DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

SCHEME OF STUDIES & EXAMINATIONS (IMPLEMENTED FROM SESSION: JULY 2023)

SCHEME	NAME OF BRANCH	BRANCH CODE	SEMESTER
OCBC JULY 2022/2023	COMPUTER SCIENCE AND ENGINEERING	CO4	FIFTH (V)

S.N.	PAPER CODE	SUBJECT CODE	SUBJECT NAME	THEORY COMPONENT								PRACTICAL COMPONENT					TOTAL CREDITS	TOTAL MARKS
				HRS PER WEEK	CREDITS	TERM WORK			THEORY PAPER			HRS PER WEEK	CREDITS	LAB WORK	PRACTICAL EXAM/VIVA			
						QUIZ/ASSIGNMENT	MID TERM TEST*		TOTAL	MARKS	DURATION				MARKS	DURATION		
							I	II										
1	7491	501	INTRODUCTION TO e-GOVERNANCE	6	6	10	10	10	30	70	03 Hrs.	0	0	0	0	0	6	100
2	7492	502	INTERNET OF THINGS	5	5	10	10	10	30	70	03 Hrs.	0	0	0	0	0	5	100
3	7493	511	INFORMATION SECURITY OR	3	3	10	10	10	30	70	03 Hrs.	4	2	20	30	03 Hrs.	5	150
	7494	512	MULTIMEDIA TECHNOLOGIES															
4	7495	521	ADVANCE COMPUTER NETWORKS OR	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
	7496	522	DATA SCIENCES:DATA WAREHOUSING AND DATA MINING															
5	7601	531	RENEWABLE ENERGY TECHNOLOGIES OR	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
	7610	532	OPERATION RESEARCH															
6			SUMMER INTERNSHIP-II**	0	0	0	0	0	0	0	0	0	3	20	30	03 Hrs.	3	50
7			MAJOR PROJECT***	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
8			WORKSHOP/VISITS etc.	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0
9			RECOVERY CLASSES/LIBERARY etc.	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0
TOTAL				20	20				150	350		16	5	40	60		25	600

NOTE - (1) * Two Best, out of Three Mid Term Tests (Progressive Tests) Marks should be entered here.

(2) ** 4-6 Weeks Summer Internship after IV Semester.

(3) ***One Credit will be carried forward to the Six semester major project evaluation.

GRAND TOTAL OF CREDITS	GRAND TOTAL OF MARKS
25	600

DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN COMPUTER SCIENCE AND ENGINEERING (C04)

SEMESTER V

COURSE TITLE	:	INTRODUCTION TO e-GOVERNANCE
PAPER CODE	:	7491
SUBJECT CODE	:	501
THEORY CREDITS	:	06
PRACTICAL CREDITS	:	00

Course Objectives:

- To cover the concepts of e-Governance
- To understand how technologies and business models shape the contours of government
- To improve citizen services and bringing in transparency.
- To explore e-Gov portals as case studies

Course Outcomes:

By the end of the course, students should be able to:

1. Relate E-Governance with ICT4D
2. Recognize GPR, NeGP and SMART Governance
3. Explain E-Governance Architecture, Change Management and Issues
4. Practice Citizen-Centric e-Governance
5. Analyze Mini Projects with Evaluation of e-Governance Initiatives

Course Content:

Unit	Topics and Sub-topics	Hours	Marks
Unit 1: E-Governance and use of ICT4D	• E-Governance: Introduction, Framework, Objectives • ICT4D: Introduction of Information and Communication Technologies for Development, Role in E-Gov and Key Technologies (AI, ML, IoT, Cloud Computing, m-Governance) • E-Governance: Stages, Challenges, Benefits and Stakeholders • E Governance Lifecycle (e-GLC) • E Gov Project: Design, Implementation, Monitoring and Evaluation. • Policy, Legal, and Ethical Considerations,	18	14
Unit 2: GPR, NeGP and SMART Governance	• Government Process Re-engineering (GPR): Definition, Need and Steps • National e-Governance Plan(NeGP) for India : Vision, Mission, Need and Key Components • SMART Governance :Definition, Elements and Thumb Rules	18	14
Unit 3: E-Governance Architecture, Change Management and Issues	• E Gov Architecture: Key Components (Technical, Application, Data, Security and Governance) • E Gov Architecture Based Models: Centralized Vs Decentralized and Integrated Vs Federated Models • Types of E-governance: G2B, G2C, G2G, G2E. • Public-Private Partnership (PPP) in e-Governance: Models (BOT, BOOT, BOLT) • E Gov Innovation: Meaning, Types, Need, and Examples • E Gov Change Management: Definition, Importance and Key Elements • E Gov Issues : Critical Success Factors, Corruption, Resistance for Change, e-Security and Cyber Laws.	18	14
Unit 4: Citizen-Centric e-Governance	• Indian Initiatives and their Impact on Citizens: Introduction, Challenges, Impact Assessment and Future Directions in context with Digital India • Best practices in managing e-Governance Projects in Indian Context. • Explore Strengths, Advantages and Best Practices through Case Studies of commonly used e-Governance Sites: CSC, e-Sewa, Post Office, Passport Seva)	18	14
Unit 5: Mini Projects	Mini Projects by Students: Primarily Evaluation of Local e-Governance Portals by forming groups of students:	18	14

with evaluation of e-Governance Initiatives	• Forming various groups of students: to perform the task of mini projects. • Selecting a project based on local e-Gov Portals (MPe-district/ MPe-services/ MP-Online/ MP Statescholarship Portal/ University-Institution) • Studying the assigned e-Gov Portal : Strengths and Limitations • Evaluating the assigned e-Gov Portal: Parameter, Stakeholder Feedback and Improvement Potential • Summarizing the Evaluation: Report Writing, Presentation, Group Discussion.		

Suggested Learning Resources:

1. Managing Transformation –Objectives to Outcomes. J Satyanarayana, Prentice Hall India
2. The State, IT and Development. Kenneth Kenniston, RK Bagga and Rohit Raj Mathur, Sage Publications India Pvt Ltd.
3. e-Government -The Science of the Possible. J Satyanarayana, Prentice Hall, India
4. Information Technology and E-Governance – N Gopalsamy , published by New Age International (P) Ltd
5. http://www.csi-sigegov.org/publications.php
6. https://negd.gov.in
7. https://www.nisg.org/case-studies-on-e-governance-in-india.

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RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN COMPUTER SCIENCE AND ENGINEERING (C04)

SEMESTER V

COURSE TITLE	:	INTERNET OF THINGS
PAPER CODE	:	7492
SUBJECT CODE	:	502
THEORY CREDITS	:	05
PRACTICAL CREDITS	:	00

Course Objective:

- To gain knowledge of the core concepts, architecture, communication protocols, and components that form the foundation of IoT systems.
- To design and implement IoT applications in diverse domains such as healthcare, agriculture, smart cities, manufacturing, and transportation.
- To explore how IoT can be combined with AI, cloud computing, and big data analytics for intelligent decision-making and automation.
- To analyze and address challenges related to data protection, secure communication, and user privacy in IoT systems.
- To apply IoT for solving real-world problems, improving efficiency, and enabling sustainable development in civilian and defense sectors.

Course Outcomes:

By the end of the course, students should be able to:

1. Explain the fundamentals of IoT.
2. Discuss various component of IoT.
3. Explore various IoT communication protocol and sensor networks.
4. Develop skills to integrate IoT sensors and actuators with Arduino and Raspberry pi.
5. Explore real-world use cases in the field of Agriculture, Healthcare and Activity Monitoring.

Course Content:

Unit	Topics and Sub-topics	Hours	Marks
Unit 1: **Fundamentals of IoT**	• **Introduction to IoT-** Definition, Characteristics, Applications,5-layer architecture: Perception, Network, Middleware, Application, Business, IoT challenges • **IOT Devices, Sensor Actuator and Controllers-** IoT devices, sensors, types of sensors, actuators, types of actuators, Controllers (Arduino, Raspberry Pi,) • **Evolution of Internet of Things**, Enabling Technologies, M2M Communication, IOT vs M2M vs WSN	10	14
Unit 2: **IoT Networking and Protocols**	• **Core Components of IoT Networking** – Devices and Nodes, Gateways, Network Infrastructure, Cloud/ Backend Server • **Types of IOT Networks and associated technologies** – Short Range and Long Range Complexity of networks • **Connectivity Technologies** – WI-FI, Bluetooth, Zigbee , LoRAWAN, RFID, NFC, • **Sensor Networks** – Wireless Sensor Networks, Mobile Wireless Sensor Networks, UAV networks	15	14

	• **IoT Protocols**-Network Layer Protocol – IPV6, 6LOWPAN, Perception Layer Protocol – HART & wireless HART, Application Layer Protocol - MQTT, CoAP, AMQP		
Unit 3: **Introduction to Arduino programming**	• **Introduction to Arduino** -Features of Arduino, Types of Arduino Board, Arduino IDE, Arduino Function Libraries,Sketch , uploading the sketch to microcontroller, Structure of Arduino code (setup() and loop()),Data types and variables, Input/Output functions (digitalRead, digitalWrite, analogRead, analogWrite), Conditional statements and loops, Serial communication (Serial.begin(), Serial.print()), • **Example Programs**– Blinking LED, Buzzer • **Integration of Sensor and Actuators with Arduino** - DHT, Sound, Accelerometer, Servo Motor, Relay, Arduino + GSM module for SMS-based control, PCB design simulation using Fritzing or Tinkercad	20	14
Unit 4: **Implementation of IoT with Raspberry Pi and Cloud Enabled IoT**	• **Raspberry pi introduction and specifications**- Evolution and different models (Raspberry Pi 3, 4, Zero), Comparison with Arduino, Basic Architecture, Raspberry Pi GPIO, pin configuration, basic set up for Raspberry pi, operating system, Basic initial Configuration, • **Interfacing** - Serial communication (UART), Interfacing with external microcontrollers (Arduino), Using USB and Bluetooth devices, Interfacing Raspberry Pi Camera module , Capturing images and videos, Motion detection and time-lapse photography, Simple surveillance system, • **Cloud enabled IoT** - Architecture, IoT data characteristics ,cloud platforms for IoT (AWS iot core, Microsoft Azure IoT Hub, Google Cloud IoT core), Sending data to cloud platforms (e.g., Thingspeak, Blynk), Installing MQTT broker (Mosquitto), Publishing sensor data using MQTT, Edge v/s Cloud Computing	20	14
Unit 5: **Security and Privacy in IoT**	• **Security and Privacy in IoT**- Authentication, Encryption, Secure Communication, Privacy Concerns • **Case Studies using Arduino**- Agriculture, Healthcare • **Case Studies using Raspberry pi** - Activity Monitoring	10	14

Suggested Learning Resources:

S. No.	Title of Book	Author(s)	Publication
1	Internet of Things: Architecture and Design Principles	Raj Kamal	McGraw Hill
2	The Internet of Things: Enabling Technologies, Platforms, and Use Cases	Pethuru Raj and Anupama C. Raman	CRC Press
3	"Internet of Things"	Dr. Jeeva Jose	, Khanna Publishing House (Edition 2017)
4	Cloud Computing: Concepts, Technology & Architecture	Thomas Erl, Zaigham Mahmood, Ricardo Puttini	Prentice Hall
5	https://nptel.ac.in/noc/individual_course.php?id=noc17-cs22		
6	Internet of Things: A Hands-on Approach	ArshdeepBahga and Vijay Madisetti	Universities Press
7	Cloud IoT (As Per RGPV Diploma Syllabus)	Shuchita Mudgil Rohan Rajoriya	Pen and paper Academy ISBN : 978-81-984249-8-3
8	An Introduction to Internet of Things	Rahul Dubey	Cengage Publisher ISBN :-9789353500931

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DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN COMPUTER SCIENCE AND ENGINEERING (C04)

SEMESTER V

COURSE TITLE	:	INFORMATION SECURITY
PAPER CODE	:	7493
SUBJECT CODE	:	511
THEORY CREDITS	:	03
PRACTICAL CREDITS	:	02

Course Objective:
To learn how to evaluate and enhance information security of IT infrastructure and organizations

Course Outcome:
By the end of the course, students should be able to:

1. Learn the fundamental aspects of Information security
2. Explain security needs and identify issues of IT infrastructure
3. Identify security weaknesses in popular networking protocols
4. Learn the basics of Cryptography
5. Demonstrate security standards

Course Content:

Unit	Topics and Sub-topics	Hours	Marks
Unit 1: **Basics of Information security**	• Introduction to Information Security- Need of Security, Types of Security Security Principles, CIA Triad (Confidentiality, integrity and authentication) • Security Terminologies: Threat, Vulnerability, Risk, active Attacks , passive attacks • Security Features of Operating Systems – Authentication, Logs, Audit Features, File System Protection, User Privileges • Anti-Virus Software	21	14
Unit 2: **Security in Networking Protocols**	• Understanding security weaknesses in popular networking protocols – IP, TCP, UDP, RIP, OSPF, HTTP, SMTP, • Security weaknesses in common networking devices – Hub, switch, router, WiFi • Security solutions to mitigate security risk of networking protocols (IPSec, HTTPS)and devices(VLAN , VPN)	21	14
Unit 3: **Fundamentals of Cryptography**	• Basics of Cryptography: Symmetric and Asymmetric key encryption, PKI • Substitution cipher- Caesar cipher, Monoalphabetic cipher , playfair cipher, polyalphabetic cipher • Transposition cipher- Rail Fence cipher,columnar cipher, DES, RSA algorithm, Diffie-Hellman key exchange • Steganography	28	14
Unit 4: **Network Security product**	• Introduction to firewalls, Types of Firewalls, Need of firewalls, Function of firewalls, User Management in firewall • IDS, VPN, VPN Concentrator • Content Screening Gateways	21	14
Unit 5: Introduction to Security Standards	• ISO 27001, Indian IT Act, IPR Laws; Security Audit procedures • Contingency planning - Incidence response, Disaster Recovery, Business Continuity Planning (BCP)	14	14

Suggested List of Practical:

1. Perform Installation & Working of Antivirus
2. Perform encryption & decryption of given message by using programming language (C/Python/ PHP)
3. Perform encryption & decryption on given message with available cryptology tool (such as CrypTool)
4. Write a program to implement the Caesar Cipher Algorithm.
5. Send and receive secret message using command prompt or available Steganography tool (such as steghide)
6. Identify and testing of browser cookies.
7. Simulate conversion of a DES implementation using an environment such as Vlab.
8. Perform firewall configuration.
9. Setting up a firewall using any rule inbound or outbound.
10. Visit the National Cyber Crime Portal (https://cybercrime.gov.in/) for understanding the Cyber Crimes, Cyber Safety Tips, Cyber Awareness and reporting process for any cyber criminal activities to analyze real time cyber crimes and role of IT act.

Suggested Learning Resources:

S. No.	Title of Book	Author(s)	Publication
1	Cryptography and Network Security - Principles and Practice , Pearson	William Stallings	TMH
2	Principles of Cyber crime,	Jonathan Clough	Cambridge University Press
3	Cyber Law Simplified	VivekSood	TMH
4	Cyber Security	Nina Godbole, SunitBelapure	Wily-India
5	Introduction to Modern Cryptography	Jonathan Katz, Yehuda Lindel	(Chapman & Hall/CRC Cryptography and Network Security Series)
6	Information Security and Cyber Laws	Sarika Gupta	Khanna Publishing House
7	Cryptography and Network security	B. Fouruzan	TMH
8	Foundations Of Cryptography	Prof. Ashish Choudhury Department of Computer Science IIIT Bangalore	https://nptel.ac.in/courses/106106221
9	Cyber Security and Privacy	Prof. Saji K Mathew Department of Management Studies IIT Madras	https://nptel.ac.in/courses/106106248
10	Virtual Lab(VLAB)	An Initiative of Ministry of Education Under the National Mission on Education through ICT	https://cse29-iiith.vlabs.ac.in/List%20of%20experiments.html
11	cyber crime reporting	Web resource for cyber crime reporting	https://cybercrime.gov.in/ Web resource for cyber crime reporting
12	RFCs of protocols listed in content (https://www.ietf.org) Various Acts, Laws and Standards (IT Act, ISO27001 Standard, IPR and Copyright Laws, etc.) Security Guideline documents of Operating Systems (OS Manual, Man Pages, etc) https://www.cert-in.org.in/ https://www.sans.org/		

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DIPLOMA IN COMPUTER SCIENCE AND ENGINEERING (C04)

SEMESTER V

COURSE TITLE	:	MULTIMEDIA TECHNOLOGIES
PAPER CODE	:	7494
SUBJECT CODE	:	512
THEORY CREDITS	:	03
PRACTICAL CREDITS	:	02

Course Learning Objectives:

To introduce students to the domain of Multimedia Technologies, which explain the technologies underlying digital images, videos and audio contents, including various compression techniques and standards, and the issues to deliver multimedia content over the Internet.

Course Outcomes:

By the end of the course, students should be able to:

1. Understand the fundamentals of Multimedia.
2. Explain about various Compression Techniques.
3. Classify various animation techniques and use of various animations Software.
4. Explain introduction to Digital Imaging.
5. Develop multimedia enable Web applications and mobile applications.

Course Content:

Unit	Topics and Sub-topics	Hours	Marks
Unit 1: **Introduction to Multimedia**	• Multimedia Foundation and Concepts: Multimedia Hardware, Multimedia Software, Multimedia Authoring and their tool, Hypertext, Hyper media Multimedia elements- text, images, audio, video and animation. • Multimedia operating systems: Key Characteristics, Comparison with traditional Operating System (Process scheduling, The file system, Disk scheduling) • Overview and principles of Multimedia communication system	15	14
Unit 2: **Basic Compression Techniques**	• Video and Audio Data Compression Techniques (Lossy Compression): Transform Coding, Discrete Cosine Transform • Sound and Text (Lossless Compression Techniques):Run Length Encoding, Dictionary Encoding,Huffman Coding • Comparison of Lossy and Lossless compression	18	14
Unit 3: **Content Development and Distribution**	• Principles of Animation, characteristics of animations, Applications of Animation, limitation of animation, Types of animation: Traditional Animation, 2D animation, 3D animation, motion graphics, and stop motion animation • Techniques to create animation, Key framing, frame by frame animation, Stage, Timeline • 2D and 3D Animation software- Introduction to blender- work environment.	27	14
Unit 4: **Introduction to Digital Imaging**	• Definition of Computer Graphics, Application of Computer Graphics • Basics of Graphic Design and use of Digital technology, Definition of Digital images, Digital imaging in multimedia • Digital image fundamentals – pixels, resolution, bit depth, color models (RGB, CMY) • Compare image file formats- GIF, JPEG, PNG, TIFF, MPEG, GIMP	22	14

Unit 5: **Introduction to Multimedia Programming and Applications**	• Key aspects of Multimedia programming • Describe basic GUI libraries used for multimedia in python. • Explanation of basic Animation APIs in python • Overview of Multimedia Applications	23	14

Suggested List of Practical:

1. Write a program for Desktop publishing with different Platform like Photoshop
2. Create animations using Blender. Blender Tools. Importing artwork into blender.
3. Perform smiling face/Angry face animation using blender.
4. Draw the moving Car/Bike/Cycle on the screen.
5. To make multimedia enable applications (web/mobile/game)

Suggested Learning Resources:

S. No.	Title of Book	Author(s)	Publication
1	Fundamentals of Multimedia	Ze-Nian Li & Mark S. Drew.	Prentice Hall/Pearson,
2	Multimedia and Animation	V.K. Jain	Khanna Publishing House, Edition 2018
3	Fundamentals of Multimedia	Ramesh Bangia	Khanna Book Publishing Co., N. Delhi (2007)
4	Principles of Multimedia	Ranjan Parekh	Tata McGraw Hill Education Private Limited, New Delhi.
5	Multimedia in Practice	Jeff coate Judith	PHI
6	Introduction to Computer Graphics	N. Krishnamurthy	T.M.H
7	Computer Graphics Principles and Practices	Second edition by James D. Foley, Andeies van Dam, Stevan K. Fe iner and Johb F. Hughes, 2000	Addition Wesley.
8	Computer Graphics	Donald Hearn and M.Pauline Baker	PHI
9	Computer Graphics, Multimedia and Animations	Malay K. Pakhira	PHI Learning
10	Multimedia on the PC	Sinclair	BPB
11	https://www.technicalcube.in/animation-book-pdf-download		

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DIPLOMA IN COMPUTER SCIENCE AND ENGINEERING (C04)

SEMESTER V

COURSE TITLE	:	ADVANCE COMPUTER NETWORKS
PAPER CODE	:	7495
SUBJECT CODE	:	521
THEORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Objectives:

Introduce Advance Networking Concepts, Theories and Tools.

Course Outcomes:

By the end of the course, students should be able to:
1. Explain advanced networking concepts
2. Compare wireless technologies
3. Apply concepts of network reliability
4. Configure basic network security mechanisms
5. Simulate Computer Network

Course Content:

Unit	Topics and Sub-topics	Hours	Marks
Unit 1 **Advanced IP Networking and Transport Layer Concepts**	**Networking Basics – Quick Review** • OSI and TCP/IP Models: Layers, functions, common protocols • IP Addressing (IPv4): Classes, static/dynamic, private/public • Routing vs Switching – Overview **Advanced IPv4 Concepts** • **Subnetting**: o CIDR notation, subnet masks, Designing Subnet • **Multicasting**: o Concepts of unicast, broadcast, multicast, Applications **Advanced TCP Mechanisms** • **Brief overview of TCP Header** • **Flow Control**: o Sliding window, acknowledgments • **Congestion Control**: o Slow start, congestion avoidance, fast retransmit/recovery • **Protocol Spoofing**: o Purpose (WAN optimization), types, security concerns **Introduction to IPv6** • **Need for IPv6**: o IPv4 limitations: address exhaustion • **IPv6 Addressing and Features**	9	14
Unit 2: **Wireless Network Technologies**	• **Telecom Networks Overview**: Basic components and services **WAN Technologies** • **Frame Relay**: Packet-switching over virtual circuits (PVC/SVC) • **ATM (Asynchronous Transfer Mode)**: High-speed cell-switching (fixed 53-byte cells) • **MPLS (Multiprotocol Label Switching)**: Label-based routing; used for	9	14

	VPNs, QoS, and traffic engineering **VSAT Communication Concepts** • **VSAT Overview**: Satellite-based communication system • **Bandwidth Reservation**: TDMA, FDMA basics **. Wireless Networking** • **Wi-Fi (IEEE 802.11)**: Short-range wireless LAN • **WiMAX (IEEE 802.16)**: Long-range wireless broadband **Mobile Communication Technologies** • **GSM**: 2G technology, SIM-based, • **CDMA**: Code-based access, • **3G**: Higher data speeds, mobile internet • **4G (LTE)**: All-IP, high-speed mobile broadband		
Unit 3: **Network Reliability, Performance Optimization, and Monitoring**	**Network Redundancy** **Purpose and Techniques** **Load Balancing** • **Concept,Types**: Hardware/software, local/global,**Methods**: Round-robin, least connections, IP hash **Caching** • **Function, Types**: Browser cache, proxy cache, CDNs,**Benefits** **Storage Networks** • **NAS**: File-based access over LAN (e.g., SMB, NFS) • **SAN**: High-speed block-level storage (e.g., iSCSI, Fibre Channel) • **Use** **Quality of Service (QoS)** • **Need**: Prioritize critical traffic (voice/video) • **Parameters**: Bandwidth, delay, jitter, loss • **Techniques**: Traffic classification, shaping, policing • **Protocols**: DiffServ, MPLS **Network Monitoring** • **SNMP**: Monitors devices using agents and a management system • **RMON**: Extended SNMP for traffic analysis and alerts	9	14
Unit 4: **Fundamentals of Network Security and Secure Infrastructure**	**Network Security Overview** • **Purpose, Common Threats**: Viruses, hacking, unauthorized access, **CIA Triad**: Confidentiality, Integrity, Availability **VLAN (Virtual LAN)** **Definition, Benefits** **VPN (Virtual Private Network)** • Definition, Types: Site-to-site, Remote access Protocols: IPsec, SSL, Use **Firewall** • **Function, Types**: Hardware or software-based, Use **IPS (Intrusion Prevention System)** • **Function**, **Difference from IDS, Uses**, **Proxy Server** • **Definition and uses**	9	14
Unit 5: **Network Design, Simulation, and Analysis Tools**	**Network Simulation** **Purpose**, **Tools**: Cisco Packet Tracer, GNS3, Use **Network Design Basics** • **Activities**: Design small office or campus networks • **Focus Areas**: IP planning, device selection, VLAN setup • **Exercises**: Draw network diagrams, assign IPs **IP Addressing Schema** • **IPv4 Basics**: Classes, private/public ranges • **Subnetting**: Split networks efficiently • **IPv6 Intro**: Address structure and usage **Protocol Analysers (Wireshark)**	9	14

	• **Tool Use**: Capture and inspect network traffic • **Wireshark Tasks**: View packets, apply filters, **Application**		

Suggested Learning Resources:

1. Computer Networks Andre,w S. Tanenbaum and David J. Wetherall-Pearson Education
2. RFCs and Standards Documents (www.ietf.org and other standard body websites)
3. Communication Networking – An Analytical Approach, Anurag-Manjunath-Joy
4. TCP/IP Illustrated (Vol.1,2), Stevens
5. Data Networks, Bertsekas-Gallager
6. An Engineering Approach to Computer Networking, S. Keshav

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DIPLOMA IN COMPUTER SCIENCE AND ENGINEERING (C04)

SEMESTER V

COURSE TITLE	:	DATA SCIENCES: DATA WAREHOUSING AND DATA MINING
PAPER CODE	:	7496
SUBJECT CODE	:	522
THEORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Objectives:

Introduce students to the domain of Data Warehousing and Data Mining**.**

Course Outcomes:

1. Explain data warehouse concepts.
2. Apply fundamental data mining techniques for data preparation, pattern discovery, and prediction.
3. Use Python standard libraries to explore and visualize datasets.
4. Describe the need for data preprocessing and explain common techniques used to prepare data for analysis.
5. Explain basic concepts of machine learning and deep learning techniques.

Course Content:

Unit	Topics and Sub-topics	Hours	Marks
Unit 1: Data Warehousing and on-line Analytical Processing	**1.1 Data Warehousing Concepts:** • Basic Concepts of Data Warehousing- Definition & characteristics, OLTP and OLAP, OLAP Operations, Data Cubes, Data Cube Computation. • Data Marts and Data Warehouse Architecture. • Data Warehouse Design and Usage- Star Schema, Snowflake Schema, Facts Table & Dimension Table. **1.2 Data Warehouse Implementation:** • Data Extraction, Transformation, and Loading (ETL). • Physical Design, and Metadata Management.	8	14
Unit 2: Data Mining Concepts	**2.1 Introduction to Data Mining:** • Definitions and Importance of Data Mining, Types of Data Mining, Data Mining Functionalities, and Applications of Data Mining. • Classification of Data Mining Systems, Data Mining Task Primitives and Major Issues in Data Mining. • Integration of Data Mining System with Database or Data Warehouse System. **2.2 Data Preprocessing:** • Introduction to Data Quality & Terminologies- Accuracy, Completeness, Consistency, Timeliness, and Validity. • KDD- Data Cleaning, Data Transformation, Data Reduction, Data Integration, Data Discretization. **2.3 Data Mining Techniques:** • Classification Algorithms- KNN, Decision Tree, Random Forest, Naive Bayes. • Clustering Algorithms- K Means, Hierarchical. • Association Rule Mining- Apriori Algorithm.	8	14
Unit 3: Basics of Data Science	**3.1 Introduction:** • Definition and scope, Importance in modern industries, Data Science lifecycle and Applications. • Types of Data- Structured, Unstructured, Semi-structured. • Quantitative vs Qualitative Data. • Roles in Data Science- Data Scientist, Data Analyst, Data Engineer, Machine Learning Engineer, Business Analyst. • Applications of Data Science. **3.2 Key Components:**	10	14

	• Data collection, Data preprocessing, Data analysis & visualization, Modelling & prediction. **3.3 Tools and Technologies:** • Visualization of Data Using Libraries Pandas, NumPy, Matplotlib and Seaborn.		
Unit 4: **Data Wrangling, Preprocessing and Applications**	**4.1 Data Wrangling:** • Handling missing values (drop, fill, imputation), Detecting and removing duplicates, Transforming, Merging and Joining datasets. **4.2 Data Preprocessing:** • Why Outlier Analysis? • Identifying and Handling Outliers. • Outlier Detection Techniques: Standard Deviation Method, IQR Method, Z-Score Method. • **Data Cleaning:** Removing noise, errors, invalid entries. • **Data Integration:** Combining data from multiple sources. • **Data Transformation:** Normalization, standardization, encoding. • **Data Reduction:** Feature selection, dimensionality reduction (e.g., PCA). • **Data Discretization:** Converting continuous data into discrete buckets.	10	14
Unit 5: **Fundamentals of Machine Learning & Deep Learning**	**5.1 Machine Learning:** • **Types of Machine Learning**- Supervised, Unsupervised and Reinforcement Learning. • **Regression Techniques:** Linear, Multiple Linear, Polynomial, Ridge & Lasso. **Model Evaluation:** Mean Absolute Error (MAE) & Mean Squared Error (MSE). • **Classification Techniques:** SVM, Decision Trees, KNN, Logistic Regression. **Model Evaluation:** Confusion Matrix, Precision, Recall, F1-score. **5.2 Deep Learning:** • Introduction to Neural Network, Perceptron and Activation Function- ReLU, Leaky ReLU and Sigmoid. • Types of Neural Network: Feedforward Neural Networks (FNN), Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN). • Applications of Deep Learning- Image Recognition, Natural Language Processing, Speech Recognition and Autonomous System.	9	14

Suggested Learning Resources:

1. Jiawei Han, Micheline Kamber, Jian Pei, Data Mining: Concepts and Techniques, Elsevier
2. Margaret H Dunham, Data Mining Introductory and Advanced Topics, Pearson Education
3. Amitesh Sinha, Data Warehousing, Thomson Learning, India.
4. Xingdong Wu, Vipin Kumar, the Top Ten Algorithms in Data Mining, CRC Press, UK.

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DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN COMPUTER SCIENCE AND ENGINEERING (C04)

SEMESTER V

COURSE TITLE	:	RENEWABLE ENERGY TECHNOLOGIES
PAPER CODE	:	7601
SUBJECT CODE	:	531
THEORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Learning Objectives:

- To understand present and future scenario of world energy use.
- To understand fundamentals of solar energy systems.
- To understand basics of wind energy.
- To understand bio energy and its usage in different ways.
- To identify different available non-conventional energy sources.

Course Outcomes:

By the end of the course, students should be able to:

1. Describe present and future scenario of worldwide energy use/demand.
2. Use solar energy systems for various applications.
3. Explain basics of wind energy.
4. Classify bio-energy and its usage in different ways.
5. Identify different available non-conventional energy sources.

Course Content:

Unit	Topics and Sub-topics	Hours	Marks
Unit 1: **Introduction**	• Classification of energy resources • worldwide energy use/demand, Reserves of conventional energy resources • Need of renewable energy • Environmental aspect of energy utilization– Climate Change and Global Warming, • Renewable energy scenario in India and around the world • Economic analysis of renewable energy systems by using simple payback period technique .	10	14
Unit 2: **Solar Energy**	• Solar radiation and its measurement • Types of solar energy system – Solar Photovoltaic (PV) system and solar Thermal system • Solar PV system – Working principle of photovoltaic cell • Solar PV cell materials • PV modules • Application of solar PV systems – On grid and Off grid. • Advantages and Limitations of solar PV systems • Solar Thermal system – Principle of conversion of radiation into heat • Solar thermal collectors – Flat plate and Concentrating type • Application of solar thermal systems • Advantages and Limitations of solar thermal systems	10	14
Unit 3: **Wind Energy**	• Importance of wind data • Wind energy conversion system and energy estimation • Types of wind energy systems • Factors affecting performance of wind power plant • Site selection	10	14

	• Types of Wind Turbine generators - Direct Current (DC), Alternating Current (AC) synchronous and Alternating Current (AC) asynchronous generators • Safety and environmental aspects		
Unit 4: **Bio-Energy**	• Biomass energy – biomass direct combustion and biomass gasifires • Working and types of biogas plants • Digestors • Ethanol production • Bio-diesel • Cogeneration systems and its advantages • Biomass applications	8	14
Unit 5: **Other Renewable Energy Sources**	• Basics of Tidal Energy • Basics of Wave Energy • Working of Ocean Thermal Energy Conversion (OTEC) system • Basics of Small Hydro power plant • Working principle of Geothermal Energy system • Hydrogen energy and its storage methods • Working principle of Fuel Cell • Hybrid systems and their advantages	7	14

Suggested Learning Resources:

S. No.	Title of Book	Author(s)	Publication
1	Energy Technology	O. P. Gupta	Khanna Publishing House, Delhi (ed. 2018)
2	Solar Energy	S. P. Sukhatme	Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997
3.	Fundamental of Renewable Energy Sources	G. N. Tiwari, M. K. Ghosal	Narosa, New Delhi, 2007
4.	Renewable Energy and environment-A Policy Analysis for India	N. H. Ravindranath, U. K. Rao, B. Natrajan, P. Monga	Tata McGraw Hill
5.	Non-Conventional Sources of Enegy	S. R. Awasthi, S. K. Soni	Satya Prakashan, New Delhi 2023-24
6.	Non-conventional Energy Sources	G. D. Rai	Khanna Publishers
7.	Renewable Energy Technologies: A Practical guide for Beginners,	Chetan Singh Solanki	PHI Learning, New Delhi
8.	Renewable Energy Sources and Emerging Technologies	D. P. Kothari, K. C. Singal, Rakesh Ranjan	PHI Learning, New Delhi

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DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN COMPUTER SCIENCE AND ENGINEERING (C04)

SEMESTER V

COURSE TITLE	:	OPERATION RESEARCH
PAPER CODE	:	7610
SUBJECT CODE	:	532
THEORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Objectives:

1: Recognize the importance of Operations Research and mathematical modeling in solving practical problems in industries.

2: Formulate real-world managerial decision problems into well-defined mathematical models.

3: Solve Linear Programming, Transportation, and Assignment problems using standard methods.

4: Understand and apply sequencing methods and game theory in decision-making scenarios.

5: Implement Operations Research techniques in industrial and business environments for effective decision-making

Course Outcome:

By the end of the course, students should be able to:

1. Recognize managerial problems to optimize the use of resources like capital, materials, staffing, and machinery.
2. Develop skills in formulating and solving mathematical models for real-world industrial problems.
3. Understand key operations research techniques for solving complex decision-making problems.
4. Apply the concepts of linear programming, transportation, and assignment models effectively.
5. Formulate strategic and informed decisions based on quantitative analysis.

Course Content:

Unit	Topics and Sub-topics	Hours	Marks
Unit 1 **Development**	**Development of Operations Research:** • Definition, History, Application, Scope, and Importance of Operations Research • Characteristics of OR problems • Scientific Methods, Category and Phases of Scientific Methods in OR • OR models and Types of models used in OR • General methods like Linear Programming, Game Theory, Transportation, Assignment and Sequencing for solving OR models.	10	14

Unit 2
 	
Allocation
	Allocation Problems:
	• Introduction to Linear Programming Problems (LPP), Components of LPP
	• Characteristics and Formulation of LPP
	• **Graphical Method** :
	  • Introduction and Steps to solve LPP using Graphical method
	  • Numerical Problems of Graphical method for two variable
	• **Simplex Method :**
	  • Introduction and Steps to convert General LPP to Standard LPP.
		10	14

	• Simplex method Algorithm • Numerical Problems of Simplex method up to three variable. • Basic problems of primal to dual conversion using Duality Principle		
Unit 3 **Transportation Problem**	**Transportation Problem:** • Introduction and Formulation of Transportation Problem • North-West Corner Rule, Least Cost, Vogel's Approximation. • Numerical Problems of balanced Transportation Problem. • Conversion of Unbalanced to Balanced Transportation Problem **Assignment Problem:** • Introduction and Formulation of Assignment Problem • Hungarian Method for Solving Assignment Problem	09	14
Unit 4 Sequencing	**Sequencing:** • Introduction, Terminology, Notations and Assumptions in sequencing problems • Johnson's algorithm for n-jobs and 2- machines (Optimal Solution) • Numerical problems of Sequencing problems with n-jobs and 2-machines • Algorithm for converting n-jobs and 3- machines to n-jobs and 2-machines • Numerical problems of Sequencing problems with n-jobs and 3-machines	08	14
Unit 5 Theory of games	**Game Theory:** • Introduction, Uses and Types of Game in Game Theory • Strategy and types of Strategy in Game Theory • Numerical problems of Two-person zero-sum games • Maximn and Minimax Principle and its Working • Introduction of Games without saddle points: Mixed Strategies • 2×2 game without saddle points	08	14

Suggested Learning Resources:

S. No.	Title of Book	Author(s)	Publisher
1	Operations Research: Principles and Applications	G. Srinivasan	PHI Learning Pvt. Ltd.
2	Operations Research: An Introduction	Hamdy A. Taha	Pearson
3	Operations Research: Principles and Practice	Ravindran, Phillips, Solberg	Wiley India
4	Operations Research: Concepts and Cases	Hillier and Liberman	McGraw-Hill

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DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

DIPLOMA IN COMPUTER SCIENCE AND ENGINEERING (C04)

SEMESTER V

COURSE TITLE	:	SUMMER INTERNSHIP - II
PAPER CODE	:	-
SUBJECT CODE	:	-
THEORY CREDITS	:	00
PRACTICAL CREDITS	:	03

SUMMER INTERNSHIP - II

4-6 weeks summer internship after IVth Semester.

It should be undertaken in an Industry only.

Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

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SEMESTER V

COURSE TITLE	:	MAJOR PROJECT
PAPER CODE	:	-
SUBJECT CODE	:	-
THEORY CREDITS	:	00
PRACTICAL CREDITS	:	00 (ONE CREDIT WILL BE CARRIED FORWARD TO THE VI SEM. MAJOR PROJECT EVALUATION)

MAJOR PROJECT

It should be based on real / live problems of the Industry/Govt./NGO/MSME/Rural Sector or an innovative idea having the potential of a Startup.

Steps :

- Problem Domain, Topic and Team Finalization.
- Assignment of Faculty as Guide / Co-guide.
- Project Planning including Requirement Analysis, Information Gathering and Feasibility study.
- Prepare System Requirement Specifications (SRS).
- Project Design with clear layout including Data Design, ER Diagrams and Data Flow Diagrams as applicable.
- Documentation of work done as a Report / Presentation.

Evaluation :

Evaluation is based on work done, quality of report, performance in viva-voce and presentation.

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