Written Report on the Study conducted for presentation to the Department. • Final Seminar, as oral Presentation before a Departmental Committee.	**3x16**
	Total No. of Hours	**48**

ARTIFICIAL INTELLIGENCE LAB (SET/CS/BT/C705)	
Lab Objective	1. To understand and implement fundamental algorithms in computer science using Python. 2. To develop problem-solving skills through coding classic algorithmic problems. 3. To gain proficiency in Python programming and improve coding practices.

	4. To apply theoretical knowledge to practical coding challenges, enhancing comprehension of algorithms. 5. To foster logical thinking and algorithmic design skills applicable to real-world problems.	
Lab Outcome	1. Students will be able to implement and understand Breadth First Search and Depth First Search algorithms in Python.	
	2. Students will successfully code and execute classic problems such as the 8-Puzzle, Water-Jug, and Tic-Tac-Toe, demonstrating applied problem-solving skills. 3. Students will be proficient in implementing complex algorithms like the Travelling Salesman Problem and Alpha-Beta Pruning in Python. 4. Students will gain the ability to design and implement solutions for combinatorial problems such as the 8-Queens Problem and Tower of Hanoi. 5. Students will develop and enhance their logical reasoning and coding skills, preparing them for more advanced computational challenges and real-world applications.	
Module Name	**Content**	**No. of Hrs.**
	1. Write a Program to Implement Breadth First Search using Python. 2. Write a Program to Implement Depth First Search using Python. 3. Write a Program to Implement Tic-Tac-Toe game using Python. 4. Write a Program to implement 8-Puzzle problem using Python. 5. Write a Program to Implement Water-Jug problem using Python. 6. Write a Program to Implement Travelling Salesman Problem using Python. 7. Write a Program to Implement Tower of Hanoi using Python. 8. Write a Program to Implement Monkey Banana Problem using Python. 9. Write a Program to Implement Alpha-Beta Pruning using Python. 10. Write a Program to implement 8-Queens Problem using Python.	
Total No. of Hou **rs**		**36**

INDUSTRIAL TRAINING SEMINAR (SET/CS/BT/S701)	
Course Objective	1. To provide students with hands-on experience in industrial settings. 2. To enhance students' technical and soft skills. 3. To familiarize students with current industry practices and technologies. 4. To facilitate professional networking opportunities. 5. To develop students' critical thinking and problem-solving abilities.

Course Outcome	1. Students will be able to apply theoretical concepts to practical situations. 2. Students will demonstrate improved technical proficiency with industry-standard tools and technologies. 3. Students will gain a better understanding of industry standards and expectations. 4. Students will develop enhanced communication skills through interactions and presentations. 5. Students will experience personal and professional growth, including increased confidence and adaptability.	
Module Name	**Content**	**No. of Hrs.**
	Student shall prepare a detailed report on her/his industrial training and deliver a seminar of 30 minutes.	-
	Total No. of Hours	-

E-COMMERCE (SET/CS/BT/M701)		
Course Objective	1. Explore the economic potential of electronic commerce (E-commerce) and the incentives driving businesses to engage in online transactions. 2. Examine the forces behind E-commerce and its advantages and disadvantages, along with its impact on traditional business models. 3. Understand the architectural framework of E-commerce systems and the network infrastructure supporting online transactions. 4. Discuss security issues in E-commerce, including the importance of firewalls, transaction security, and encryption techniques to protect sensitive information. 5. Explore electronic payment systems, including protocols like SET, payment gateways, digital tokens, and various methods of online payments.	
Course Outcome	1. Develop a comprehensive understanding of the economic potential and incentives driving Ecommerce, enabling students to identify opportunities and challenges in online business. 2. Gain insight into the architectural framework of E-commerce systems, including the network infrastructure required for secure and efficient transactions. 3. Acquire knowledge of security issues in E-commerce and understand the importance of implementing security measures such as firewalls and encryption techniques to protect data integrity and confidentiality. 4. Demonstrate proficiency in evaluating different electronic payment systems and understanding their functionalities and security features. 5. Understand the application of E-commerce technologies in various business contexts, including online banking, electronic data interchange (EDI), and emerging trends in mobile commerce, preparing students for careers in digital business environments.	
Module Name	**Content**	**No. of Hrs.**
Technology and Prospects	Economic potential of electronic commerce, Incentives for engaging in electronic commerce, forces behind E-Commerce, Advantages and Disadvantages, Architectural framework, Impact of E-Commerce on business.	8
Network Infrastructure of E- Commerce	Internet and Intranet based E-Commerce Issues, problems and prospects, Network Infrastructure, Network Access Equipment's, Broadband telecommunication (ATM, ISDN, and FRAME RELAY). Mobile Commerce: Introduction, Wireless Application Protocol, WAP Technology, Mobile Information device, Mobile Computing Applications.	10
Web Security	Security Issues on web, Importance of Firewall, components of Firewall, Transaction security, Emerging client server, Security Threats, Network Security, Factors to consider in Firewall design, Limitation of Firewalls.	8
Encryption	Encryption techniques, Symmetric Encryption-Keys and data encryption standard, Triple encryption. Asymmetric encryption-Secret key encryption, public and private pair key encryption, Digital Signature, Virtual Private Network.	8
Electronic Payments	Overview, The SET protocol, payment Gateway, certificate, digital Tokens, Smart card, credit card, magnetic strip card, E-Checks, Credit/Debit card based EPS, online Banking EDI Application in business	8
	Total No. of Hours	**42**
Textbooks	1. E-Commerce, Ritendra Goel, New Age International Publishers	

References	1. RaviKalakota,AndrewWinston,:FrontiersofElectronicCommerce"Addison Wesley. 2. Bajaj and Nag. "E-Commerce the cutting edge of Business".TMH. 3. P. Loshin, John Vacca, "Electronic Commerce" Firewall Media,N.Delhi. 4. E Business & Commerce: BrahmCazner, Wileydreamtech.

Semester VIII

UNIX AND SHELL PROGRAMMING (SET/CSE//BT/C801)		
Course Objective	1. To provide a comprehensive understanding of Unix user accounts, including the process of starting and shutting down processes, logging in and out, and basic command-line operations. 2. To introduce students to shell programming in Unix, covering Unix file systems, file management commands, shell variables, and scripting techniques such as command substitution, functions, conditionals, and loops. 3. To familiarize students with regular expressions and filters, including patterns, syntax, character classes, and quantifiers, and to demonstrate their practical application using tools like egrep, sed, awk, and perl. 4. To equip students with the necessary knowledge and skills to work within the C environment in Unix, including understanding the C compiler, vi editor, project management, memory management, makefiles, static and dynamic libraries, and debugging with gdb. 5. To explore advanced topics related to Unix processes, including process management, initialization processes, job control, network files, security, authentication, password administration, archiving, and handling signals and signal handlers.	

Course Outcome	1. Students will be proficient in Unix user account management, process handling, and basic command-line operations, enabling them to navigate and operate within the Unix environment effectively. 2. Students will have the ability to write shell scripts to automate tasks, manipulate files and directories, and customize their Unix environment using shell variables and scripting constructs. 3. Students will demonstrate competence in using regular expressions and filters to search and manipulate text data efficiently, employing tools like egrep, sed, awk, and perl for text processing tasks. 4. Students will be proficient in working within the C environment in Unix, including compiling and debugging C programs, managing projects with makefiles, and effectively utilizing static and dynamic libraries. 5. Students will have a deep understanding of Unix processes, job control mechanisms, security features, and signal handling, enabling them to develop robust and secure Unix-based applications.	
Module Name	**Content**	**No. of Hrs.**
Unix	User accounts, Unix – starting and shutting processes, Logging in and Logging out, Command line, simple commands.	8
Shell Programming	Unix file system, Unix files, inodes and structure and file system related commands, Shell as command processor, shell variables, creating command substitution, scripts, functions, conditionals, loops, customizing environment.	8
Regular Expressions and Filters	Introducing regular expressions patterns, syntax, character classes, quantifiers, introduction to egrep, sed, programming with awk and perl.	10
The C Environment	The C compiler, vi editor, compiler options, managing projects, memory management, use of make files, dependency calculations, memory management, dynamic and static memory, building and using static and dynamic libraries, using ldd, soname, dynamic loader, debugging with gdb.	10
Processes	Processes, starting and stopping processes, initialization processes, rc and init files, job control – at, batch, cron, time, network files, security, privileges, authentication, password administration, archiving, Signals and signal handlers.	6
	Total No. of Hours	**42**
Text Books	1. Sumitabha Das, "Your Unix – The Ultimate Guide", TMH, 2000.	
References	1. John Goerzen, "Linux Programming Bible", IDG Books, New Delhi, 2000. 2. Mathew, "Professional Linux Programming", Vol.1 & 2, Wrox-Shroff, 2001. 3. Welsh & Kaufmann "Running Linux", O'Reiley& Associates, 2000.	

MACHINE LEARNING (SET/CS/BT/C802)

Course Objective	1. Define learning systems and explore their goals and applications within the context of machine learning. 2. Examine the various aspects involved in developing a learning system, including training data acquisition, concept representation, and function approximation techniques. 3. Introduce logistic regression and other discriminative learning algorithms, including perceptron, decision trees, and support vector machines. 4. Discuss unsupervised learning techniques such as clustering, dimensionality reduction, and latent variable models. 5. Explore reinforcement learning and control methods, including Markov decision processes (MDPs), Q-learning, and policy iteration.
Course Outcome	1. Understand the fundamental concepts and objectives of learning systems and their relevance in machine learning applications. 2. Gain proficiency in acquiring and preprocessing training data, representing concepts, and approximating functions for learning tasks. 3. Identify and implement various discriminative and generative learning algorithms for classification and regression tasks. 4. Apply unsupervised learning techniques to uncover patterns, clusters, and latent variables in data sets. 5. Develop a comprehensive understanding of reinforcement learning algorithms and their applications in decision-making and control tasks.

Module Name	Content	No. of Hrs.
Introduction	Definition of learning systems, Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation. Definition of learning systems, Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation. linear discriminative, non-linear discriminative, decision trees, probabilistic (conditional and generative), nearest neighbor	10
Logistic regression	Logistic regression, Perceptron, Exponential family, Generative learning algorithms, Gaussian discriminant analysis, Naive Bayes, Support vector machines: Optimal hyper plane, Kernels. Model selection and feature selection. Combining classifiers: Bagging, boosting (The Ada boost algorithm), Evaluating and debugging learning algorithms, Classification errors	12
Unsupervised learning:	Clustering. K-means. EM Algorithm. Mixture of Gaussians. Factor analysis. PCA (Principal components analysis), ICA (Independent components analysis), latent semantic indexing. Spectral clustering, Markov models Hidden Markov models (HMMs).	10
Reinforcement Learning and Control	MDPs. Bellman equations, Value iteration and policy iteration, Linear quadratic regulation (LQR). LQG. Q-learning. Value function approximation, Policy search. Reinforce. POMDPs	10
	Total No. of Hours	**42**

Text books	1. Tom M Mitchell, Machine Learning, McGraw Hill Education. 2. Duda, Richard, Pattern Classification. 2nd,Wiley India
References	1. Tom M. Mitchell, Machine Learning . McGraw-Hill Series,. 2. Introduction to Machine Learning – Ethem Alpaydin, MIT Press, Prentice hall of India.

PROJECT Stage - II (SET/CS/BT/S803)

Course Objective	6. Literature Review and Research Skills: To enable students to conduct a thorough survey and study of published literature on a given topic, identifying key research papers, trends, and gaps. 7. Problem Identification and Definition: To teach students how to select and precisely define a relevant and feasible research problem within the scope of their assigned topic. 8. Preliminary Solution Development: To guide students in developing a preliminary approach to solving the identified problem, including conceptualizing models, simulations, experiments, and feasibility studies. 9. Analytical and Technical Proficiency: To enhance students' abilities to conduct preliminary analysis, modeling, or simulation, and to design experiments or feasibility studies related to their research problem. 10. Communication and Presentation Skills: To improve students' skills in preparing comprehensive written reports and delivering effective oral presentations to communicate their research findings and methodologies.	
Course Outcome	6. Enhanced Research Skills: Students will be proficient in conducting comprehensive literature reviews, identifying key research works, and understanding the current state of knowledge in their research area. 7. Clear Problem Definition: Students will be able to define a specific, relevant, and researchable problem within the context of their assigned topic. 8. Preliminary Solution Approaches: Students will develop the ability to conceptualize and formulate preliminary approaches to solving the identified problem, demonstrating initial feasibility and validity. 9. Technical Analysis and Design: Students will gain experience in performing preliminary analyses, designing models, simulations, or experiments, and evaluating the feasibility of their approaches. 10. Effective Communication: Students will be capable of preparing detailed written reports and delivering articulate oral presentations to effectively convey their research process, findings, and implications to a departmental committee.	
Module Name	**Content**	**No. of Hrs.**
	Project – I includes following assignments. • Survey and study of published literature on the assigned topic. • Select and define an appropriate problem. • Working out a preliminary approach to the Problem relating to the assigned topic. • Conducting Preliminary Analysis/ Modeling/ Experiment/ Simulation/ Experiment/ Design/Feasibility. • Preparing a Written Report on the Study conducted for presentation to the Department. • Final Seminar, as oral Presentation before a Departmental Committee.	**3x16**
	Total No. of Hours	**48**

CYBER SECURITY AND ETHICAL HACKING (SET/CS/BT/M801)		
Course Objective	1. Provide an introduction to hacking, including its types and processes, and the basics of security. 2. Establish a foundation for ethical hacking techniques, covering methodologies and various attack vectors. 3. Explore web application security, including core defense mechanisms and techniques for managing and securing web applications. 4. Examine hacking techniques specific to wireless networks, including sniffing, spoofing, and denial of service attacks.	

	5. Discuss the applications of hacking techniques in various scenarios, such as firewall engineering, secure communications, and mobile hacking.	
Course Outcome	1. Understand the fundamentals of hacking, including its various types and the importance of security. 2. Gain proficiency in ethical hacking methodologies, including social engineering, password hacking, and network penetration testing. 3. Develop skills in identifying and mitigating web application security vulnerabilities. 4. Acquire knowledge of hacking techniques specific to wireless networks and best practices for securing wireless LANs. 5. Learn about the applications of hacking techniques in real-world scenarios and the legal and ethical considerations involved.	
Module Name	**Content**	**No. of Hrs.**
BASICS OF HACKING	Introduction to Hacking, Types of Hacking, Hacking Process, Security – Basics of Security- Elements of Security, Penetration Testing, Scanning, Exploitation WebBased Exploitation.	6
ETHICAL HACKING TECHNIQUES	Building the foundation for Ethical Hacking, Hacking Methodology, Social Engineering, Physical Security, Hacking Windows, Password Hacking, Privacy Attacks, Hacking the Network, Hacking Operating Systems- Windows & Linux, Application Hacking, Footprinting, Scanning, Enumeration.	9
WEB APPLICATIONS SECURITY	Evolution of Web applications, Web application security, Core Defense Mechanisms, Managing the Application, Web Application Technologies- Web Hacking, Web functionality, How to block content on the Internet, Web pages through Email, Web Messengers, Unblocking applications, Injecting Code Injecting into SQL, Attacking Application Logic.	9
HACKING TECHNIQUES IN WIRELESS NETWORKS	Introduction to Wireless LAN Overview, Wireless Network Sniffing, WirelessSpoofing, Port Scanning, Wireless Network Probing, AP Weakness, Denial of Service (DOS), Man-in-the-Middle Attacks, War Driving, Wireless Security Best Practices, Software Tools, Cracking WEP, Cracking WPA & WPA-II.	9
HACKING TECHNIQUES APPLICATIONS	Safer tools and services, Firewalls, Filtering services, Firewall engineering, Secure communications over insecure networks, Case Study: Mobile HackingBluetooth-3Gnetwork weaknesses, Case study: DNS Poisoning, Hacking Laws	9
	Total No. of Hours	**42**

Textbooks	1. Kevin Beaver, "Hacking for Dummies" Second Edition, Wiley Publishing, 2. Stuart McClure, Joel Scambray, George Kurtz, "Hacking Exposed 6: NetworkSecurity Secrets & Solutions", Seventh edition, McGraw-Hill Publisher
References	1. Ankit Fadia, "An Unofficial Guide to Ethical Hacking" Second Edition, Macmillan publishers India Ltd, 2006 2. Ankit Fadia, "How to Unblock Everything on the Internet" Vikas PublishingHouse Pvt Ltd, 2012

INTERNET OF THINGS (IOT) (SET/CS/BT/M802)

Course Objective	1. Provide an architectural overview of IoT systems, focusing on design principles, capabilities, and standards considerations. 2. Explore the fundamentals of M2M and IoT technologies, including devices, gateways, networking, data management, and analytics. 3. Cover networking fundamentals specific to IoT, including protocols and layers such as PHY/MAC, network, transport, and session layers. 4. Discuss data management and analytics techniques for IoT systems, including data collection, preprocessing, storage, processing, visualization, and machine learning. 5. Examine embedded systems used in IoT devices, programming languages, security threats, vulnerabilities, and techniques to ensure secure IoT systems.	
Course Outcome	1. Understand the architectural principles and capabilities required for designing IoT systems and recognize the importance of standards in IoT development. 2. Identify the components and technologies involved in M2M and IoT systems, including devices, networking protocols, and analytics methods. 3. Demonstrate proficiency in networking fundamentals specific to IoT, including protocols and layers used in IoT communication. 4. Develop skills in data management and analytics for IoT, including collecting, preprocessing, storing, processing, visualizing, and analyzing IoT data. 5. Gain practical knowledge of embedded systems, programming languages, and security measures to design and implement secure IoT solutions.	
MODULE	**CONTENT**	**No. of Hrs.**
IoT-An Architectural Overview:	Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management.	8
Networking Fundamental of IOT	PHY/MAC Layer (3GPP MTC, IEEE802.11, IEEE 802.15), WirelessHART, ZWave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH, ND, DHCP, ICMP, RPL, CORPL, CARP, Transport and Session Layer: Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)- (TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT.	12
Data Management and Analytics	Data collection, storage, and preprocessing, Real-time and batch processing, Data visualization techniques, Introduction to analytics and machine learning for IoT data.	6
Embedded Systems and Security of IOT	Introduction to microcontrollers (Arduino, Raspberry Pi, etc.), Sensors and actuators used in IoT devices, Programming embedded systems (C/C++, Python, etc.), Security: Threats and vulnerabilities in IoT systems, Authentication and access control, Encryption techniques, Privacy considerations and regulations.	8
Cloud Computing and Edge Computing and IOT Platform	Introduction to cloud platforms (AWS, Azure, Google Cloud, etc.), Edge computing concepts and architectures, Deployment strategies for IoT applications, IOT Platform: Overview of IoT platforms (IoTivity, ThingWorx, IBM Watson IoT, etc.).	8
	Total No. of Hours	42

Text Books	1. Hakima Chaouchi, — "The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-140-7, Wiley Publications 2. Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things: Key Applications and Protocols", WileyPublications 3. Vijay Madisetti and ArshdeepBahga, — "Internet of Things (A Hands-on-Approach)",1 st Edition, VPT, 2014. 4. J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media,2016. Keysight Technologies, "The Internet of Things: Enabling Technologies and Solutions for Design and Test", Application Note, 2016.
References	1. Daniel Minoli, — "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications 2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms,