Syllabus & Scheme

(First Semester)

for

M.Voc. (Robotics & Automation)

Industry Partner-JBM

Teaching Scheme for First Semester

Code	Subjects	Credits			Marks							Hrs per course		
					Th.			Pr.			Total	Total		
		Th.	Pr.	Total	Int.	Ext.	Total	Int.	Ext.	Total		Th.	Pr.	THr.
GEC	Advanced Electrical & Electronics Engg'	3	-	3	15	35	50	-	-	-	50	45	-	45
GEC	Industrial Management	3	-	3	30	70	100	-	-	-	100	45	-	45
GEC	Research Methodology	4	-	4	30	70	100	-	-	-	100	60	-	60
GEC	Drives and Control System For Automation	3	-	3	30	70	100	-	-	-	100	45	-	45
GEC	Advanced Communication Skills and Computing	3	-	3	15	35	50	-	-	-	50	45	-	45
GEC Lab	Advance Electrical & Electronics Engg' Lab	-	2	2	-	-	-	35	15	50	50	-	60	60
GEC Lab	Advanced Communication Skills and Computing Lab	-	2	2	-	-	-	35	15	50	50	-	60	60
GEC Total		**16**	**4**	**20**	**120**	**280**	**400**	**70**	**30**	**100**	**500**	**240**	**120**	**360**
SEC	Basics of Robotics	3	-	3	15	35	50	-	-	-	50	45	-	45
SEC	Basics of Automation	3	-	3	15	35	50	-	-	-	50	45	-	45
SEC Lab	Basics of Robotics Lab	-	2	2	-	-	-	35	15	50	50	-	60	60
SEC Lab	Basics of Automation Lab	-	2	2	-	-	-	35	15	50	50	-	60	60
SEC Lab	MATLAB	-	2	2	-	-	-	70	30	100	100	-	60	60
SEC Total		**6**	**6**	**12**	**30**	**70**	**100**	**140**	**60**	**200**	**300**	**90**	**180**	**270**
Grand Total		**22**	**10**	**32**	**150**	**350**	**500**	**210**	**90**	**300**	**800**	**330**	**300**	**630**

Advanced Electrical & Electronics Engineering

Code:			Theory:	50
T	P	C	Practical:	50
3	2	5	Max. Marks:	100

Objective:

- To impart knowledge of various types of motors used in industries.
- To understand about Special purpose machines used in industries.
- To understand the various types of power controlled devices such as choppers,thristors,cycloconverters

Learning Outcome: The student will be able:

- To understand working principles of various types of motors, differences, characteristics and selection criteria.
- To apply the knowledge in selection of motors, heating effects and braking concepts in various industrial applications
- To explain control methods of various motors
- To elucidate various Thyristors, choppers and cycloconverters principles and methods and use the same to application areas

Unit I: Induction Motors: Construction – Types – Principle of operation of three phase induction motors – Speed Torque characteristics - Equivalent circuit - Starting and Speed control – Single-phase induction motors (only qualitative analysis). - Introduction to Linear induction motor – PMSIM – Applications.

Unit II: SYNCHRONOUS AND SPECIAL PURPOSE MACHINES: Construction of Synchronous machines - Types – Induced emf – Working principles of: Brushless alternators – Stepper motor - Servomotor – Universal motor -. Applications – rating and duty cycle -Sizing of Motor for an Industrial application.

Unit III: Thyristor and their characteristics: Introduction to thyristor family V-I characteristics of SCR, GTO, LASCR, DIAC and TRIAC. Principle of operation of SCR. Two transistor analogy. Turn on methods of a thyristor Switching characteristics of thyristor during turn-on and turn-off. Gate characteristics. Firing of thyristor. Gate triggering circuits. Series and parallel, operation of SCRs and their triggering circuits.

Unit IV: Choppers: Introduction and principle of chopper operations. Control strategies, two quadrant chopper, Four quadrant chopper. Regenerative chopper. Steady state time domain analysis of type A-chopper, voltage commutated chopper or classical Jones chopper.

Unit V: Cycloconverter: Basic circuit and operation of single phase cyclo converter. Single phase bridge cyclo converter. Three phase to single phase to single phase cyclo converter. Advantages disadvantages of cyclo converters .

Text Book

1.P.S. Bimbhra, **Power Electronics**, Khanna Publishers.
2. M.D. Singh, K.B. Khanchandani, **Power Electronics**, Tata Mc Graw Hill Publishing company limited.
3. M.H. Rashid, **Power Electronics**, PHI
4. VKMehta and Rohit Mehta, ―Principles of Power System‖, S.Chand and Company Ltd, 2003

Reference Book

1. P.C. Sen**, Power Electronics**, Tata Mc Graw Hill Publishing company limited
2. K Murugesh Kumar, ―Induction and Synchronous machines‖, Vikas Publishing House Pvt Ltd, 2010

Experiments

1. To study principle of operation of SCR, plot V-I characteristics and study the effect of gate triggering on turning on of SCR.
2. To draw V-I characteristics of an UJT and to use UJT as relaxation oscillator.
3. Thyristorised speed control of a D.C. Motor.
4. Speed Control of induction motor using thyristor.
5. To study speed Torque characteristics of A.C. servo motor
6. To study speed Torque characteristics of DC servo motor.
7. To study a stepper motor & to execute microprocessor or computer-based control of the same by changing number of steps, direction of rotation & speed

Industrial Management

Code: **Theory: 100**

T	P	C
3	0	3

Max. Marks: 100

Objectives

- Train students about quality assurance programmes implemented in industries.
- To examine the latest business practices crucial for running successful business.

Learning Outcome

- The course will provide a conceptual framework of handling the diverse and complex problems in business and industries. It will help in addressing and solving the real life problems relating to industrial setups.

Unit 1

Introduction: Concept, Development, Application and scope of Industrial Management, Productivity: Definition, Measurement, Types of production system.

Unit 2

Management Function: Principle of Management – Time and motion study, Work simplification – process charts and flow diagrams, Production Planning.

Unit 3

Strategy: Mintzberg's 5P's of strategy – Corporate, Business and Functional Levels of strategy, Preparing an Environmental Threat and Opportunity Profile (ETOP),

Unit 4

Porter's Five Forces Model of competition:Quality Control: Process control, SQC, Control charts, Introduction to TQM, Kaizen, Five S (5S), Introduction to Supply Chain Management, Warehouse Management, Lean Supply Chain Management of an Automotive Industry, Total Productive Maintenance

Unit 5

Six Sigma Quality Management Standards (Introductory aspects only), The ISO 9001:2000 Quality Management System Standard, The ISO 14001:2004 Environmental Management System Standard, ISO 27001:2005 Information Security Management System, JIT.

Suggested Readings

- P. Khanna, "Industrial Engineering and Management", Dhanpatrai publications Ltd, New
- L.C.Jhamb , Savitri Jhamb , Industrial Management – I , Everest Publishing House .
- K.Shridhara Bhat, "Materials and Logistics Management", Himalaya Publishing House.
- Azar Kazmi , "Strategic Management & Business Policy ", Tata McGraw Hill, New Delhi
- Ravi M. Kishore, "Project Management", Tata McGraw Hill, New Delhi

Research Methodology

Code: **Theory: 100**

T	P	C
4	0	4

Max. Marks: 100

Objectives:

- To import the knowledge on analysis of Research methodology.
- The students will be able to estimate the performance of different testing method for research.

Learning Outcomes:

- The Students will be able to analysis the methods used for data collection hypothesis testing and sampling process for research methodology

Unit I Introduction: Definition, mathematical tools for analysis, Types of research, exploratory research, conclusive research, modelling research, algorithmic research, Research process- steps. Data collection methods- Primary data – observation method, personal interview, telephonic interview, mail survey, questionnaire design. Secondary data- internal sources of data, external sources of data.

Unit II Sampling Methods Scales: Measurement, Types of scale – Thurston's Case V scale model, Osgood's Semantic Differential scale, Likert scale, Q- sort scale. Sampling methods- Probability sampling methods – simple random sampling with replacement, simple random sampling without replacement, stratified sampling, cluster sampling. Non-probability sampling method – convenience sampling, judgment sampling, quota sampling.

Unit III Hypotheses Testing: Testing of hypotheses concerning means -one mean and difference between two means - one tailed and two tailed tests, concerning variance – one tailed Chi-square test.

Unit IV Design of Experiments: Introduction, Types - Full and Fractional Factorial Design- Orthogonal Array Design - Taguchi techniques - Regression Models - Response Surface Methods

Unit V Optimization and Report Writing Optimization: Classification- methods- genetic, particle swarm and artificial bee colony algorithms. Report writing- Types of report, guidelines to review report and typing instructions - oral presentation. 9 Hours Unit VI$ Application Apply Research Methodology principles into design and manufacturing field.

Text Books

1. 1. C.R. Kothari, Research Methodology –Methods and techniques, New Age Publications, New Delhi, 2009.
2. R. Panneerselvam, Research Methodology, Prentice-Hall of India, New Delhi, 2004.
3. K. Deb, Optimization for Engineering Design Algorithms and Examples, Prentice Hall of India Pvt. 2010.

Reference Books

1. Ashok D. Belegundu, R. Tirupathi and Chandrupatla, Optimization Concepts and Applications in Engineering, Pearson Education, 2014.
2. R. PanneerSelvam, Design and Analysis of Experiments, Prentice Hall India Learning Private Limited, 2012.
3. http://nptel.ac.in/courses/11110503

Drives and Control System for Automation

Code: **Theory: 100**

T	P	C
3	0	3

Max. Marks: 100

Objective:

- To impart knowledge of various control drives for motors used in industries.
- To understand about Programmable Logic Controller(PLC) and its instructions.
- To understand the various logics used in programming a PLC.

Learning Outcome: The student will be able:

- To understand working principles of various types of motors, differences, characteristics and selection criteria.
- To apply the knowledge in selection of motors, heating effects and braking concepts in various industrial applications
- To explain control methods of special drives
- To elucidate various linear and rotary motion principles and methods and use the same to application areas
- To carry out programming using PLC and use of various PLCs to Automation problems in industries.

Unit I Introduction: Working principle of synchronous, Asynchronous & stepper motors, Difference between Induction and servo motors, Torque v/s speed characteristics, Power v/s. Speed characteristics, Vector duty induction motors, Selection of feedback system, Duty cycle, V/F control, Flux Vector control. (SLE: Current control (sensor less vector control)

Unit II Industrials Drives: DC and AC motors operation and selection, method of control and application of brushless DC motor, PMSM, stepper motor, A.C servomotor, selection criteria for servo motor and servo amplifier, universal motor, electric drive, types of industrial drives, the characteristics of drive, advantages of drives over other prime movers, motor rating, heating effects, electric braking, rheostat and regenerative braking principles in power converters.

Unit III Motion laws for rotary and linear systems: Converting rotary to linear system, concepts and principles of ball screws, rack and pinion, belt and pulley, chain drives, gear drives, Selection of converting systems, Dynamic response gearing, and control approaches of Robots, Control loops using Current amplifier.

Unit IV Introduction to Programmable Logic Controllers: Definitions of PLC, basic structure of PLC, working principles, data storage methods, inputs / outputs flag processing's, types of variables, definition of firmware, software, programming software tool and interfacing with PC (RS232 & TCP-IP), methods of PLC programming (LD, ST, FBD & SFC), difference between relay logic and PLC,Communication Protocols:-CC Link /Profinet/Ethernet/Controlnet/Devicenet/Profibus.

Unit V Logic, instructions & Application of PLC: What is logic, Conventional Ladder v/s PLC ladder, series and parallel function of OR, AND, NOT logic, Ex Or logic, Analysis of rung. Timer and Counter Instructions; on delay and Off delay and retentive timer instructions, PLC counter up and down instructions, combining counters and timers, Comparison and data handling instructions, Sequencer instruction, Visualization Systems, Types of visualization system, PC based Controller.

Text Books:

1.Process Control Instrumentation Technology, Johnson Curties, Prentice hall of India, 8th edition
2.Andrew Parr, Industrial drives, Butterworth – Heineamann
3.G.K.Dubey.Fundamentals of electrical drives
4.Programmable Logic Controllers by W.Bolton

References:

1.Introduction to Programmable Logic Controllers by Garry Dunning, 2nd edition, Thomson, ISBN:981-240-625-5
2.Instrumentation Engineers Hand Book - Process Control, Bela G Liptak, Chilton book company, Pennsylvania
3.A.E. Fitzerald ,C.Kingsley and S.D Umans, Electric Machinery - McGraw Hill Int. Student edition
4.S.K.Pillai. A First course on electric drives –Wiley Eastern 1990
5.Programmable Logic Controllers by Hugh Jack.

Advanced Communication Skills and Computing

Code:
T P C
3 2 5

Theory: 50
Practical: 50
Max. Marks: 100

Objectives:

- To inculcate in students professional and ethical attitude, effective communication skills, teamwork, skills, multidisciplinary approach and an ability to understand engineer's social responsibilities.
- To inculcate in students written communication skills.
- To inculcate in student's basic information and communication technology and proper paradigms that needs to be implemented to develop any kind of computer applications. The course will help in developing the basic technical skills by hands on experience

Learning Outcomes:

- The syllabus introduces students to have advanced skill set of channelizing information, self-development, decision making and interpersonal skills.
- Students will be able to the use the computer for MS Office, viewing information on Internet, sending mails, using internet banking services etc.

Unit I
Business Writing: Writing applications- for Business (e.g. applying for a Loan, Salary advance, Refund etc.); Job application, Leave applications, - Customer Care/Customers Relations - Public Relations (Concept, Principles, Do's and Don'ts etc.); Sentence Structure and Length - Paragraph Structure and Length - Final Draft

Unit II
Group Discussions - Conflict and Negotiations - Presentation and Interviews, framing questions and answers- Practice Sessions on current topics using Mock Discussions, Notices, Agenda, Minutes, Handbooks, Manual; Digital Literacy: Copyright, Trademark & patents.

Unit **III**
Introduction to MS-Office: Introduction to Word, Excel, Power Point, Project & Outlook, Electronic Spreadsheets, Feature of MS-Excel, Entering Data, Entering Series, Editing Data, Cell Referencing, Ranges,Graphical Reperesentation of Data.

Unit IV
Functions &Formulae: Date and time Functions, Auto sum, Copying Formula, Formatting Data, Creating Charts, formatting charts, Creating Database, Sorting Data, Filtering, etc. Pivot Table, Picot Chart, Coding of Data in Excel, Statistical functions (countif, countblank, rank), Text functions (left, right, mid, trim, concatenate), Financial functions (pv, fv, pmt), Lookup functions (hlookup, vlookup), Two level nested functions.

Unit V- Analysis: Using Tables, Create, modify a pivot table/data pilot, Filter, Sort data in a pivot table/data pilot, use one-input, two-input data tables/multiple operations tables; Sorting and filtering: Sort data by multiple columns at same time, create a customized list and perform a custom sort, macros**,** Customer feedback analysis using Google Doc.

Text Book
1.Word Processing and Typing by Sharon Spencer, Heinemann.
2.MS Office by S.S. Srivastava, Firewall Media.
3.Microsoft Office 2010 by Bittu Kumar, V & S Publications
4.Sen, Leena. Communication Skills, Prentice Hall of India, New Delhi.
5.Prasad, P. Communication Skills, S.K. Kataria& Sons.
6.Bansal, R.K. and J.B. Harrison. Spoken English, Orient Language.

Basics of Robotics

Code:
T P C
3 2 5

Theory: 50
Practical: 50
Max. Marks: 100

Objectives:

- To impart knowledge on direct and inverse kinematics of manipulator
- To understand the basic elements of serial and parallel robots
- To learn trajectory and motion analysis of robotic movements

Learning Outcomes:

- Understanding of serial and parallel robots
- Trajectory planning of robot motion
- Knowing the controlling aspects of a robot.

Unit-I

Introduction: Introduction, position and orientation of objects, objects coordinate frame Rotation matrix, Euler angles Roll, pitch and yaw angles coordinate Transformations, Joint variables and position of end effector, Dot and cross products, coordinate frames, Rotations, Homogeneous coordinates.

Unit-II

Direct Kinematics: Link coordinates D-H Representation, The ARM equation. Direct kinematic analysis for Four axis, SCARA Robot and three, five and six axis Articulated Robots.

Unit-III

Inverse Kinematics: The inverse kinematics problem, General properties of solutions. Tool configuration, Inverse kinematics of four axis SCARA robot and three and five axis, articulated robot.

Unit-IV

Workspace Analysis and Trajectory Planning: Workspace Analysis, work envelope of a Four axis SCARA robot and five axis articulated robot workspace fixtures, the pick and place operations, Joint space technique - continuous path motion, Interpolated motion, straight line motion and Cartesian space technique in trajectory planning.

Unit-V

Manipulator Dynamics: Introduction, Lagrange's equation kinetic and potential energy. Link inertia Tensor, link Jacobian Manipulator inertia tensor. Gravity, Generalized forces, Lagrange-Euler Dynamic model, Dynamic model of a Two-axis planar robot, Newton Euler formulation, Lagrange - Euler formulation, problems.

Text Books:

1. Robert J. Schilling, *Fundamentals of Robotics Analysis and Control*, PHI Learning. 2009.
2. Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, *Robotics Engineering an Integrated Approach*, Phi Learning., 2009.
3. P.A. Janaki Raman, *Robotics and Image Processing An Introduction*, Tata Mc Graw Hill Publishing company Ltd., 1995.
4. Francis N-Nagy Andras Siegler, *Engineering foundation of Robotics*, Prentice Hall Inc., 1987.

Reference Books:

1. Bernard Hodges, *Industrial Robotics*, Second Edition, Jaico Publishing house, 1993.
2. Tsuneo Yohikwa, *Foundations of Robotics Analysis and Control*, MIT Press. 2003.
3. John J. Craig, *Introduction to Robotics Mechanics and Control*, Third Edition, Pearson, 2008.
4. Bijay K. Ghosh, Ning Xi, T.J. Tarn, *Control in Robotics and Automation Sensor – Based integration*, Academic Press, 1999

List of Experiments (DBME-104-P)

1. Study of different types of robots based on configuration and application.
2. Study of different type of links and joints used in robots
3. Study of components of robots with drive system and end effectors.
4. Determination of maximum and minimum position of links.
5. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
6. Estimation of accuracy, repeatability and resolution.
7. Robot programming exercises

Basics of Automation

Code:			Theory:	50
T	P	C	Practical:	50
3	2	5	Max. Marks:	100

Objectives:

- To impart knowledge on Process automation,
- To create expertise in the field of process automation using PLC, DCS and SCADA

Learning Outcomes:

- Able to select the appropriate controller for a particular application.
- Designing various controllers used in the industries.
- Designing safety instrumented systems.

Unit-I

Automation Fundamentals: Automation and its importance, automation applications, expectations of automation. Types of plant and control – categories in industry, open loop and close loop control functions, continuous processes, discrete processes, and mixed processes. Automation hierarchy – large control system hierarchy, data quantity & quality and hierarchical control.

Unit-II

Programmable Logic Controller Hardware: Evolution of PLC, Definition, functions of PLC, Advantages, Architecture, working of PLC, Scan time, Types & Specifications. DI-DO-AI-AO examples and ratings, I/O modules, local and remote I/O expansion, special purpose modules, wiring diagrams of different I/O modules, communication modules, Memory & addressing- memory organization (system memory and application memory), I/O addressing, hardware to software interface.

Unit-III

Programmable Logic Controller Software: Development of Relay Logic Ladder Diagram, introduction to PLC Programming, programming devices, IEC standard PLC programming languages, LD programming- basic LD instructions, PLC Timers and Counters

Unit-IV

Distributed Control System: Introduction to DCS – Evolution of DCS, DCS flow sheet symbols, architecture of DCS – controller, Input and output modules, communication module, data highway, local I/O bus, workstations, specifications of DCS. Introduction to Hierarchical Control and memory: Task listing, Higher & Lower Computer level tasks. Supervisory computer tasks and DCS configuration –Supervisory Computer functions

Unit-V

Supervisory Control and Data Acquisition (SCADA):SCADA introduction, brief history of SCADA, elements of SCADA. Features of SCADA, MTU- functions of MTU, RTU- Functions of RTU, Protocol Detail SCADA as a real time system, and Communications in SCADA- types & methods used, components, Protocol structure and Mediums used for communications.

Text Books:

1. Samuel M. Herb, "Understanding Distributed Processor Systems for Control", ISA Publication.
2. Thomas Hughes, "Programmable Logic Controller", ISA Publication.
3. Stuart A. Boyer, "SCADA supervisory control and data acquisition", ISA Publication.
4. Gruhn and Cheddie, "*Safety Shutdown Systems"* – ISA, 1998,
5. Poppovik Bhatkar, "Distributed Computer Control for Industrial Automation", Dekkar Publication.

Reference Books:

1. S.K.Singh, "Computer Aided Process Control", Prentice Hall of India.
2. Krishna Kant, "Computer Based Process Control", Prentice Hall of India
3. N.E. Battikha, "The Management of Control System: Justification and Technical Auditing", ISA.
4. Gary Dunning, "Introduction to Programmable Logic controller", Thomas Learning, edition, 2001.

List of Experiments (DBEC-104-P)

1. Wire up a PLC for the given lamp circuit
2. Design a Ladder logic for the given lamp circuit
3. Design and implement ladder logic for the forward and reverse control of a hydraulic cylinder.
4. Design a ladder diagram for performing the given arithmetic operations.
5. Design a ladder diagram for performing the given application using counters
6. Design a ladder diagram for performing the given application using Timers.
7. Interfacing PLC to HMI- text display.
8. Programming a graphical HMI
9. Networking PLCs- drives and a host computer.
10. Troubleshooting PLCs

Note: Any 7 experiments are to be performed

Matlab

Code:

T	**P**	**C**
0	**2**	**2**

Practical: 100
Max. Marks: 100

List of Experiments

1.Obtain the unit step response of a second order system with zeta =0.5% and ω_n =6 rad/s.

2.The Closed loop transfer function of a system is %s(s^2+9s+19)/(s^3+7s^2+14s+8). Determine the unit step response of the %system.

3.The open loop transfer function of a servo system with unity %feedback is given by G(s)=10/)(s+2)(s+5). Determine the damping ratio, % undamped natural frequency of oscillation. What is the percentage overshoot of the response to a unit step input.

4.For a unity feedback control system the forward path function is % given by G(s)=20/s(s+2)(s^2+2s+20).Determine the steady state error of % the system when inputs are i) 5 ii) 5t iii) 3t^2/2

5.Sketch the polar plot of %G(s)=20s/(s+1)(s+10).

6.Sketch the Bode Plot for the transfer function of %G(s)=1000/s(1+0.1s)(1+.001s).

7. Sketch the Bode Plot for transfer function of %G(s)=1000/(1+.01s)(1+.001s).

8.Sketch the Bode Plot for the transfer function of %G(s)=1000/s(1+0.1s)(1+0.001s).

9.Sketch the Bode Plot for the transfer function of %G(s)=$e^{-0.35}$/s(1+s).

10.A unity feedback control system is characterised by open loop transfer function of %G(s)=K(s+13)/s(s+3)(s+7).Find the range of values of k for the system to be stable.

SHRI VISHWKARMA SKILL UNIVERSITY

Syllabus & Scheme

(Second Semester)

for

M.Voc. (Robotics & Automation)

Industry Partner-JBM

SHRI VISHWKARMA SKILL UNIVERSITY

Teaching Scheme for Second Semester

Code	Subjects	Credits			Marks							Hrs. per course		
					Th.			Pr.			Total	Total		
		Th.	Pr.	Total	Int.	Ext.	Total	Int.	Ext.	Total		Th.	Pr.	THr.
GEC	Plant Maintenance & Safety	-	2	2	-	-	-	70	30	100	100	-	60	60
GEC	Entrepreneurship Development	-	2	2	-	-	-	70	30	100	100	-	60	60
GEC Total		**-**	**4**	**4**	**-**	**-**	**-**	**140**	**60**	**200**	**200**	**-**	**120**	**120**
SEC	On The Job Training	-	24	24	-	-	-	245	105	350	350	-	1080	1080
SEC Total		**-**	**24**	**24**	**-**	**-**	**-**	**245**	**105**	**350**	**350**	**-**	**1080**	**1080**
Grand Total		**-**	**28**	**28**	**-**	**-**	**-**	**385**	**165**	**550**	**550**	**-**	**1200**	**1200**

SHRI VISHWKARMA SKILL UNIVERSITY

Plant Maintenance & Safety

Code:

T	P	C	Practical: 100
0	2	2	Max. Marks: 100

Objectives:

- To study the various aspects of safety.
- To practically study the various safety system related to human and machine safety.

Learning Outcomes

- Students can be able understand the need of safety.
- Students can undergo maintenance activities related to machine safety.

Unit-I

Introduction to Maintenance & its Planning: History and evolution of maintenance strategies, classification of maintenance, Maintenance planning and need, Breakdown and Corrective Maintenance, Creation of Maintenance Notification, Release of Maintenance Notification, Maintenance Order creation from Notification, Material Requirement Planning, Purchase Order creation for Maintenance Materials

Unit-II

Maintenance Processing Execution: Maintenance Order Release, Goods issue for Maintenance Order, Confirmation of Maintenance Order, Closing of Maintenance Order, Creation of Measuring Document

Unit-III

Preventive Maintenance: Maintenance Strategy, Time based strategy Plan, Performance based strategy Plan, Condition based Maintenance, Creation of Maintenance Plan, Scheduling of Maintenance Plan, Preventive Maintenance Order execution, Dead line Monitoring

Unit-IV

Security Systems: Fundamentals: Introduction to Security Systems, Concepts, CCTV: Camera: Operation & types, Camera Selection Criteria, Camera Applications, CCTV Applications: CCTV Applications

Unit-V

Accident preventions, protective equipment's and Safety: Personal protective equipment, Survey the plant for locations and hazards, Part of body to be protected, Education and training in safety, Prevention causes and cost of accident, Housekeeping, First aid, Firefighting equipment, Accident reporting, Investigations, Industrial psychology in accident prevention, Safety trials

Text Books

1. Understanding Building Automation Systems (Direct Digital Control, Energy Management, Life Safety, Security, Access Control, Lighting, Building Management Programs) (Hardcover) by Reinhold A. Carlson (Author), Robert A. Di Giandomenico (Author)
2. Building Automation: Control Devices and Applications by In Partnership with NJATC (2008)
3. Building Control Systems, Applications Guide (CIBSE Guide) by the CIBSE (2000)
4. MAINTENANCE ENGG. PRINCIPLES, PRACTICES & MANAGEMENT 1st Edition (English, Paperback, S. K. Srivastava

SHRI VISHWKARMA SKILL UNIVERSITY

Entrepreneurship Development

Code:

T	P	C	Practical: 100
0	2	2	Max. Marks: 100

Objectives:

- Enable the students to develop the insight needed to discover and create entrepreneurial opportunities.
- Successfully start and manage their own businesses to take the advantage of these opportunities.

Learning Outcomes:

- The course will create awareness among the students about the entrepreneurship and factors that will help in facilitating the entrepreneurial development with a focus on new ventures/ start-ups.

Unit-I

Entrepreneurship- Meaning, Nature and Scope, Characteristics and Qualities of a Successful Entrepreneur, Relationship between Entrepreneurship Development and Economic Development.

Unit-II

Entrepreneurship and Society, New Venture Development- Meaning and Stages, Sources of Financing Entrepreneurship, Managerial Vs Entrepreneurial Approach.

Unit-III

EDP Programmes, Concept of Economic Freedom, Financial Markets and Entrepreneurship, Venture Capital; Angel Capital.

Unit-IV

Entrepreneurial Strategies and Business Plan, Presenting Business Plans to the Investors, Future of Entrepreneurship in India.

Unit-V

Women Entrepreneurship: Concept, Factors governing women entrepreneurship, Schemes for women entrepreneurship, Rural Entrepreneurship, Concept, advantage and challenges.

Suggested Readings:

- Dollinger, MJ, Entrepreneurship- Strategies and Resources, Pearson Education.
- Desai,Vasant, Entrepreneurship Development, Himalaya Publishing House.
- Gupta, C.B. and Srinivasan, P., Entrepreneurship Development, Sultan Chand & Sons.
- Charanthimath, P.M., Entrepreneurship Development and Small Business Enterprise, Pearson Education.

- Havinal, Veerbhadrappa, Management and Entrepreneurship, 1st Edition, New Age International Publishers, 2008.

SHRI VISHWKARMA SKILL UNIVERSITY

Syllabus & Scheme

(Third Semester)

for

M.Voc. (Robotics & Automation)

Industry Partner-JBM

SHRI VISHWKARMA SKILL UNIVERSITY

Teaching Scheme for Third Semester

Code	Subjects	Credits			Marks							Hrs per course		
					Th.			Pr.			Total	Total		
		Th.	Pr.	Total	Int.	Ext.	Total	Int.	Ext.	Total		Th.	Pr.	THr.
GEC	Pneumatics & Hydraulic Control	3	-	3	15	35	50	-	-	-	50	45	-	45
GEC	Elective -I	3	-	3	30	70	100	-	-	-	100	45	-	45
GEC	Elective -II	4	-	4	30	70	100	-	-	-	100	60	-	60
GEC	Sensors Application in Robotics	3	-	3	15	35	50	-	-	-	50	45	-	45
GEC	Machine Vision System	3	-	3	30	70	100	-	-	-	100	45	-	45
GEC Lab	Pneumatics & Hydraulic Control Lab	-	2	2	-	-	-	35	15	50	50	-	60	60
GEC Lab	Sensors Application in Robotics Lab	-	2	2	-	-	-	35	15	50	50	-	60	60
GEC Total		**16**	**4**	**20**	**120**	**280**	**400**	**70**	**30**	**100**	**500**	**240**	**120**	**360**
SEC	Advance Robotics	3	-	3	15	35	50	-	-	-	50	45	-	45
SEC	Automation System Design	3	-	3	15	35	50	-	-	-	50	45	-	45
SEC Lab	Advance Robotics Lab	-	2	2	-	-	-	35	15	50	50	-	60	60
SEC Lab	Automation System Design Lab	-	2	2	-	-	-	35	15	50	50	-	60	60
SEC Lab	HMI & SCADA LAB	-	2	2	-	-	-	70	30	100	100	-	60	60
SEC	Seminar on Research Article		2	2	-	-	-	70	30	100	100	-	60	60
SEC Total		**6**	**8**	**14**	**30**	**70**	**100**	**210**	**90**	**300**	**400**	**90**	**240**	**330**
Grand Total		**22**	**12**	**34**	**150**	**350**	**500**	**280**	**120**	**400**	**900**	**330**	**360**	**690**

Elective –I
Artificial Intelligence & Expert System
Automatic Control System
Process Control and Automation
Elective-II
Optimization Technique
Virtual Instrumentation
CAD/CAM
Note: -Minimum 8 students for elective subject.

SHRI VISHWKARMA SKILL UNIVERSITY

PNEUMATIC AND HYDRAULIC CONTROL

Code:			Theory:	50
T	P	C	Practical:	50
3	2	5	Max. Marks:	100

Objectives:

- This course will give an appreciation of the fundamental principles, design and operation of hydraulic and pneumatic machines, components and systems and their application in recent automation revolution.

Learning Outcomes:

- Able to identify hydraulic and pneumatic components.
- Able to design hydraulic and pneumatic circuits and control elements.

UNIT I-Introduction

Fluid properties, Concepts of fluid dynamics, Hydraulic systems and their components, Pneumatic systems and their components, Use of fluid power, Properties of Hydraulic fluids, fluid flow fundamentals, Comparison of hydraulic and pneumatic systems, Safety considerations.

UNIT II- Hydraulic System

Hydraulic power transmission- Fluid power system design, Hydrostatic pumps and motors- Introduction, selection of pumps and motors, Types of motors and pumps, Some general considerations, comparison of motor performance characteristics.
Hydraulic actuators and motors- Introduction, linear actuators, principal features, Actuator selection. Flow control valves- Valve configurations, symbolic representation, Valve analysis, three-way spool valve analysis, flapper valve analysis, single and two stage pressure control valves, introduction to electro-hydraulic valves.

UNIT III-Pneumatic System

Pneumatic fundamentals, symbols, Pneumatic elements, Steady flow of ideal gases, orifice and nozzle calculations, capillary flow, flow of real gases, linear flow equations in orifices and nozzles. Multiple restrictions and volume calculations, Single acting pneumatic actuators and their applications.

UNIT IV- Hydraulic Control Elements

Control of single and double acting hydraulic cylinder, regenerative circuit, pump unloading circuit, Counter valve application, Hydraulic cylinder sequencing control, speed control of hydraulic cylinder.

UNIT V – Pneumatic Control Elements

Simple pneumatic control- direct and indirect actuation pneumatic cylinders, memory valves. Flow control valves and speed control of cylinders- supply air throttling and exhaust air throttling, use of quick exhaust valve

Text Books:

1. Herbert E. Merritt, “Hydraulic Control Systems”, John Wiley & Sons.
2. B.W. Anderson, “The Analysis and Design of Pneumatic Systems”, Wiley.

Reference Books:

1. A.B. Goodwin, “Fluid Power Systems”, Macmillan.
2. Anthony Esposito, “Fluid power with applications”, Prentice Hall, 7th Edition.
3. Arthur Akers, Max Gassman, Richard Smith, “Hydraulic Power System Analysis”, Taylor and Francis
4. Group.
5. Andrew Parr, "Pneumatic & Hydraulic", PHI.
6. John Pippenger & Tyler Hicks, “Industrial Hydraulics”, 3rd edition McGraw Hill

List of Experiments

1. Design of simple pneumatic and hydraulic circuits using basic components.
2. Construction and testing of multiple pneumatic actuator circuit using Cascade method.
3. Co-ordinated motion of actuators using electro – pneumatic elements.
4. Construction and testing of a hydraulic actuator regenerative circuit.
5. Co-ordinated motion of actuators using electro – hydraulic elements
6. Design and Simulation of hydraulic and pneumatic circuits using Fluid SIM .

Sensors Applications in Robotics

SHRI VISHWKARMA SKILL UNIVERSITY

Code:	**Theory: 50**
T P C	**Practical: 50**
3 2 5	**Max. Marks: 100**

Objectives:

- To study about the basics of sensors .
- To gain knowledge about different types of sensors and signal conditioning**.**

Learning Outcome: Students will be able to:

- To explain various signal condition devices used in electronic devises and use of appropriate method in signal conditions in various applications.
- Analyse and choose appropriate sensors in different industrial applications.
- To describe the impact of an RFID system on manufacturing, defense, distribution, retail and health sectors
- To describe the methods to abstract ("filter") information in RFID and other sensor networks.
- To integrate various sensors in developing Flexible Manufacturing Systems.
- To describe the future advances to the quality and integrity of Manufacturing and related sectors resulting from the use of RFID and other sensor technologies.

Unit I Fundamentals of Sensors and Transducers: Performance terminology, static and dynamic characteristics of transducers, classification of sensors and transducers, signal processing and signal conditioning. Operational amplifiers, filters, protection devices, analog to digital converter, digital to anolog converter.

Unit II Sensors and their applications: Inductive, capacitive, magnetic, various types of photo sensors, detection methods, through-beam detection, reflex detection & proximity detection, ultrasonic and microwave sensors. Applications and understanding of the above sensors.

Unit III Advanced Sensor Technologies: Laser production, characteristics of lasers, types of laser sensors, bar code sensors, benefits of bar coding, transponder, RFID (Radio Frequency Identification), electro-magnetic identifier, optical encoders ,.color sensors, sensing principles, color theory, unit color measurement, colour comparator, color sensing algorithm, fuzzy logic color sensor. fuzzy logic for opt-electronic colour sensor in manufacturing.

Unit IV Sensors in Flexible Manufacturing Systems: Vision sensors, image transformations, robot visual sensing tasks, detecting partially visible objects, sensors in flexible manufacturing system cell.

Unit V Sensors for Special Applications: A multi objective approach for selection of sensors in manufacturing**,** cryogenic manufacturing applications, semiconductor absorption sensors, semiconductor temperature detector using photoluminescence temperature detectors using point-contact, sensors in process manufacturing plants, measurement of high temperature, robot control through sensors, other sensors, collection and generation of process signals in decentralized manufacturing system.

Text Books:

1. Sabnesoloman, sensors & control systems in manufacturing. Mc-Graw Hill book Company Network, 1994.

2. Mechatronics by W,Bolton,

References:

1. Sensor Technology Handbook by Jon S. Wilson
2. N.L.Buck&T.G.Buckwith, Mechanical measurement.
3. Sensors and Transducers by Ian Sinclair

List of Experiments

1. Temperature Measurement using thermistor, thermocouple and RTD using LabVIEW
2. Load Cell Measurement using LabVIEW
3. Strain Measurement using LabVIEW
4. Displacement Measurement using LVDT using LabVIEW
5. Vibration Measurement using Accelerometer using LabVIEW
6. ADC and DAC.
7. Speed and Position Control of Servo Moto using LabVIEW
8. Offline Programming: The previously modelled SCARA robot is then programmed offline, also using the industrial robot simulation system.

SHRI VISHWKARMA SKILL UNIVERSITY

Machine Vision System

Code: **Theory: 100**

T	P	C
3	0	3

Max. Marks: 100

Course Objectives

- To learn the fundamentals of vision systems
- To understand the image recognition and retrieval algorithms
- To learn the concepts of object recognition and applications of vision systems.

Course Outcomes (Cos)

- Able to know the basics concepts of vision systems.
- To apply the vision concept of designing robots.
- To use the algorithms to image processing

Unit I
Vision System
Basic Components – Elements of visual perception, Lenses: Pinhole cameras, Gaussian Optics – Cameras – Camera-Compute interfaces

Unit II
Vision Algorithms
Fundamental Data Structures: Images, Regions, Sub-pixel Precise Contours – Image Enhancement: Gray value transformations, image smoothing, Fourier Transform – Geometric Transformation - Image segmentation – Segmentation of contours, lines, circles and ellipses – Camera calibration – Stereo Reconstruction.

Unit III
Object Recognition
Object recognition, Approaches to Object Recognition, Recognition by combination of views – objects with sharp edges, using two views only, using a single view, use of dept values.

Unit IV
Applications
Transforming sensor reading, Mapping Sonar Data, Aligning laser scan measurements - Vision and Tracking: Following the road, Iconic image processing, Multiscale image processing, Video Tracking.

Unit V
Robot Vision
Basic introduction to Robotic Operating System (ROS) - Real and Simulated Robots - Introduction to Open CV, Open NI and PCL, installing and testing ROS camera Drivers, ROS to Open CV - The CV bridge Package.

Text Book

1. Carsten Steger, Markus Ulrich, Christian Wiedemann, "*Machine Vision Algorithms and Applications*", WILEY-VCH, Weinheim, 2008.
2. Damian M Lyons, "*Cluster Computing for Robotics and Computer Vision*", World Scientific, Singapore, 2011.
3. Rafael C. Gonzalez and Richard E. Woods, "*Digital Image Processing*", Addition - Wesley Publishing Company, New Delhi, 2007.
4. Shimon Ullman, "*High-Level Vision: Object recognition and Visual Cognition*", A Bradford Book, USA, 2000.
5. R.Patrick Goebel, "*ROS by Example: A Do-It-Yourself Guide to Robot Operating System* – Volume I", A Pi Robot Production, 2012.

SHRI VISHWKARMA SKILL UNIVERSITY

Automation System Design

Code:
T P C
3 2 5

Theory: 50
Practical: 50
Max. Marks: 100

Objectives:

- To know about the pneumatic, electric, hydraulic and electronic systems in automation of mechanical operations.

Learning Outcomes:

- Able to gain knowledge of industrial automation by transfer lines and automated assembly lines.
- Able to understand about automated controls using pneumatic and hydraulic systems.

Unit-I

Fundamental Concepts of Industrial Automation: Fundamental concepts in manufacturing and automation, definition of automation, reasons for automating. Types of production and types of automation, levels of automation.

Unit-II

Programmable Automation: Special design features of CNC systems and features for lathes and machining canters. Drive system for CNC machine tools. Introduction to CIM; condition monitoring of manufacturing systems.

Unit-III

Design for High Speed Automatic Assembly: Introduction, Design of parts for high speed feeding and orienting, high speed automatic insertion. Analysis of an assembly. General rules for product design for automation.

Unit-IV

Transfer Lines and Automated Assembly: General terminology and analysis, analysis of transfer lines without storage, partial automation. Automated flow lines with storage buffers. Automated assembly-design for automated assembly, types of automated assembly systems.

Unit-V

Elements of Hydraulic Systems: Pumps and motors- types, characteristics. Cylinders, types, typical construction details. Valves for control of direction, flow and pressure, types, typical construction details.

Text Books:

- Mikell P Groover, "Automation Production Systems and Computer- Integrated Manufacturing" Pearson Education, New Delhi, 2001.
- WemerDepper and Kurt Stoll, "Pneumatic Application", KemprathReihe, Vogel BuchVerlagWurzbutg, 1987.

Reference Books:

- Mikell P Groover, "Industrial Robots – Technology Programmes and Applications", McGraw Hill, New York, USA. 2000.
- Steve F Krar, "Computer Numerical Control Simplified ", Industrial Press, 2001.

List of Experiments (DBEE-310-P)

1. Co-ordinated motion of multiple pneumatic actuators in a desired sequence using Cascade method
2. Integration of fringe condition modules in multiple actuator pneumatic systems
3. Co-ordinated motion of multiple actuator, electro – pneumatic systems in a desired sequence using hard – wire programmed control systems
4. Co-ordinated motion of multiple actuator, electro – pneumatic systems in a desired sequence using PLC.
5. Interfacing of an LVDT with a PC for monitoring the displacement of machine slide and raising an alarm if the displacement exceeds specified limit.
6. Inspection using Machine Vision System
7. Control of speed, direction and number of revolutions of a stepper motor using PC.
8. Development of an obstacle avoidance robot using servo motors, ultrasonic and touch sensors.

SHRI VISHWKARMA SKILL UNIVERSITY

Advanced Robotics

Code:
T P C
3 2 5

Theory: 50
Practical: 50
Max. Marks: 100

Objectives:

- To introduce the basic concepts, parts of robots and types of robots.
- To make the student familiar with the various drive systems for robot, sensors and their applications in robots and programming of robots.
- To discuss about the various applications of robots, justification and implementation of robot

Learning Outcomes:

- To explain the basic principles of Robotic technology, configurations, control and programming of Robots.
- Design an industrial robot which can meet kinematic and dynamic constraints.
- To describe the concept of Robot kinematics and dynamics, latest algorithms & analytical approaches
- To discuss and apply the concepts of dynamics for a typical Pick and Place robot.
- To choose the appropriate Sensor and Machine vision system for a given application.
- To explain the basic principles of programming and apply it for typical Pick & place, loading & unloading and palletizing applications.

Unit-I

Kinematics of Robot Manipulator: Introduction, General Mathematical Preliminaries on Vectors& Matrices, Direct Kinematics problem, Geometry Based Direct kinematics problem, Co-ordinate and vector transformation using matrices, Rotation matrix, Inverse Transformations, Problems, Composite Rotation matrix, Homogenous Transformations, Robotic Manipulator Joint Co-Ordinate System

Unit-II

Trajectory Planning: Introduction, Trajectory Interpolators, Basic Structure of Trajectory Interpolators, Cubic Joint Trajectories. General Design Consideration on Trajectories: - 4-3-4 & 3-5-3 Trajectories

Unit-III

Robot Sensing & Vision: Various Sensors and their Classification, Use of Sensors and SensorBased System in Robotics, Machine Vision System, Description, Sensing, Digitizing, Image Processing and Analysis and Application of Machine Vision System, Robotic Assembly Sensors and Intelligent Sensors.

Unit-IV

Industrial Applications: Objectives, Automation in Manufacturing, Robot Application inIndustry, Task Programming,, Robot Intelligence and Task Planning, Modern Robots, Future Application and Challenges and Case Studies.

Unit-V

Robot Teaching: Introduction, Various Teaching Methods, Task Programming, Survey of Robot Level Programming Languages, A Robot Program as a Path in Space, Motion Interpolation, WAIT, SIGNAL & DELAY Commands, Branching, Robot Language Structure, various Textual Robot Languages Such as VAL II, RAIL and their Features.

Text Books

1. Robert J. Schilling, Fundamentals of Robotics Analysis and Control, PHI Learning. 2009.
2. Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, Robotics Engineering an Integrated Approach, Phi Learning., 2009.
3. P.A. Janaki Raman, Robotics and Image Processing An Introduction, Tata Mc Graw Hill Publishing company Ltd., 1995.
4. Francis N-Nagy Andras Siegler, Engineering foundation of Robotics, Prentice Hall Inc., 1987.

Reference Books

1. Bernard Hodges, Industrial Robotics, Second Edition, Jaico Publishing house, 1993.
2. Tsuneo Yohikwa, Foundations of Robotics Analysis and Control, MIT Press. 2003.
3. John J. Craig, Introduction to Robotics Mechanics and Control, Third Edition, Pearson, 2008.
4. Bijay K. Ghosh, Ning Xi, T.J. Tarn, Control in Robotics and Automation Sensor – Based integration, Academic Press, 1999.

List of Experiments

1. Forward and Inverse kinematics of two axis planar articulated robot using analytical and DH algorithm using Lego NXT.
2. Forward and Inverse kinematics to control hand movements in NAO.
3. Study and selection of Gripper.
4. Implementation of trajectory planning algorithm for straight line motion using Matlab and executing PID based control of two axis planar articulated robot in Lego NXT.
5. Analysis and Simulation using Fanuc Robo guide software and real time Programming of Fanuc M 710i robot.
6. Programming of Adept Cobra S 600 SCARA robot.

SHRI VISHWKARMA SKILL UNIVERSITY

VIRTUAL INSTRUMENTATION

Code: **Theory: 100**

T	P	C
4	0	4

Max. Marks: 100

Objectives:

- To understand basic concepts of virtual instrumentation, programming techniques, data acquisition and interfacing techniques.
- To understand about the virtual instrumentation for different application.

Learning Outcomes:

The student will be able to

- Know the basics concepts of instrumentation
- Apply the VI tools to complete the task
- Differentiate the usage of virtual tool from the physical component

UNIT- I

Virtual Instrumentation: An introduction Historical perspective, advantages, block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming. Development of Virtual Instrument using GUI, Real-time systems.

UNIT- II

VI programming techniques: VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers, Publishing measurement data in the web.

UNIT- III

Data acquisition basics: Introduction to data acquisition on PC, Sampling fundamentals, Input/Output techniques and buses. ADC, DAC, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements.

UNIT -IV

VI Interface requirements: Common Instrument Interfaces: Current loop, RS 232C/ RS485, GPIB. Bus Interfaces: USB, PCMCIA, VXI, SCSI, PCI, PXI, Firewire. PXI system controllers, Ethernet control of PXI. Networking basics for office & Industrial applications, VISA and IVI.

UNIT- V

VI toolsets: Distributed I/O modules. Application of Virtual Instrumentation: Instrument Control, Development of process database management system, Simulation of systems using VI, Development of Control system, Industrial Communication, Image acquisition and processing, Motion control.

Text Books

1. LabVIEW Graphical Programming , Gary Johnson, Second edition, McGraw Hill, Newyork, 1997.
2. LabVIEW based Advanced Instrumentation Systems, S. Sumathi and P. Surekha, Spinger.

Reference Books

1. PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Kevin James, Newnes, 2000.

2. WEB RESOURCES: www.ni.com. 3.LabVIEW for everyone, Lisa K. wells & Jeffrey Travis Prentice Hall, New Jersey, 1997.

SHRI VISHWKARMA SKILL UNIVERSITY

Artificial Intelligence & Expert System in Automation

Code: **Theory: 50**

T	P	C
3	0	3

Max. Marks: 100

Objectives:

- To acquire knowledge about Computer Integrated Manufacturing Systems.
- To learn about the concept of Knowledge Based System
- To acquire knowledge about Machine learning and Automated Process Planning

Learning Outcomes:

- Usage of neural network in various application of manufacturing.
- Selection of suitable approach in process planning.
- Know about the importance of computer in automated manufacturing

Unit-I

Introduction:Expert system.Architecture, knowledge base, inference engine, expert system shell, applications.

Unit-II

Fuzzy Logic: Fuzzy sets, membership functions, operation on fuzzy sets; fuzzy control system, Fuzzyfication, knowledge base, inference, defuzzification, application.

Unit-III

Neural Network : Neuron structure, classification, artificial neural network, back propagation training and algorithm, neuro-fuzzy controllers, applications.

Unit-IV

Genetic algorithms: Concepts, encoding and selection methods, genetic operators (crossover and Mutation), applications.

Unit-V

Knowledge Representation: Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects,Reasoning Systems for Categories, Semantic networks, Description logics, Reasoning with Default Information, Truth maintenance systems.
(SLE**:** The Internet Shopping World)

Text Books

1. Haykin “Neural Networks – A comprehensive Foundation” (Mc-millan)

2. J.M. Zureda “Introduction to artificial neural networks” (Jaico)

3. A Cichocki& R Unbehauen " Neural Networks for optimization and signal Processing" John Wiley 4. George J. Klin& Tina A Polgar "Fuzzy sets, uncertainty and Information"

5. BaertKosko "Neural network and fuzzy systems"

References:

1. Peterson "Introduction to Artificial Intelligence and expert system (PHI)

2. Michell "Introduction to Genetic Algorithm" (PHI)

3. Vidyasagar M "Theory of learning and generalization" Springer

4. S. Rajasekaran, G.A. VijaylakshmiPai "Neural Networks, Fuzzy Logic and Genetic Algotithm", PHI.

5. T.J. Ross: "Fuzzy Logic with Engineering Applications" Second Edition John Wiley India

SHRI VISHWKARMA SKILL UNIVERSITY

Process Control & Automation

Code: **Theory: 50**

T	P	C
3	0	3

Max. Marks: 100

Objectives:

- To impart knowledge on Process automation.
- To create expertise in the field of process automation using PLC.

Learning Outcomes:

- Able to select the appropriate controller for a particular application.
- Designing various controllers used in the industries.
- Designing safety instrumented systems

Unit-I

Process Modeling- Introduction to Process control and process instrumentation-Hierarchies in process control systems-Theoretical models-Transfer function-State space models-Time series models Development of empirical models from process data-chemical reactor modelling-. Analysis using softwares

Unit-II

Feedback Control- Feedback controllers-PID design, tuning, troubleshooting-Cascade control-Selective control loops-Ratio control-Control system design based on Frequency response Analysis-Direct digital design

Unit-III

Feedforward Control-Feedforward and ratio control-State feedback control- LQR problem- Pole placement -Simulation using Softwares-Control system instrumentation-Control valves- Codes and standards- Preparation of P& I Diagrams.

Unit-IV

Advanced process control-Multi-loop and multivariable control-Process Interactions-Singular value analysis-tuning of multi loop PID control systems-decoupling control-strategies for reducing control loop interactions-Real-time optimization-Simulation using softwares

Unit-V

Model predictive control-Batch Process control-Plant-wide control & monitoring- Plant wide control design- Instrumentation for process monitoring-Statistical process control-Introduction to Fuzzy Logic in Process Control ,Introduction to OPC-Introduction to environmental issues and sustainable development relating to process industries. Comparison of performance different types of control with examples on softwares

Text Books

1. Seborg, D.E., T.F. Edgar, and D.A. Mellichamp, Process Dynamics and Control, John Wiley , 2004

2. Johnson D Curtis, Instrumentation Technology, (7th Edition) Prentice Hall India, 2002.

3. Bob Connel, Process Instrumentation Applications Manual, McGrawHill, 1996.

Reference Books

1. Edgar, T.F. & D.M. Himmelblau, Optimization of Chemical Processes, McGrawHill Book Co, 1988.

2. Macari Emir Joe and Michael F Saunders, Environmental Quality Innovative Technologies

SHRI VISHWKARMA SKILL UNIVERSITY

CAD/CAM

Code: **Theory: 50**

T	P	C
4	0	4

Max. Marks: 100

Objectives:

- Understand the basic fundamentals of computer aided design and manufacturing.
- To learn 2D & 3D transformations of the basic entities like line, circle, ellipse etc.
- To understand the different geometric modeling techniques like solid modeling, surface modeling, feature based modeling etc. and to visualize how the components look like before its manufacturing or fabrication

Learning Outcomes: After the successful completion of this course, the student will be able:

- To design and do manufacturing planning of mechanical system using state of the art CAD/ CAM and CAE tools and integrated database.
- To create and manipulate 2D and 3D objects on graphic work station
- To explain surface modelling and solid modelling and the use of application software in designing mechanical systems
- To use FEM in the design of mechanical system.

Unit I

Computer Aided Design: Introduction, Conventional Approach to Design, Description of the Design Process, Parametric and Variation Designs, Engineering Analysis and CAD, Compute Aided Engineering, Integrated Database Management System in CAE, CAE product Development, CAE implementation.

Unit II

Transformation and Manipulation of Objects: Introduction, Homogeneous Co-ordinatesystem,2DTransformationTranslation,Scaling,Rotation,Mirroring,Reflection,Concatenation, , Manipulation of Simple Geometrical objects, Algorithms.

Unit III

Curves and Surfaces: - Conic sections, Involutes, Cycloids, Spirals and other curves, Parametric equations- algorithms. Line Fitting, Non Linear Curve Fitting with a Power Function, Curve Fitting with a High Order Polynomial, Chebyshev Polynomial Fit. Cubic Splines, Bezier Curves, B-Spline Curve, Surface creation, Plane Surface, Ruled Surface, Rectangular Surface.

Unit IV

Finite Element Modeling and Analysis: Introduction, Basic Concepts in FEM, PotentialEnergy Formulation and Closed form Solution, Galerkin Method, Bar element**:** Introduction, FE formulation, Proprieties of the Local Stiffness Matrix, Global Stiffness Matrix, Solution of the Truss Problem.

Unit V

Advances in CAD/CAM: CIM, Architecture, Objectives, CIM Implementation, Agile Manufacturing, Reverse Engineering, Concurrent Engineering, Rapid Prototyping, Virtual Manufacturing & Prototyping and Factory of the Future.

Text Books:

1. Principles of Computer Aided Design and Manufacturing- Farid Amirouche,2nd Edition, Pearson Prentice Hall, 2003
2. CAD/CAM Theory and Practice- Ibrahim-Zeid, TATA McGraw Hill, 2nd edition, 2009.
3. Introduction to Finite elements in Engineering – ChandruPatla&Belagundu, 3rd edition, 2009.

Reference Books:

1. CAD/CAM/CIM – P. Radhakrishnan, New age international, 3rd edition, 2007.
2. Finite Element procedure- Bathe, Eastern Economy Edition. PHI, 2009
3. Interactive Computer Graphics- Principles & Practice- Foley &Vandam, 2nd Edition, 2006
4. CAD/CAM - P.N.Rao, 3rd edition, 2010.
5. Computer graphics- Hearn Donald & Beaker, M.Pauline, PHI, 3rd edition, 2009.

SHRI VISHWKARMA SKILL UNIVERSITY

Optimization Techniques

Code: **Theory: 50**

T	P	C
4	0	4

Max. Marks: 100

Objectives:

- To impart knowledge on optimization methods to find the optimized solution of the problems that arises in industry.
- To familiarize the advanced mathematical methods to solve industry research problems**.**

Learning Outcomes:

- Acquire more knowledge in basic concept of optimization.
- Improvement in problem evaluation technique.
- Choose an appropriate method to solve a practical problem.

Unit-I

SINGLE VARIABLE NON-LINEAR UNCONSTRAINED OPTIMITION: One dimensional Optimization methods, Uni-modal function, elimination method, Fibonacci method, golden section method, interpolation methods- quadratic & cubic interpolation methods.

Unit-II

MULTI VARIABLE NON-LINEAR UNCONSTRAINED OPTIMIZATION: Direct search method – Univariant Method – pattern search methods – Powell's – Hook – Jeeves, Rosenbrock search methods – gradient methods, gradient of function, steepest decent method, Fletcher reeves method, Variable metric method.

Unit-III

GEOMETRIC PROGRAMMING: Polynomials – arithmetic – geometric inequality – unconstrained G.P – constrained G.P

Unit-IV

DYNAMIC PROGRAMMING: Multistage decision process, principles of optimality, examples, conversion of final problem to an initial value problem, application of dynamic programming, production inventory. Allocation, scheduling replacement.

Unit-V

LINEAR PROGRAMMING: Formulation – Sensitivity analysis. Change in the constraints, cost coefficients, coefficients of the constraints, addition and deletion of variable, constraints. Simulation: Introduction – Types – Steps – application – inventory – queuing – thermal system.

Text Book:

1. Optimization theory & Applications/ S.S Rao/ New Age International
2. Introductory to operation research/Kasan& Kumar/Springar
3. Optimization Techniques theory and practice / M.C Joshi, K.M Moudgalya/ Narosa Publications.

Reference Book:

1. Operation Research/H.A. Taha/TMH
2. Optimization in operations research/R.L Rardin.
3. Optimization Techniques/Benugundu&Chandraputla/Person Asia.
4. Optimization Techniques /Benugundu&Chandraputla / Pearson Asia.

SHRI VISHWKARMA SKILL UNIVERSITY

Automatic Control System

Code: **Theory: 50**

T	P	C
3	0	3

Max. Marks: 100

Objectives:

- To apply knowledge of mathematics, science and engineering.
- To use the analysis and design tools of classical linear control.
- To use modern computer tools such as Matlab tools to solve control problems.

Learning Outcomes :

The student will be able to

- Know the basics concepts nonlinearity
- Application of state space on modelling
- Design the controller for automated systems

Unit I

Introduction

Open loop and closed loop systems - Examples - Elements of closed loop systems - Transfer function - Modelling of physical systems – Mechanical, Thermal, Hydraulic systems and Electric Networks - Transfer function of DC generator, DC servomotor, AC servomotor, Potentiometer, Synchro's, Tach generator, Stepper motor - Block diagram - reduction techniques, Signal flow graph – Mason" gain formula.

Unit II

Time domain analysis

Standard Test signals – Time response of second order system - Time domain specifications - Types of systems - Steady state error constants - Introduction to P, PI and PID modes of feedback control.

Unit III

Frequency domain analysis

Frequency domain specifications - Time and frequency response correlation – Polar plot – Bode plot – All pass minimum phase and non-minimum phase systems.

Unit IV

System stability

Characteristic equation - Routh Hurwitz criterion of stability - Absolute and Relative stability - Nyquist stability - Nyquist stability criterion - Assessment of relative stability – Gain and Phase Margin.

Unit V

Root locus method

Root locus concepts - Construction of root loci – Root contours.

State Space Analysis: Limitations of conventional control theory - Concepts of state, state variables and state model – state model for linear time invariant systems - Introduction to state space representation using physical - Phase and canonical variables.

Text Book

1. Norman Nise S, “Control system Engineering“, John Wiley & Sons, New Delhi,2013
2. Nagrath I J, and Gopal, M, 'Control Systems Engineering” Prentice Hall of India, New Delhi, 2008.

Reference Book

1. Richard C Dorf and Robert H Bishop, "Modern Control Systems.", Addison-Wesley -2007
2. Ogata K, "Modern Control Engineering", Pearson Education, New Delhi, 2006.
3. Kuo B C, "Automatic Control Systems", Prentice-Hall of India Pvt. Ltd, New Delhi, 2004.

SHRI VISHWKARMA SKILL UNIVERSITY

HMI & SCADA Lab

Code:

T	P	C
0	2	2

Practical:100
Max. Marks: 100

List of Experiments

1. PLC interfaced with SCADA and status read/ command transfer operation.

2. Parameter reading of PLC in SCADA.

3. Alarm annunciation using SCADA.

4. Reporting and Trending in SCADA System.

5. Temperature sensing using SCADA.

6. To understand the trouble of interacting with machines - Redesign interfaces of home appliances.

7. Design a system based on user-centered approach.

SHRI VISHWKARMA SKILL UNIVERSITY

Scheme and Syllabus

(Fourth Semester)

for

M.Voc. (Robotics & Automation)

Industry Partner-JBM

SHRI VISHWKARMA SKILL UNIVERSITY

Teaching Scheme for Fourth Semester

Code	Subjects	Credits			Marks							Hrs. per course		
					Th.			Pr.			Total	Total		
		Th.	Pr.	Total	Int.	Ext.	Total	Int.	Ext.	Total		Th.	Pr.	THr.
GEC	Industrial Ethics	-	2	2	-	-	-	70	30	100	100	-	60	60
GEC	Value Education	-	2	2	-	-	-	70	30	100	100	-	60	60
GEC Total		**-**	**4**	**4**	**-**	**-**	**-**	**140**	**60**	**200**	**200**	**-**	**120**	**120**
SEC	Comprehensive Viva	-	2	2	-	-	-	100	100	200	200	-	60	60
SEC	On The Job Training	-	22	22	-	-	-	245	105	350	350	-	990	990
SEC Total		**-**	**24**	**24**	**-**	**-**	**-**	**345**	**205**	**550**	**550**	**-**	**1050**	**1050**
Grand Total		**-**	**28**	**28**	**-**	**-**	**-**	**485**	**265**	**750**	**750**	**-**	**1170**	**1170**

SHRI VISHWKARMA SKILL UNIVERSITY

Industrial Ethics

Code:

T	P	C	Practical: 100
0	2	2	Max. Marks: 100

Objectives

- The aim of the course is to develop moral responsibility and mould them as best professionals & to create an ethical vision and achieve harmony in life

Learning Outcome

- Will be able to elaborate the business ethics, its rights, duties and principals (Theory)
- Ensuring social responsibility and decision making ability (Theory)
- Demonstrate Controlling mind through yoga and meditation (Theory)
- Make sure that the Working with safety in industry and understanding the laws of safety (Theory)
- Identify the rights and responsibility as an employee of an organisation, and understanding the moral issues (Theory)
- Recognise potential ethical issues in the workplace and discuss with an appropriate person (Theory)
- Promote a safe working environment and adhere to risk management strategies for clients, colleagues and others who enter the workplace (Theory)
- Work safely in the training environment including (Theory)
- Identify, control and report HSE issues relating to immediate work environment according to procedures (Theory)
- Perform consistently in accordance with the organisation's goals and objectives and organisational/professional codes of conduct (Theory)
- Reflect individual responsibilities and accountabilities in work goals (Theory)
- Apply ethical and inclusive practices in professional practice (Project/Practical)

Unit I - Business ethics: Meaning of ethics, why ethical problems occur in business. Ethical principles in business: Utilitarianism: weighing social cost and benefits, Rights and duties, Justice and fairness, ethics of care, Integrating utility, rights, justice and caring

Unit II - Moral Issues: Code of Conduct, An alternative to moral principles: virtue ethics, Moral issues in business: Worker's and employee's rights and responsibilities, Profit maximization vs. social responsibility.

Unit III - Controlling of the Mind: Control of the mind through Simplified physical exercise, Yoga- Objectives, Types, Asanas; Meditation- Objectives, Types, Effect on Body Mind and Soul.

Unit IV - Social Responsibility: Social Responsibility of Business, Ethical Decision-making, Social Responsibility of Business and Corporate Governance, Profession and Professionalism, Professional Ethics, Intellectual property rights.

Unit V - Employee Safety & Health: basics of health safety & laws, employee theft, Fire & Earthquake safety, fire safety, first aid training, general office safety, terrorism, safety representatives, safety inspection, investigating accidents.

Books Recommended

Text Books

1. Values & Ethics in Management, Galgotia Publishers, by Kaur, Tripat;

2. Human values for Managers, by Chakraborty, S.K.
3. Ethics in Management: A Vedantic Perspective, Oxford University Press. By Chakraborty, S.K

Suggested Readings

1. Corporate Governance, Business Ethics & CSR, Ane Books Pvt Ltd, New Delhi, by Sharma, J.P.
2. Corporate Governance and Social Responsibility of Business, Ane Books Pvt. Ltd, New Delhi.By Sharma, J.P.

Journals

1. Individual Manager Issues "What, If Anything, is Wrong with Baby Selling?," Radin, Pacific Law Journal, v. 26, p. 135, 1995.
2. "The Matter of 'Business'" in Changing World of the Executive, Peter Drucker, Times Books, New York, NY, 1982.
3. When All You Ever Wanted Wasn't Enough, Harold Kushner, 1986

Web Links

https://www.swayamprabha.gov.in/index.php/program/archive/16
https://www.swayamprabha.gov.in/index.php/program/archive/5

SHRI VISHWKARMA SKILL UNIVERSITY

Value Education

Code:

T	P	C
0	2	2

Practical: 100
Max. Marks: 100

Objective

- To provide guiding principles and tools for the development of the whole person recognizing that the individual is comprised of Physical, Intellectual, Emotional and Spiritual dimensions.

Learning Outcome

- The students will be able to think about and reflect on different values.
- Inspire students to choose their own personal, social, moral and spiritual values and be aware of practical methods for developing and deepening.
- Able to outline the need, objectives and types of Value Education. (Theory)
- Will be able to make use of self-Exploration and Ethical Corporate Behaviour in the organisation (Theory)
- Apply the Social Values wherever required. (Theory)
- Apply ethical and inclusive practices in professional practice (Theory)
- Make the application of 7 Habits when required in the organisation. (Theory)
- Will make the swach Bharat Campaign as important aspect of your organization (Theory)
- Use resources correctly and efficiently (Theory)
- Keep your immediate work area clean and tidy (Theory)
- Ensure your work meets the agreed requirements (Theory)

Unit I: Value Education-Introduction – Definition of values, Need for Inculcation of values –Object of Value Education-Sources of Value – Types of Values: i) Personal values ii) Social values iii) Professional values iv) Moral and spiritual values v) Behavioral (common) values)
Unit II- Self Exploration: Self Exploration–what is it? - its content and process, Ethical Corporate Behaviour, its Development, Ethical Leadership.
Unit III- Values and Ethics: Concepts, Human Values-Classification of Values, Understanding Harmony in the Human Being
Unit IV- Social values – Definition of Society – Units of Society – Individual, family, different groups – Community – Social consciousness – Equality and Brotherhood – Dialogue – Tolerance – Responsibility
Unit V- Swach Bharat Abhiyan (Activity)

Recommended Books
Text Books
Eternal Human Values NCERT-Campus Sri Aurobindo Marg., New Delhi by Prof.R.P.Dhokalia.,
Reference Books
1. Values for life, Better yourself Books, Bandra Mumbai by Dr. S. Ignacimuthu S.J.,
2. Values (Collection of Essays) by Sri Ramakrishna Math, Chennai-4., (1996)
Web Link
1.https://www.bing.com/videos/search?q=value+education+videos&qpvt=value+education+videos&view=detail&mid=F45E0FD8A0D9D367E178F45E0FD8A0D9D367E178&&FORM=VRDGAR

2.https://www.bing.com/videos/search?q=Importance+of+Values+Education&&view=detail&mid=52AFAB098F37E8E4813252AFAB098F37E8E48132&&FORM=VDRVRV
3.https://www.bing.com/videos/search?q=Importance+of+Values+Education&&view=detail&mid=93231659A8367A7ECE1293231659A8367A7ECE12&&FORM=VDRVRV