Rajiv Gandhi Proudyogiki Vishwavidyalaya,Bhopal

New Scheme of Examination as per AICTE Flexible Curricula

VIII Semester Bachelor of Technology (B.Tech.) Computer Science & Information Technology/ *(w.e.f. July,2020)*

S.No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical						
				End Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem	Term work / Lab Work & Sessional		L	T	P	
1.	CSIT 801	DC	Data Science	70	20	10	30	20	150	2	1	2	4
2.	CSIT 802	DE	Departmental Elective	70	20	10	-	-	100	3	1	-	4
3.	CSIT 803	OE	Open Elective	70	20	10	-	-	100	3	0	0	3
4.	CSIT 804	D Lab	Departmental Elective Lab	-	--	-	30	20	50	-	-	6	3
5.	CSIT 805	P	Major Project-II	-	-	-		100	100	-	-	8	4
6.	Additional Credits#	*#Additional credits can be earned through successful completion of credit based MOOC's Courses available on SWAYAM platform (MHRD) at respective UG level.*											
			Total	210	60	30	60	140	500	8	2	16	18

Departmental Electives	Open Electives
802(A) Data Warehousing & Mining	803(A) Digital Marketing & SEO
802 (B) Bio Informatics	803(B) Quantum Computing
802 (C) Web & Information Retrieval	803(C) Cyber Law and Forensics
802 (D) Block Chain Technology	803 (D) Robotics

Open Electives can be offered to students of all branches **including CSE branch.** However, they can be offered to students of Non-CSE branches only if they have not taken any similar courses previously and have sufficient knowledge of pre-requisite courses (if any) of respective open electives subject.

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	**1 Credit**	**1 Credit**

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CSIT-801 Data Science

Objective:

The objective of this course is to familiarize students with the roles of a data scientist and enable them to analyze data to derive meaningful information from it.

Course Outcomes: After the completion of this course, the students will be able to:

1. Demonstrate proficiency with statistical analysis of data.
2. Build and assess data-based models.
3. Execute statistical analyses with professional statistical software.
4. Demonstrate skill in data management.
5. Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

Unit I

Data Science and Big Data Overview: Types of data, Sources of data, Data collection, Data storage and management, Big Data Overview, Characterization of Big data, Drivers of Big Data, Challenges, Big Data Use Cases, Defining Big Data Analytics and examples of its use cases, Data Analytics Lifecycle: Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize.

Unit II

Advanced Analytical Theory and Methods: Clustering, K-means, Additional Clustering Algorithms, Association Rules, Apriori Algorithm, Applications of Association Rules, Regression, Linear Regression, Logistic Regression, Classification, Decision Trees, Naive Bayes, Additional Classification Methods, Text Analysis, Text Analysis Steps, Determining Sentiments.

Unit III

Advanced Analytics-Technology and Tools: Analytics for Unstructured Data Use Cases, MapReduce, Apache Hadoop, Traditional database vs. Hadoop, Hadoop Core Components, HDFS, Design of HDFS, HDFS Components, HDFS Architecture, Hadoop 2.0 Architecture, Hadoop-2.0 Resource Management, YARN.

Unit IV

The Hadoop Ecosystem: Introduction to Hive, Hbase, Hive Use Cases: Face book, Healthcare;

Hive Architecture, Hive Components. Integrating Data Sources, Dealing with Real-Time Data Streams, Complex Event Processing, Overview of Pig, Difference between Hive and Pig, Use Cases of Pig, Pig program structure, Pig Components, Pig Execution, Pig data models, Overview of Mahout, Mahout working.

Unit V

Introduction to R, Basic Data Analytics Methods Using R, Communicating and Operationalizing an Analytics Project, Creating the Final Deliverables, Data Visualization Basics.

Recommonded Books:

1. EMC Education Services, "Data Science and Big Data Analytics", Wiley, 2015.
2. Judith Hurwitz, Alan Nugent, Fern Halper, and Marcia Kaufman, "Big Data for Dummies",Wiley & Sons,2013.
3. VigneshPrajapati, "Big Data Analytics with R and Hadoop" ,Packt Publishing, 2013.
4. David Dietrich, Barry Heller, and Beibei Yang"Data Science and Big Data Analytics:Discovering, Analyzing, Visualizing and Presenting Data", John Wiley & Sons, Inc.

List of Experiments:

1. Introduction to R tool for data analytics science
2. Basic Statistics and Visualization in R
3. K-means Clustering
4. Association Rules
5. Linear Regression
6. Logistic Regression
7. Naive Bayesian Classifier
8. Decision Trees
9. Simulate Principal component analysis
10. Simulate Singular Value Decomposition

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Departmental Elective CSIT802-(A) Data Warehousing & Mining

Objective:

1. Student should understand the value of Historical data and data mining in solving real world problems.
2. Student should become affluent with the basic Supervised and unsupervised learning algorithms commonly used in data mining.
3. Student develops the skill in using data mining for solving real-world problems.

Course Outcomes: After the completion of this course, the students will be able to:

1. Understand the functionality of the various data mining and data warehousing component
2. Appreciate the strengths and limitations of various data mining and data warehousing models
3. Explain the analyzing techniques of various data
4. Describe different methodologies used in data mining and data ware housing.
5. Compare different approaches of data ware housing and data mining with various technologies.

Unit-I

Data Warehousing: Introduction, Delivery Process, Data warehouse Architecture, Data Preprocessing: Data cleaning, Data Integration and transformation, Data reduction. Data warehouse Design: Datawarehouse schema, Partitioning strategy Data warehouse Implementation, Data Marts, Meta Data, Example of a Multidimensional Data model. Introduction to Pattern Warehousing.

Unit-II

OLAP Systems: Basic concepts, OLAP queries, Types of OLAP servers, OLAP operations etc. Data Warehouse Hardware and Operational Design: Security, Backup And Recovery,

Unit-III

Introduction to Data& Data Mining: Data Types, Quality of data, Data Preprocessing, Similarity measures, Summary statistics, Data distributions, Basic data mining tasks, Data Mining V/s knowledge discovery in databases. Issues in Data mining. Introduction to Fuzzy sets and fuzzy logic.

Unit-IV

Supervised Learning: Classification: Statistical-based algorithms, Distance-based algorithms, Decision tree-based algorithms, Neural network-based algorithms, Rule-based algorithms, Probabilistic Classifiers

Clustering & Association Rule mining : Hierarchical algorithms, Partitional algorithms, Clustering large databases – BIRCH, DBSCAN, CURE algorithms. Association rules : Parallel and distributed algorithms such as Apriori and FP growth algorithms.

Recommonded Books:

1. Pang – ningTan , Steinbach & Kumar, *"Introduction to Data Mining"*, Pearson Edu, 2019.
2. Jaiwei Han, Micheline Kamber, "*Data Mining : Concepts and Techniques*", Morgan Kaufmann Publishers.
3. Margaret H. Dunham, "*Data Mining : Introductory and Advanced topics*", Pearson Edu.,
4. Anahory& Murray, "*Data Warehousing in the Real World"*, Pearson Edu.

List of Experiments:

1. Create an Employee Table with the help of Data Mining Tool WEKA.
2. Create a Weather Table with the help of Data Mining Tool WEKA.
3. Apply Pre-Processing techniques to the training data set of Weather Table
4. Apply Pre-Processing techniques to the training data set of Employee Table
5. Normalize Weather Table data using Knowledge Flow.
6. Normalize Employee Table data using Knowledge Flow.
7. Finding Association Rules for Buying data.
8. Finding Association Rules for Banking data.
9. Finding Association Rules for Employee data.
10. To Construct Decision Tree for Weather data and classify it.

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Departmental Elective CSIT-802(B) Bio Informatics

Objective:

The course has been designed to be an entry level in Bioinformatics. It is introductory in nature and will provide an overview of the concepts and practices in Bioinformatics. The course structure has been designed such that students will acquire skills required to become Assistant Programmer/Technical Assistant in Bioinformatics. It would also help students to acquire a good foundation to take up further studies.

Course Outcomes: After Completing the course student should be able to:

1. To get introduced to the basic concepts of Bioinformatics and its significance in Biological data analysis.
2. Describe the history, scope and importance of Bioinformatics and role of internet in Bioinformatics.
3. Explain about the methods to characterize and manage the different types of Biological data.
4. Classify different types of Biological Databases.
5. Introduction to the basics of sequence alignment and analysis.

Unit-I

Introduction: Introduction to bioinformatics, objectives of bioinformatics, Basic chemistry of nucleic acids, structure of DNA & RNA, Genes, structure of bacterial chromosome, cloning methodology, Data maintenance and Integrity Tasks.

Unit-II

Bioinformatics Databases & Image Processing: Types of databases, Nucleotide sequence databases, Protein sequence databases, Protein structure databases, Normalization, Data cleaning and transformation, Protein folding, protein function, protein purification and characterization, Introduction to Java clients, CORBA, Using MYSQL, Feature Extraction.

Unit-III

Sequence Alignment and database searching: Introduction to sequence analysis, Models for sequence analysis, Methods of optimal alignment, Tools for sequence alignment, Dynamics Programming, Heuristic Methods, Multiple sequences Alignment

Unit-IV

Gene Finding and Expression: Cracking the Genome, Biological decoder ring, finding genes through mathematics & learning, Genes prediction tools, Gene Mapping, Application of Mapping,

Modes of Gene Expression data, mining the Gene Expression Data

Unit-V

Proteomics & Problem solving in Bioinformatics: Proteome analysis, tools for proteome analysis, Genetic networks, Network properties and analysis, complete pathway simulation: E-cell, Genomic analysis for DNA & Protein sequences , Strategies and options for similarity search , flowcharts for protein structure prediction

Recommended Books:

1. Gopal & Jones, BIOINFORMATICS with fundamentals of Genomics & Proteomics ,TMH Pub
2. Rastogi , Bioinformatics –Concepts , skills & Applications , CBS Pub
3. Claverie , Bioinformatics , Wiley pub
4. Stekel , Micrarray BioInformatics , Cambridge

List of Experiments:

1. To find information in online databases.
2. To retrieve the sequence of the Human keratin protein from UniProt database and to interpret the results.
3. To retrieve the sequence of the Human keratin protein from Genbank database and to interpret the results.
4. To find the similarity between sequences using BLAST.
5. To find the similarity between sequences using FASTA
6. To align more than two sequences and find out the similarity between those sequences using ClustalW.

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Departmental Elective CSIT-802(C) Web & Information Retrieval

Course Objective:

This course aims at introducing the area of Information Retrieval and at examining the theoretical and practical issues involved in designing, implementing and evaluating Information Retrieval systems.

Course Outcomes: After the completion of this course, the students will be able to:

1. To identify basic theories and analysis tools as they apply to information retrieval.
2. To develop understanding of problems and potentials of current IR systems.
3. To learn and appreciate different retrieval algorithms and systems.
4. To apply various indexing, matching, organizing, and evaluating methods to IR problem.
5. To become aware of current experimental and theoretical IR research.

Unit-I

Introduction: Information verses data retrieval, the retrieval process, taxonomy of Information Retrieval Models.

Unit-II

Classic Information Retrieval Techniques: Boolean Model, Vector model, Probabilistic Model, comparison of classical models. Introduction to alternative algebraic models such as Latent semantic Indexing etc.

Unit-III

Keyword based Queries, User Relevance Feedback: Query Expansion and Rewriting, Document preprocessing and clustering, Indexing and Searching: Inverted Index construction, Introduction to Pattern matching.

Unit-IV

Web Search: Crawling and Indexes, Search Engine architectures, Link Analysis and ranking algorithms such as HITS and Page Rank, Meta searches, Performance Evaluation of search engines using various measures, Introduction to search engine optimization.

Unit-V

Introduction to online IR Systems, Digital Library searches and web Personalization.

Recommended Books:

1. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, “Modern Information Retrieval” Pearson Education
2. C. Manning, P. Raghvan and H. Schutze, “Introduction to Information Retrieval”, Cambridge University Press.
3. Amy N. Langville and Carl D. Meyer, “Google’s PageRank and Beyond: The Science of Search Engine Rankings”, Princeton Universit Press
4. Pierre Baldi, Paolo Frasconi and PadhraicSmythe, “Modelling the internet and the web: Probabilistic methods and Algorithms”, John Wiley

List of Experiments:

Students must experiment on various information retrieval systems like page rank etc

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Departmental Elective CSIT 802 (D) Block Chain Technology

Objective:

To understand the concept of Blockchain and its platforms- Bitcoin, Ethereum, Hyperledger and Multichain. The course provides an overview of the structure and mechanism of Blockchain.

Course Outcomes: After Completing the course student should be able to:

1. Understand blockchain architecture and requisite crypto foundation.
2. Understand various consensus protocol and their usage for their specific application.
3. Understand and Resolve security concern in blockchain.
4. Explore blockchain advances and upcoming platforms.
5. Learn to write smart contracts.
6. Understand use cases.

Unit I

Introduction and crypto foundation: Elliptic curve cryptography, ECDSA, Cryptographic hash function, SHA-256, Merkle trees, Cryptocurrencies.

Unit II

Bitcoin, Bitcoin addresses, Bitcoin blockchain, block header, mining proof of work (PoW) algorithm, difficulty adjustment algorithm, mining pools, transactions, double spending attack, The 51% attacker, block format, transaction format, Smart contacts (escrow, micropayments, decentralized lotteries), payment channels.

Unit III

Ethereum: Overview of differences between Ethereum and bitcoin, block format, mining algorithm, proof-of-stake (PoS) algorithm, account management, contracts and transactions, Solidity language, decentralized application using Ethereum.

Unit IV

Smart Contracts Different Blockchains and Consensus mechanisms.

Unit V

Blockchain and Security R3, CORDA and Hyperledger System architecture, ledger format, chain code, transaction flow and ordering, private channels, membership service providers, case studies.

Recommended Books:

1. Mastering Bitcoin:Unblocking Digital Cryptocurrencies, by Andreas Antonopoulos.
2. Mastering Ethereum, Antonopoulos, Andreas M. and Wood, O'Reilly Media,Inc.,2018
3. An Introduction to Bitcoin, V. Saravanan, Lecture Notes.
4. Bitcoin and Cryptocurrencies Technologies: A Comprehensive Introduction, Arvind Narayanan, Princeton University Press(July 19,2016)ISBN-10:0691171696.

List of Experiments:

1. To Create a first block in blockchain
2. To encrypt a block using Sha 256 Encryption Algorithm
3. To Mine a Block in Blockchain
4. To authenticate a mined block using consensus algorithm'
5. To implement proof of work
6. To secure a block using encryption
7. To create a simple cryptocurrency
8. To write a smart contract in solidity

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Open Elective CSIT-803 (A) Digital Marketing and SEO

Objective:

Developing an overall understanding of digital marketing / online marketing platforms, mainly web analytics, social media tools, marketing through search engines, search engine optimization, mobile marketing, email marketing, Pay per click, digital display marketing, content marketing and Strategizing marketing.

Course Outcomes: After the completion of this course, the students will be able to

1. Understand the concept of digital marketing and its real-world iterations
2. Articulate innovative insights of digital marketing enabling a competitive edge
3. Understand how to create and run digital media based campaigns
4. Identify and utilize various tools such as social media etc.
5. Understand how to do SEO Audit

Unit-I

Digital Marketing: Introduction, Moving from Traditional to Digital Marketing, Integrating Traditional and Digital Marketing, Reasons for Growth. Need for a comprehensive Digital Marketing Strategy. Concepts: Search Engine Optimization (SEO); Concept of Pay Per Click

Unit-II

Social Media Marketing: Introduction, Process - Goals, Channels, Implementation, Analyze Tools: Google and the Search Engine, Facebook, Twitter, YouTube and LinkedIn, Issues: Credibility, Fake News, Paid Influencers, Social Media and Hate/ Phobic campaigns, Analytics and linkage with Social Media, The Social Community.

Unit-III

Email Marketing: Introduction, email marketing process, design and content, delivery, discovery. Mobile Marketing: Introduction and concept, Process of mobile marketing: goals, setup, monitor, analyze; Enhancing Digital Experiences with Mobile Apps. Pros and Cons; Targeted advertising. Issues: Data Collection, Privacy, Data Mining, Money and Apps, Security, Spam. Growth Areas.

Unit-IV

Managing Digital Marketing: Content Production; Video based marketing; Credibility and Digital Marketing; IoT; User Experience; Future of Digital Marketing.

Unit-V

SEO Analytics, Monitoring & Reporting : Google Search Console (GSC),Key Sections & Features of GSC; How to monitor SEO progress with Key Features of GSC: Overview, Performance, URLnspection, Coverage, Sitemaps, Speed, Mobile Usability, Backlinks, Referring Domains, Security & Manual Actions, How to do SEO Reporting

Recommended Books:

1. Dodson, Ian: The Art of Digital Marketing - The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaigns. Wiley
2. Ryan, Damien: Understanding Digital Marketing - Marketing Strategies for Engaging the Digital Generation. Kogan Page Limited.
3. Gupta, Sunil: Driving Digital Strategy. Harvard Business Review Press
4. Tuten, Tracy L. and Solomon, Michael R.: Social Media Marketing. Sage
5. Bhatia, Puneet S.: Fundamentals of Digital Marketing. Pearson
6. Kotler, Philip: Marketing 4.0: Moving from Traditional to Digital. Wiley

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Open Elective CSIT-803(B) Quantum Computing

Objective:

The objective of this course is to provide the students an introduction to quantum computation. Much of the background material related to the algebra of complex vector spaces and quantum mechanics is covered within the course.

Course Outcomes: After the completion of this course, the students will be able to:

1. Analyze the behavior of basic quantum algorithms Implement simple quantum algorithms and 2. Information channels in the quantum circuit model
3. Simulate a simple quantum error-correcting code
4. Prove basic facts about quantum information channels

Unit I

Introduction to quantum mechanics: Postulates of quantum mechanics, Qubit and quantum states, Vector Spaces, Single Qubit Gates, multiple Qubit Gates, Controlled Gates, Composite Gates, Matrices and operators.

Unit II

Density operators: Density Operator for a Pure State, Density Operator for a Mixed State,Properties of a Density Operator, Characterizing Mixed States, Completely Mixed States, Partial Trace and Reduced Density Operator.

Quantum measurement theory: Distinguishing Quantum States and Measurement,Projective Measurements, Measurements on Composite Systems, Generalized Measurements, Positive Operator Valued Measures.

Unit III

Entanglement: Quantum state entanglement, Bell's Theorem, The Pauli Representation, Using Bell States For Density Operator Representation, Quantum gates and circuits: Single Qubit Gates, The Z Y Decomposition, Basic Quantum Circuit Diagrams, Controlled Gates, Application of Entanglement in teleportation and supper dense coding., Distributed quantum communication

Quantum Computer: Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance**.**

Unit IV

Quantum Algorithm: Hadamard Gates, The Phase Gate, Matrix Representation of Serial and Parallel Operations, Quantum Interference, Quantum Parallelism and Function Evaluation, Deutsch -Jozsa Algorithm, Quantum Fourier Transform, Phase Estimation, Shor's Algorithm ,Quantum Searching and Grover's Algorithm

Unit V

Quantum Error Correction: Introduction, Shor code, Theory of Quantum Error Correction, Constructing Quantum Codes, Stabilizer codes, Fault Tolerant Quantum Computation, Entropy and information –Shannon Entropy, Basic properties of Entropy,Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource.

Recommended Books:

1. Quantum Computing Explained: David McMahon, Wiley Interscience (IEEE Computer Science).
2. Quantum Computing without Magic Devices : Zdzislaw Meglicki; PHI .
3. Quantum Computation and Quantum Information: M.A. Nielsen & Isaac L. Chuang, Cambridge University Press .
4. Quantum Computing and communications: An Engineering Approach: Sandor Imre and Ferenc Balazs, Wiley.

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Open Elective CSIT- 803 (C) Cyber Laws and Forensics

Objective

The objective of this course is to emphasize the importance of cyber laws and digital forensics, and to prepare students to conduct a digital investigation in an organized and systematic way.

Course Outcomes: After the completion of this course, the students will be able to:

1. Become aware of various cybercrimes and cyber laws
2. Underline the need of digital forensic and role of digital evidences
3. Understand different types of digital evidences that can be presented to support investigations
4. List the methods to generate legal evidence and supporting investigation reports
5. Use various digital forensic tools

Unit-I

Introduction to cybercrime, definition, cybercrime and information security, classification of cybercrimes, cybercrime: the legal perspectives, an Indian perspective, cybercrime and the Indian ITA 2000, a global perspective on cybercrime, Cyber offences: How criminals plan them, Tools and methods used in cybercrime, Need of cyber law, The Indian IT act, challenges to Indian law and cybercrime scenario in India, digital signature and Indian IT act,

Unit-II

Law and framework for information security, law for intellectual property rights (IPR), patent law, copy right law, Indian copyright act, privacy issue and law in Hong Kong, Japan, and Australia, data protection act in Europe, health insurance portability and accountability act of 1996(HIPAA), Gramm-leach-Bliley act of 1999(GLAB), Sarbanes-Oxley (SOX), legal issue in data mining.

Unit III

Digital forensics Science, The need for computer forensics, Understanding computer forensics, computer forensics versus other related disciplines, A brief History of computer Forensics, Cyber forensics and digital evidence, Digital forensics lifecycle, chain of custody concept, Network forensics, Approaching a computer forensics investigation, setting up a computer forensics laboratory, Forensics and social networking sites, computer forensics from compliance perspective, challenges in computer forensics, forensics auditing, anti-forensics.

Unit IV

Current Computer Forensics Tools, Evaluating Computer Forensics Tool Needs, Types of Computer Forensics Tools, Tasks Performed by Computer Forensics Tools, Tool Comparisons, Other Considerations for Tools, Computer Forensics Software Tools, Command-Line Forensic tools, UNIX/Linux Forensics Tools, Other GUI Forensics Tools, Computer Forensics Hardware Tools, Forensic Workstations

Unit V

Forensics of hand-held devices, Investigating Network Intrusions and Cyber Crime, Network Forensics and investigating logs, investigating network Traffic, Investigating Web attacks, Router Forensics. Cyber forensics tools and case studies

Recommended Books

1. The Indian Cyber law with Cyber glossary, Suresh T. Vishwanathan, New Delhi, Bhart Law House, 2000.
2. Law of Cyber Crimes and Information Technology Law, S.V. JogaRao, 2007.
3. Cory Altheide, Harlan Carvey, Digital Forensics with Open Source Tools, Syngress imprint of Elsevier.
4. Bill Nelson, Amelia Phillips, Christopher Steuart, "Guide to Computer Forensics and Investigations", Fourth Edition, Course Technology.
5. Angus M. Marshall, "Digital forensics: Digital evidence in criminal investigation", John –Wiley and Sons, 2008.
6. Nina Godbole and Sunit Belapure–Cyber Security, Wiley India Publication.

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Open Elective CSIT-803 (D) Robotics

Objective:

To understand the basic concepts associated with the design and functioning and applications of Robots. To study about the drives and sensors used in Robots. To learn about analyzing robot kinematics and robot programming

Course Outcomes: After the completion of this course, the students will be able to:

1. Learn about knowledge for the design of robotics.
2 Learn about force and torque sensing
3. Understand different sensors and vision of machine
4. Understand robot kinematics and robot programming
5. Apply basics on an application of Robots

Unit-I

Fundamentals of Robot: Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Functions – Need for Robots – Different Applications

Unit-II

Robot Drive Systems and End Effectors: Pneumatic Drives, Hydraulic Drives, Mechanical Drives, Electrical Drives, D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of Drives End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

Unit-III

Sensors and Machine Vision: Requirements of a sensor, Principles and Applications of the following types of sensors– Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors),Touch Sensors, (Binary Sensors, Analogue Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors. Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis –Data Reduction: Edge detection, Feature Extraction and Object Recognition -Algorithms. Applications– Inspection, Identification, Visual Serving and Navigation.

Unit-IV

Robot Kinematics and Robot Programming: Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs

Unit-V

Implementation and Robot Economics: RGV, AGV; Implementation of Robots in Industries – Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method.

Recommended Books:

1. M.P.Groover, "Industrial Robotics – Technology, Programming and Applications", McGraw- Hill, 2001.
2. Saha S. , Introduction to Robotics , TMH.
3. Ghoshal Ashitava, Robotics, Fundamental Concepts and Analysis, Oxford.
4. Yu Kozyhev, Industrial Robots Handbook, MIR Publications.