

Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

New Scheme Based On AICTE Flexible Curricula **Robotics and Mechatronics Engineering, VII- Semester**

RM 701	Computer Integrated Manufacturing	2L-1T-2P	4 Credits
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Course Outcomes:

After studying this course, students will be able to;

- Build up the concept of Automation, CIM, CAD, CAM
- Differentiate Production Planning and Control and Computerized Process Planning
- Solve problems related to Robot Accuracy and Repeatability.
- Prepare part programs for simple jobs on CNC machine tools and robot programming..
- Develop an FMS (Flexible Manufacturing System) layout for given simple part family, using group technology concepts and familiarize with computer aided process planning.

Syllabus:

Module 1: Introduction

CIM – definition, scope and elements of CIM system-benefits, Production system facilities – low-medium-high-Manufacturing support systems-Automation in production systems, Automated manufacturing systems-Computerized Manufacturing Support Systems-Reasons for Automating, Automation principles and strategies-USA Principle-Ten Strategies for Automation and Production Systems, Automation –definition- Basic elements of an automated system - Levels of automation.

Module 2: NC and CNC Machines

Fundamentals of NC Technology- Basic Components of an NC System- NC Coordinate Systems-Motion Control Systems, Applications of NC- Machine Tool Applications- Other NC Applications-Advantages and Disadvantages of NC, Computer Numerical Control Features of CNC- The Machine Control Unit for CNC- CNC Software, CNC Applications Advantages and Disadvantages of CNC, DNC- Direct Numerical Control- Distributed Numerical Control

Module 3: CNC Part Programming

Introduction to Part Programming-Coordinate system-Dimensioning-Axes & motion nomenclature Definition and importance of various positions like machine zero, home position, and work piece zero, CNC part programming- Structure of part programme-Word addressed format-Preparatory function(G)-Miscellaneous function(M)- Tool compensation Subroutines (Macros)(L)-Canned cycles-Mirror image, Simple program on Milling and Turning operations.

Module 4: Group Technology and CAPP

Group technology-Definition-Advantages and limitations of GT-Part family formation , Classification and coding-Opitz coding system, Applications & benefits of GT, Cellular manufacturing-Machining cell designs-Machining cell planning, Computer aided process planning-Approaches to CAPP-Implementation techniques-Essential elements in a retrieval type CAPP system-Essential elements in a generative CAPP system, Flexible manufacturing system-Scope of FMS-FMS compared to other types of manufacturing approaches-Types of FMS-Benefits of FMS-Major elements of FMS

Module 5: Automated Guided Vehicle System (AGVS) and Industrial Robotics

Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.

Robot Anatomy and Related Attributes – Classification of Robots- Robot Control systems – End Effectors – Sensors in Robotics – Robot Accuracy and Repeatability - Industrial Robot Applications – Robot Part Programming – Robot Accuracy and Repeatability – Simple Problems.

REFERENCES:

1. Mikell.P.Groover “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India, 2008.
2. Radhakrishnan P, Subramanyan S.and Raju V., “CAD/CAM/CIM”, 2nd Edition, New Age International (P) Ltd, New Delhi, 2000
3. S.Kant Vajpay; Principles of CIM; PHI
4. Rao PN; CAD/CAM;TMH
5. Rao PN, Tiwari NK, Kundra TK; Computer Aided Manufacturing; TMH
6. Alavudeen A, Venkateshwar N; Computer Integrated Mfg; PHI

List of Experiments (please expand it):

1. 2D and 3D modeling on CAD software
2. Use of CAM software for writing CNC programs
3. Study of automatic and semi automatic control system and writing the electrical analogy.

4. Production & layout for GT for group of jobs to be manufactured
5. A case study / tutorial using CAPP Software
6. Writing M & G codes for given operations.
7. Robot and AGV programming

LIST OF SOFTWARES/ LEARNING WEBSITES:

- i. <http://www.nptel.ac.in>
- ii. <http://www.youtube.com/watch?v=M3eX2PKM1RI>
- iii. <http://www.youtube.com/watch?v=EHQ4QIDqENI&list=PLBkqkLQO2nAt5MNL0>
- iv. <http://www.youtube.com/watch?v=hJFLcvtiNQ>
- v. <http://www.youtube.com/watch?v=BIM1AyxfYkw> .
- vi. <http://www.mtabindia.com> vii. <http://www.swansoftcncsimulator.com>

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New Scheme Based On AICTE Flexible Curricula Robotics and Mechatronics Engineering, VII- Semester

RM-702 (a)	Mechatronics and Manufacturing Automation	3L-1T-0P	4 Credits
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Course Objectives:

After studying this course, students will be able to;

- 1 Understand Industrial Automation and its Applications
- 2 Understand the mechatronic system, usage and advantages of mechatronics.
- 3 Comprehend the traditional Automation and mechatronic system
- 4 Understand the techniques of Fault finding in mechatronic system
- 5 Comprehend the Mechatronics system approach with case study

Module -1 Theory of Mechatronics Automation - definition - need, advantages and disadvantages of automation-Types of automation fixed, programmable and integrated automation-their advantage and disadvantage -basic elements of an automated system- future challenge of automation Mechatronics - Definition-advantages-Mechatronic system-mechanical, electrical, electronic and computer system-measurement system-sensor,signal conditioning and display system control system-Open loop and close loop system- advantages and disadvantages of open loop and closed loop system.

Module 2 Sensors and Transducers: Sensors and Transducers - Performance terminology- range and span -error - accuracy - sensitivity - hysteresis error - non linearity error - reproducibility - stability - dead band - resolution and output impedance. Displacement, position and proximity sensors - eddy current proximity sensors, inductive proximity sensors –proximity switches -micro switch ,reed switch, photo sensitive switch and mechanical switch- optical encoders- incremental and absolute encoders-tachogenerator- fluid pressure measurement devices - diaphragm, bellows and tube pressure sensors - liquid flow sensors - orifice plate, turbine meters -float sensors temperature sensors -bimetallic strips, resistance temperature detectors - thermistors - thermo couples- light sensors -photo diodes ,photo transistors and photo resistors - selection of sensors - inputting data by switches - mechanical switches - debouncing of mechanical switches

Module 3 Actuators: Actuation systems ,Pneumatic and Hydraulic System , Directional control valves-spool valve poppet valve - pilot operated valve -directional valve, Pressure control valves -pressure regulating valve -pressure limiting valve and pressure sequence valves. Cylinders. - Single acting and double acting -cylinder sequencing. Process control valve - diaphragm actuators - rotary actuators. Semi rotary actuators Electrical actuation systems: Electrical systems, mechanical switches, solid state switches - diodes -thyristors - triacs - bipolar transistors, solenoids .Basic principle , working principle of AC and DC motors, principle of working, and types of Stepper motors.

Module 4 Traditional Automation and Mechatronic system

Traditional Automation System, mechatronic system, Comparison, measurement system, elements of measurement system, elements of control system

Module 5 Application of Mechatronics systems and Fault finding: Fault finding - Fault detection techniques - common hardware faults. - Possible design solutions -Timed switch - bathroom scales.

REFERENCES

1. Bolton - Mechatronics - Pearson Third edition
2. R.K.Rajput - A textbook of mechatronics - Education asia.
3. A.K.Gupta, S.K.Arora - Industrial automation and mechatronics - Laxmipublication PVT Ltd.
4. Ganesh hedge - Mechatronics - Laxmi publication PVT Ltd.
- 5.Kushdeep Goyal & Deepak Bandari - Industrial Automation & Robotics-S.K.Kataria & sons
6. K.P.Ramachandran – Mechatronics – wiley India Pvt Ltd
7. E.K.VijayaraghavanMechatronics in Manufacturing System- John wiley and sons
8. R. Nagaraj- Microprocessor and Micro controller- Scitech Publications.
9. N. Shanmugam- Mechatronics- , Anuradha Publications D. S. Kumar, Satya Prakasan & Tech India Pub.

Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

New Scheme Based On AICTE Flexible Curricula

Robotics and Mechatronics Engineering, VII-Semester

RM-702 (b)	Totally Integrated Automation	3L-1T-0P	4 Credits
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Course Objectives: Automation is playing a key role in Industries. Industries rely heavily on automation for economic viability and mass production. It is important for the students to learn basic of automation, how system works and importance of PLC, SCADA and robots in automation. This course will provide opportunity to learn industrial automation techniques.

After learning the course , students will be able to:

- To gain knowledge in automation in industries.
- To gain knowledge in various electrical and electronic programmable automation and their applications.
- To know about the basics in SCADA and DCS systems.
- To gain knowledge in communication protocols in an integrated system
- To know about the advanced in automation industries

Syllabus

Module 1 Introduction

Need for Total integrated Automation (TIA) , TIA Architecture ,Components of TIA systems, Selection of TIA , Components, Programmable Automation Controllers (PAC), Vertical Integration structure

Module 2: Supervisory Control and Data Acquisition (SCADA): Overview, Developer and runtime packages, Architecture, Tools, Tags, Graphics. Alarm logging , Tag logging, Trends .History , Report generation, VB & C Scripts for SCADA application.

Module 3: Communication Protocols of SCADA

Proprietary and open Protocols, OLE/OPC, DDE, Server/Client Configuration, Messaging , User administration – Interfacing of SCADA with PLC, drive, and another field device.

Module 4: Industrial Plant Design

Design criteria – Process sequencing - Plant layout modeling – Selection of industrial power and automation cables, Overview of plant simulation software.

Module 5: Case Studies:

Case studies of Machine automation, Process automation

REFERENCE BOOKS:

1. Industrial Instrumentation and Control By. S.K. Singh The McGraw Hill Companies.
2. Process Control Instrumentation Technology By. C.D. Johnson, PHI.
3. Industrial control handbook, Parr, Newnem.
4. David Bailey, Edwin Bright, —Practical SCADA for industry, Newnes, Burlington, 2003.
5. Gordon Clarke, Deon Reyneders, Edwin Wright, —Practical Modern SCADA Protocols: DNP3, 60870.5 and Related systems, Newnes Publishing, 2004
6. William T Shaw, —Cybersecurity for SCADA systems, PennWell, 2006.
7. Stuart G McCrady, —Designing SCADA Application Software, Elsevier, 2013.
8. SIMATIC STEP 7 in the Totally Integrated Automation Portal, SIEMENS AG, 2012.

Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

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RM-702 (c)	Programming for Robot Operating System	3L-1T-0P	4 Credits
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This course gives an introduction to the Robot Operating System (ROS) including many of the available tools that are commonly used in robotics as well as programming for ROS.. With the help of different examples, the course will provide a good starting point for students to work with robots. They learn how to create software including simulation, to interface sensors and actuators, and to integrate control algorithms

Course Outcomes :

After studying this course, students will be able to;

1. learn about ROS architecture: Master, nodes, topics, messages, services, parameters and actions
2. Console commands: Navigating and analyzing the ROS system and the catkin workspace
3. Create ROS packages: Structure, launch-files, and best practices
4. Create ROS C++ client library (roscpp).also Create own ROS C++ programs
5. Perform simulation with ROS: Gazebo simulator, robot models (URDF) and simulation environments (SDF)

Module 1: ROS Architecture & Philosophy

ROS master, nodes, Console commands, Catkin workspace and build system ,Launch-files, Gazebo simulator, Programming Tools

Module 2: ROS Package Structure

Integration and programming with Eclipse, ROS C++ client library (roscpp) , ROS subscribers and publishers . ROS parameter server.RViz visualization

Module 3: Simulating with RO System

TF Transformation System , RQT User Interface , Robot models (URDF) , Simulation descriptions (SDF). Gazebo simulator.

Module 4: ROS services

ROS actions (actionlib) , ROS time, ROS bags, Debugging strategies, Introduction to ROS2

Module 5: Case Study:

Using ROS in complex real-world applications

References:

1. Programming Robots with ROS" by Morgan Quigley, Brian Gerkey & William Smart.
2. Introduction to Robotics" by John Craig

Useful Websites:

D. Jud, M. Wermelinger, M. Hutter, Programming for Robotics - Introduction to ROS,
<https://rsl.ethz.ch/education-students/lectures.html>

<http://web.ics.purdue.edu/~rvoyles/Classes/ROSprogramming/index.html>

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RM-703 (a)	Entrepreneurship Development	3L-0T-0P	3 Credits
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Course Outcomes:

After studying this course, students will be able ;

1. To understand the basics of Entrepreneurship concepts
2. To have concepts of need, want and demand as well as to know about marketing environment, CRM and market research
3. To compare TQM ,QFD and six sigma
4. To understand the fundamentals of plant economics
5. To compare theories of entrepreneur

Syllabus

Module 1: Entrepreneurship Fundamentals

Entrepreneur: Concept, Characteristics, Types of Entrepreneurs, Difference between Entrepreneur and Intrapreneur, Functions of Entrepreneur / Start up, Obstacle in entrepreneurship

Module 2 : Marketing:

Importance, definition, core concepts of need want and demand, exchange & relationships, product value, cost and satisfaction (goods and services) marketing environment; selling, marketing and societal marketing concepts; four P's, product, price, placement, promotion; consumer, business and industrial market, market targeting, advertising, publicity, CRM and market research. Finance: Nature and scope, forms of business ownerships, balance sheet, profit and loss account, fund flow and cash flow statements, breakeven point (BEP) and financial ratio analysis

Module 3 : Productivity and Operations;

Productivity, standard of living and happiness, types of productivity, operations (goods and services) Vs project management, production processes and layouts, steps in method improvement, time measurement, rating and various allowances; standard time and its utility, predetermined motion and time method, product and process specification, TQM, cost of quality, introduction to lean manufacturing (JIT), QFD, TPM & six sigma quality.

Module 4 : Plant Economics:

Interaction between design and cost equations for optimal design of equipments, inflation, energy conservation and environmental control, economic design criteria, terms involved in profitability analysis, Gross income, depreciation, net profit.

Module 5 : Theories of Entrepreneur:

Definition and concepts, characteristics, comparison with manager, classification, theories of entrepreneur, socio, economic, cultural and psychological; entrepreneur traits and behavior, roles in economic growth, employment, social stability, export promotion and indigenization, creating a venture, opportunity analysis competitive and technical factors, sources of funds, entrepreneur development program.

REFERENCES:

1. Peter MS, Timmerhaus KD; Plant design and economics for chemical engr; TMH
2. Schwery HE; Process engg economics; TMH
3. Daft R; The new era of management; Cengage
4. . Bhat Anil, Arya kumar; Management: Principles ,Processes Practices; Oxford H E
5. Khan, Jain; Financial Management;
6. Mohanty SK; Fundamental of Entrepreneurship; PHI.
7. Kuratko, Hoolgetts; Entrepreneurship; Theory Process practice; Cengage.

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New Scheme Based On AICTE Flexible Curricula **Robotics and Mechatronics Engineering, VII-Semester**

RM-703 (b)	Industry 4.0	3L-0T-0P	3 Credits
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Course Objectives:

- To impart basic idea in Industry 4.0.
- To provide students with good depth of knowledge of designing Industrial 4.0 Systems for various application.
- Learn the design and analysis of Industry 4.0 systems for Energy and smart vehicular applications.

Syllabus:

UNIT 1 Introduction to Industry 4.0

Introduction, Historical Context, General framework, Application areas, Dissemination of Industry 4.0 and the disciplines that contribute to its development, Artificial intelligence, The Internet of Things and Industrial Internet of Things, Additive manufacturing, Robotization and automation, Comparison of Industry 4.0 Factory and today's Factory, Current situation of Industry 4.0. Introduction to Industry 4.0 to Industry 5.0 Advances

UNIT 2 Industry 4.0 and Cyber Physical System

Introduction to Cyber Physical Systems (CPS), Architecture of CPS- Components, Data science and technology for CPS, Emerging applications in CPS in different fields. Case study: Application of CPS in health care domain.

UNIT 3 Smart Energy Sources

Energy Storage for Mitigating the Variability of Renewable Electricity Sources-Types of electric energy storage, Potential of Sodium-Sulfur Battery Energy Storage to Enable Integration of Wind-Case study. Electric Vehicles as Energy Storage: V2G Capacity Estimation.

UNIT 4. New Business Models

How CPS can induce new Business Models, The Role of horizontal and vertical value streams .New Business Models for the Smart Factory. Characteristics of Business Models within the Smart Factory. Examples of new Business Models - Business Model: Service provider - Business Model: Data provider Business Model: Technology provider - Business Model: Platform provider

UNIT 5 Smart Applications

Understanding Smart Appliances -Smart Operation-Smart Monitoring-Smart Energy Savings-Smart Maintenance, Case study-Smart Cars, Self-Driving Cars, Introducing Google's Self-Driving Car, Intellectual Property Rights.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the basic concepts of Industry 4.0 and the other related fields.

CO2 – Understand cyber physical system and the emerging applications.

CO3 - Analyze the different new business models

CO4 – Implement the industry 4.0 to solve engineering problems.

CO5 – Design of smart vehicle and analyze its performance..

TEXT / REFERENCE BOOKS

1.Jean-Claude André, —Industry 4.0, Wiley- ISTE, July 2019, ISBN: 781786304827,2019.

2. Diego Galar Pascual, Pasquale Daponte, Uday Kumar, —Handbook of Industry 4.0 and SMART Systems, Taylor and Francis,2020

3. Miller M, —The internet of things: How smart TVs, smart cars, smart homes, and smart cities are changing the world, Pearson Education, 2015, ISBN: 9780134021300.

4. Pengwei Du and Ning Lu, —Energy storage for smart grids: planning and operation for renewable and variable energy resources VEs, Academic Press, 2018, Reprint edition, ISBN-13:978-0128100714

5.Hossam A. Gabbar, —Smart Energy Grid Engineering, Academic Press, 2017, ISBN 978- 0-12-805343-0.

6.Mini S. Thomas, John Douglas McDonald, —Power System SCADA and Smart Grids, CRC Press, 2017.

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RM-703 (c)	Data Science using R Programming	3L-0T-0P	3 Credits
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Course Objectives:

In this course, students will learn how to program in R and how to use R for effective data analysis and visualization.

Course Outcomes:

By the end of the course students shall be confident and equipped with all the knowledge required to perform analytical activities in R. Specifically,

- Understand the fundamental syntax of R through readings, practice exercises, demonstrations, and writing R code.
- Apply critical programming language concepts such as data types, iteration, control structures, functions, and boolean operators by writing R programs and through examples
 - Import a variety of data formats into R using RStudio
- Prepare or tidy data for in preparation for analysis
- Query data using SQL and R
- Analyze a data set in R and present findings using the appropriate R packages
- Visualize data attributes using ggplot2 and other R packages.

Module: 1: R Introduction

Overview of R Programming, Downloading and installing, Help of Function, Viewing documentation, General issues in R, Package Management

Module: 2 Data Inputting in R and Data Visualization

Data Types, Subsetting, Writing data, Reading from csv files, Creating a vector and vector operation, Initializing data frame, Control structure, Re-directing R Output

Data Visualization; Creating bar chart and dot plot, Creating histogram and box plot, Plotting with base graphics, Plotting and coloring in R

Module: 3 Basic Statistics, Functions and Programming in R

Computing Basic Statistics, Measures of central tendency , Measures of variability , Skewness and kurtosis , Summary functions, describe functions, and descriptive statistics by group , Correlations, Comparing means of two samples, Testing a proportion, Data Munging Basics

Functions and Programming in R ; Flow control: For loop, If condition, Debugging tools

Module: 4 Data manipulation in R

List Management, Data Transformation, Merging Data Frames, Outlier Detection, Combining multiple vectors

Module: 5 R an Database and Statistical Modelling in R

Performing queries, RODBC and DBI Package, Advanced Data handling, Combined and restructuring data frames

Statistical Modelling in R; Logical Regression, Hierarchical Clustering PCA for Dimensionality Reduction

REFERENCES:

1. Wickham, H. & Golemund, G. (2018). for Data Science. O'Reilly: New York. Available for free at <http://r4ds.had.co.nz>

Required software

- R: <http://www.r-project.org/> (FREE)
- RStudio (additional libraries required): <http://www.rstudio.com/> (FREE)

Learning resources

- R Project: <http://www.r-project.org/>
- RStudio (additional libraries required): <http://www.rstudio.com>
- Quick-R <http://www.statmethods.net/>
- Google's R Style Guide [http://google-styleguide.googlecode.com/svn/trunk/ Rguide.xml](http://google-styleguide.googlecode.com/svn/trunk/Rguide.xml)
Academic honor code

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New Scheme Based On AICTE Flexible Curricula **Robotics and Mechatronics Engineering, VII-Semester**

RM-704	Mechatronics Laboratory	0L-0T-6P	3 Credits
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Course Objectives: To know the method of programming the microprocessor and also the design, modeling & analysis of basic electrical, hydraulic & pneumatic systems, which enable the students to understand the concept of mechatronics.

Course Outcomes:

On successful completion of the course, the student will be able to

1. Describe and demonstrate Mechatronics systems and overview of control systems & actuators. M
2. Distinguish between various sensors, transducers and actuators and their applications.
3. Understand the basic concept of microprocessor and perform simple operations on it.
4. Identify various signal conditioning units, amplifiers, logic gates and their role in programmable logic controllers
5. Determine various signal conditioning units, amplifiers, logic gates and their role in programmable logic controllers

Suggested List of Experiments

1. Assembly language programming of 8085 – Addition – Subtraction – Multiplication – Division – Sorting Code Conversion.
2. Stepper motor interface.
3. Traffic light interface.
4. Speed control of DC motor.
5. Study of various types of transducers.
6. Study of hydraulic, pneumatic and electro-pneumatic circuits.
7. Modeling and analysis of basic hydraulic, pneumatic and electrical circuits using software.
8. Study of PLC and its applications.
9. Study of image processing technique.

Major Apparatus required in Lab:

1. 8085 Microprocessor
2. Analog-Digital Training Kit
3. PLC based Pneumatic Trainer
4. Electro hydraulic trainer

5. DC Motor
6. Stepper Motor
7. Various types of Transducers

Evaluation: Evaluation will be continuous and integral part of the class as well as through external assessment (Viva/voce)

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New Scheme Based On AICTE Flexible Curricula **Robotics and Mechatronics Engineering, VII-Semester**

RM-705	MATLAB and R Programming	0L-0T-6P	3 Credits
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The purpose of this laboratory is to provide the knowledge of latest research tools/techniques such as MATLAB and R Programming which is being used in finding out the solution of most of the engineering problems. MATLAB is a multi-paradigm numerical computing environment and proprietary programming language developed by MathWorks. MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages.

Suggested List of Experiments: (Atleast 10 Experiments)

R Programming:

1. Study of basic Syntaxes in R
2. Implementation of vector data objects operations
3. Implementation of matrix, array and factors and perform va in R
4. Implementation and use of data frames in R
5. Create Sample (Dummy) Data in R and perform data manipulation with R
6. Study and implementation of various control structures in R
7. Data Manipulation with dplyr package
8. Data Manipulation with data.table package
9. Study and implementation of Data Visualization with gg plot2
10. Study and implementation data transpose operations in R

MATLAB Programs:

Following are the suggested list of experiments related to MATLAB (Pl expand)

1. Introduction to MATLAB
2. Working with matrices
3. Rational and logical operation of MATLAB
4. Creating a plot using Plot function
5. Complex and statistical functions (e.g.: Produce ten elements vector of random complex numbers and find the summation of this vector)
6. Numbers and strings (1. Write a program in M-File to read 3 x 3 Matrix, then display the diagonal of matrix as shown below: The Diagonal of This Matrix = []

2. Write a program to read a string, then replace each character in the string with its following character in ASCII code*.)

7. Write a function that will receive as an input argument a temperature in degrees Fahrenheit, and will return the temperature in both degrees Celsius and Kelvin. The conversion factors are $C = (F - 32) * 5/9$ and $K = C + 273.15$. Write a script to use the developed function

8. Write a script that will: a. Call a function to prompt the user for an angle in degrees. b. Call a function to calculate and return the angle in radians. c. Call a function to print the result. Write all of the functions as well. Note that the solution to this problem involves four M-files: one which acts as a main program (the script shown below), and three for the functions.

9. Write a program to print a length conversion chart. It will print lengths in feet, from 1 to an integer specified by the user, in one column and the corresponding length in meters (1 foot = 0.3048 m) in a second column. The main script will call one function that prompts the user for the maximum length in feet; this function must error-check to make sure that the user enters a valid positive integer. The script then calls a function to write the lengths to the screen.

Evaluation: Evaluation will be continuous and integral part of the class as well as through external assessment (Viva/voce)

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New Scheme Based On AICTE Flexible Curricula **Robotics and Mechatronics Engineering, VII-Semester**

RM-706	Major Project -I	0L-0T-8P	4 Credits
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Objectives of the course Major Project I:

- To provide students with a comprehensive experience for applying the knowledge gained so far by studying various courses.
- To develop an inquiring aptitude and build confidence among students by working on solutions of small industrial problems.
- To give students an opportunity to do some thing creative and to assimilate real life work situation in institution.
- To adapt students for latest development and to handle independently new situations.
- To develop good expressions power and presentation abilities in students.

The focus of the Major Project I is on preparing a working system or some design or understanding of a complex system using system analysis tools and submit it the same in the form of a write up i.e. detail project report. The student should select some real life problems for their project and maintain proper documentation of different stages of project such as need analysis market analysis, concept evaluation, requirement specification, objectives, work plan, analysis, design, implementation and test plan. Each student is required to prepare a project report and present the same at the final examination with a demonstration of the working system (if any)

Working schedule:

The faculty and students should work according to following schedule: Each student undertakes substantial and individual project in an approved area of the subject and supervised by a faculty of the department. In special case, if project is huge, then maximum 03 students may be permitted to work together as a team to do the same. The student must submit outline and action plan for the project execution (time schedule) and the same be approved by the concerned faculty and Head of department.

Project guide should motivate students to develop some Innovative working models in the emerging area Robotics and Automation, Advanced Automotives, Aero modelling, Renewable Energy based systems, Mechatronics, Robotic systems, Advanced Manufacturing Technology based systems etc. which can contribute to the society.

Evaluation: There will be both external and internal evaluation of project carried out by each student.

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New Scheme Based On AICTE Flexible Curricula **Robotics and Mechatronics Engineering, VII-Semester**

RM-707	Internship- III	0L-0T-6P	3 Credits
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Evaluation:

Internal Evaluation will be done on the basis of Internship/industrial training (real time) carried out in industry/research center. Preference should be given to Public sectors, Govt and reputed Limited companies/research organizations. A detailed report may be submitted in the department after successful completion of internship.
