

**DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY
UTTAR PRADESH, LUCKNOW**



STUDY, EVALUATION SCHEME & SYLLABUS

For

**B. VOC.
ROBOTICS AND AUTOMATION (RA)**

Based on

**AICTE MODEL CURRICULUM
(EFFECTIVE FROM THE SESSION: 2020-21)**

EVALUATION SCHEME
B. Voc Robotics and Automation

NSFQ Level 5 SEMESTER- I											
S. No.	Subject Code	Subject	Total Teaching/ Training Hours	Evaluation Scheme				End Semester		Total	Credit
				CT	TA	AT	Total	TE	PE		
1	BRAV511	Basics of Industrial Automation	30	10	5	5	20	30		50	2
2	BRAV512	Basic Mechanical Systems	30	10	5	5	20	30		50	2
3	BRAV513	Welding Technology	30	10	5	5	20	30		50	2
4	BRAV514	Basic Electrical and Electronics Systems	30	10	5	5	20	30		50	2
5	BRAP511	Basic Electrical and Electronics Lab	30				20		30	50	1
6	BRAP512	Pneumatics Lab	30				20		30	50	1
7	BRAP513	Language Lab	30				20		30	50	2
8	BRAT511	Welding Supervisor (ASC/Q3104)							Any one Training 400hrs/ 8weeks	150	12
	BRAT512	MIG MAG or GMAW Welder (CSC/Q0209)									
	BRAT513	Embedded Software Engineer (ELE/Q1501)									
	BRAT514	CNC Setter Cum Operator (CSC/Q0123)									
	BRAT515	Field Engineer RACW (ELE/Q3105)									
Total			610							500	24

NSFQ Level 5 SEMESTER- II											
S. No.	Subject Code	Subject	Total Teaching / Training Hours	Evaluation Scheme				End Semester		Total	Credit
				CT	TA	AT	Total	TE	PE		
1	BRAV521	Sensor and Transducer	30	10	5	5	20	30		50	2
2	BRAV522	Manufacturing Technology- I	30	10	5	5	20	30		50	2
3	BRAV523	Pneumatic &Hydraulic Systems	30	10	5	5	20	30		50	2
4	BRAV524	Basics of Industrial Robotics	30	10	5	5	20	30		50	2
5	BRAP521	Mini Project	30				20		30	50	1
6	BRAP522	Applied Robotic Control Lab	30				20		30	50	1
7	BRAP523	Sensor and Transducer Lab	30				20		30	50	2
8	BRAT521	Welding Supervisor (ASC/Q3104)							Any one Training (other than 1 st sem) 400 hrs/ 8 weeks	150	12
	BRAT522	MIG MAG or GMAW Welder (CSC/Q0209)									
	BRAT523	Embedded Software Engineer (ELE/Q1501)									
	BRAT524	CNC Setter Cum Operator (CSC/Q0123)									
	BRAT525	Field Engineer RACW (ELE/Q3105)									
Total			610							500	24

GV: General Vocational; VP: Vocational Practical; OJT: On Job Training; SSC: Sector Skill Council

NSFQ Level 6 SEMESTER- III

S. No.	Subject Code	Subject	Total Teaching/ Training Hours	Evaluation Scheme				End Semester		Total	Credit
				CT	TA	AT	Total	TE	PE		
1	BRAV631	Manufacturing Technology- II	30	10	5	5	20	30		50	2
2	BRAV632	Electrical Machines For Automation	30	10	5	5	20	30		50	2
3	BRAV633	Fundamentals of Mechatronics	30	10	5	5	20	30		50	2
4	BRAV634	Machine Tools	30	10	5	5	20	30		50	2
5	BRAE631	Environment&Ecology /Universal Human Values & Ethics	30	10	5	5	20	30		50	2
6	BRAP631	Mechatronics Lab	30				20		30	50	1
7	BRAP632	Manufacturing Technology Lab	30				20		30	50	1
8	BRAT631	Service Engineer – Installation (CSC/Q0501)					Any one Training 400 hrs/ 8 weeks			150	12
	BRAT632	Automation Specialist (ASC/Q6807)									
	BRAT633	CNC Programmer (CSC/Q0401)									
	BRAT634	Service Engineer – Breakdown Service (CSC/Q0503)									
	BRAT635	Tool & Die Maker (CSC/Q0306)									
Total			610							500	24

NSFQ Level 6 SEMESTER- IV											
S. No.	Subject Code	Subject	Total Teaching/ Training Hours	Evaluation Scheme				End Semester		Total	Credit
				CT	TA	AT	Total	TE	PE		
1	BRAV641	Tool and Die Making	30	10	5	5	20	30		50	2
2	BRAV642	CNC Technology	30	10	5	5	20	30		50	2
3	BRAV643	Internet of Things	30	10	5	5	20	30		50	2
4	BRAV644	Microprocessors and Microcontrollers	30	10	5	5	20	30		50	2
5	BRAH641	Universal Human Values & Ethics/ Environment & Ecology	30	10	5	5	20	30		50	2
6	BRAP641	IOT Lab	30				20		30	50	1
7	BRAP642	Microprocessors and Microcontrollers lab	30				20		30	50	1
8	BRAT641	Service Engineer – Installation (CSC/Q0501)					Any one Training (other than 3rd sem)400 hrs/ 8 weeks			150	12
	BRAT642	Automation Specialist (ASC/Q6807)									
	BRAT643	CNC Programmer (CSC/Q0401)									
	BRAT644	Service Engineer – Breakdown Service (CSC/Q0503)									
	BRAT645	Tool & Die Maker (CSC/Q0306)									
Total			610							500	24

Level 7 SEMESTER- V											
S. No.	Subject Code	Subject	Total Teaching/ Training Hours	Evaluation Scheme				End Semester		Total	Credit
				CT	TA	AT	Total	TE	PE		
1	BRAV751	Embedded Processors	30	10	5	5	20	30		50	2
2	BRAV752	Robotics And Material Handling Systems	30	10	5	5	20	30		50	2
3	BRAV753	Modern Automated and Intelligent Vehicles	30	10	5	5	20	30		50	2
4	BRAV754	Implementation of Quality Management System	30	10	5	5	20	30		50	2
5	BRAE751	Indian Constitution / Essence of Indian Traditional Knowledge	30	10	5	5	20	30		50	2
6	BRAP751	Electro-pneumatics Lab	30				20		30	50	1
7	BRAP752	Modern Automated and Intelligent Vehicles Lab	30				20		30	50	1
8	BRAT751	Embedded product designer Technical lead (ELE/Q1403)					Any one Training 400 hrs/ 8 weeks			150	12
	BRAT752	Programmable Logic Controllers-programmer (IAS/Q5609)									
	BRAT753	Product Design Manager L7 (ASC/Q8103)									
Total			610							500	24

NSFQ Level 7 SEMESTER- VI											
S. No.	Subject Code	Subject	Total Teaching/ Training Hours	Evaluation Scheme				End Semester		Total	Credit
				CT	TA	AT	Total	TE	PE		
1	BRAV761	Programmable Logic Controllers	30	10	5	5	20	30		50	2
2	BRAV762	Field and Service Robotics	30	10	5	5	20	30		50	2
3	BRAV763	Essence of Indian Traditional Knowledge/ Indian Constitution	30	10	5	5	20	30		50	2
4	BVAP761	Major Project	180						150	150	6
5	BRAT761	Embedded product designer Technical lead (ELE/Q1403)					Any one Training (other than 5 th sem) 400 hrs/ 8 weeks			200	12
	BRAT762	Programmable Logic Controllers-programmer (IAS/Q5609)									
	BRAT763	Product Design Manager L7 (ASC/Q8103)									
Total			670							500	24

GV: General Vocational; VP: Vocational Practical; OJT: On Job Training; SSC: Sector Skill Council)
National Skill Qualifications Framework (NSQF)

(SEMESTER I)
(5.GV.01)Basics of Industrial Automation

Unit I:

AUTOMATION: Definition, Advantages, goals, types, need, laws and principles of Automation. Elements of Automation. Fluid power and its elements, application of fluid power, Pneumatics vs. Hydraulics, benefit and limitations of pneumatics and hydraulics systems, Role of Robotics in Industrial Automation.

Unit II:

Manufacturing Automation: Classification and type of automatic transfer machines; Automation in part handling and feeding, Analysis of automated flow lines, design of single model, multi-model and mixed model production lines. Programmable Manufacturing Automation CNC machine tools, Machining centers, Programmable robots, Robot time estimation in manufacturing operations.

Unit III:

Type Automation: Automated Flow lines, Methods of Workpart Transport, Transfer Mechanism, Buffer Storage, Control Functions, and Automation for Machining Operations, Design and Fabrication Considerations.

Unit IV:

Material Handling Equipment, Analysis for Material Handling Systems, Design of the System, Conveyor Systems, Automated Guided Vehicle Systems. Automated Storage Systems: Storage System Performance, Automated Storage/Retrieval Systems, Work-in-process Storage, Interfacing Handling and Storage with Manufacturing. Product identification system: Barcode, RFID etc. Automated Assembly Systems: Design for Automated Assembly, Types of Automated Assembly Systems, Part Feeding Devices, Analysis of Multi-station Assembly Machines, Analysis of a Single Station Assembly Machine

Reference Books:

1. Automation, Production Systems and Computer Integrated Manufacturing”- M.P.Grover, PearsonEducation.
2. Computer Based Industrial Control – Krishna Kant, EEE-PHI
3. Principles and Applications of PLC – Webb John, Mcmillan 1992
4. An Introduction to Automated Process Planning Systems – Tiess Chiu Chang & Richard A. Wysk
5. Anatomy of Automation – Amber G.H & P.S. Amber, PrenticeHall.

(Semester I)
(5.GV.02) Basic of Mechanical Systems

Unit I: Strength of Materials & Power Transmission

Stress, strain, elastic constraints, stress in circular shaft subjected to pure torsion only, Riveted and bolted joints.

Unit II: Shear Force & Bending Moment

Elementary idea of Shear force and bending moment for concentrated, uniformly distributed loads simply supported beam cantilever and overhanging beam, Simple Shear force and bending moment diagrams, Relationship between shear force and bending moment

Unit III: Power Transmission: Pulleys, Gears & Shaft

Classification of Pulleys, Types of Belts, Simple calculation of pulley diameter, Classification of Gears, Simple calculation of number of teeth and speed, Power transmission by solid and hollow shaft

Unit IV: Hydraulics & Hydraulic Machines

Properties of fluids, pressure of fluid and its measurement. Flow of fluids, velocity and discharge, Bernoulli's theorem and its application in venturimeter, flow through pipe, head loss due to friction

Reference Books:

1. Basic Mechanical Engineering, M.P. Poonia & S.C. Sharma, Khanna Publishing House
2. Strength of Materials, D.S. Bedi, Khanna Publishing House

(Semester I)
(5.GV.03) Welding Technology

UNIT-I

Introduction: Welding as compared with other fabrication processes, Importance and application of welding, classification of welding processes, Health & safety measures in welding

UNIT II

Welding Power Sources: Physics of welding Arc, Basic characteristics of power sources for various arc welding processes, Transformer, rectifier and generators.

UNIT III

Physics of Welding Arc: Welding arc, arc initiation, voltage distribution along the arc, arc characteristics, arc efficiency, heat generation at cathode and anode, Effect of shielding gas on arc, isotherms of arcs and arc blow. Metal Transfer: Mechanism and types of metal transfer in various arc welding processes

UNIT IV

Welding Processes: Manual Metal Arc Welding (MMAW), TIG, MIG, Plasma Arc, Submerged Arc Welding, Electrode Gas and Electroslag, Flux Cored Arc Welding, Resistance welding, Friction welding, Brazing, Soldering and Braze welding processes, Laser beam welding, Electron beam welding, Ultrasonic welding, Explosive welding, Friction Stir Welding, Underwater welding & Microwave welding, Heat Affected Zone

Books and References:

1. Welding and Welding Technology, by- Richard L. Little, McGraw Hill Education.
2. Welding Principles and Practices, by- Edwards R. Bohnart, McGraw Hill Education.
3. Welding Engineering and Technology, by- R. S. Parmar, Khanna Publishers.
4. Welding Handbooks (Vol. I & II).

(Semester I)
(5.GV.04) Basic Electrical and Electronics Systems

Unit-I:

Circuit Analysis

Concept of network, Active and passive elements, voltage and current sources, concept of linearity and linear network, unilateral and bilateral elements, source transformation, Kirchoff's Law: loop and nodal methods of analysis, star delta transformation.

Unit-II:

Introduction of Semiconductors: Intrinsic and Extrinsic, P-N junction Diode: Depletion layer, V-I characteristics, half and Full Wave rectification, Clippers, Breakdown Mechanism: Zener and Avalanche, Zener Diode as Shunt Regulator.

Display Devices

Liquid Crystal Display (LCD), Light Emitting Diode (LED), Organic-Light Emitting Diode (O-LED), 7- segment display.

Unit-III:

Digital Design and Binary Numbers: Minterm and Maxterm Realization of Boolean Functions, Gate-level minimization: The map method up to four variable, don't care conditions, SOP and POS simplification, Digital logic gates, NAND and NOR implementation.

Unit-IV:

Combinational Logic: Combinational Circuits, Analysis Procedure, Design Procedure, Binary Adder-Subtractor, Code Converters, Parity Generators and Checkers, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers.

Synchronous Sequential Logic: Sequential Circuits, Storage Elements: Latches, Flip Flops, Analysis of Clocked Sequential circuits.

Text Book

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill.
2. Digital Logic And Computer Design By M. Morris Mano
3. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill.
4. C.L. Wadhwa, Basic Electrical Engineering, Pearson Education
5. J.B. Gupta, Basic Electrical Engineering, Kataria & Sons
6. Robert L. Boylestad / Louis Nashelsky "Electronic Devices and Circuit Theory", Latest Edition, Pearson Education.
7. H S Kalsi, "Electronic Instrumentation", Latest Edition, TMH Publication.

(Semester I)
(5.VP.01) Basic Electrical and Electronics Lab
List of Experiments

1. Verification of Kirchhoff's laws
2. Verification of Superposition Theorem.
3. Verification of Thevenin's Theorem.
4. Verification of Norton's Theorem.
5. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
6. To design half wave rectifier circuits using diode.
7. To generate random numbers using 7-Segment display.
8. Study of Cathode Ray Oscilloscope and measurement of different parameters using CRO.
9. To design and perform Adder and Subtractor circuit using Op-Amp.
10. To understand the concept of Wireless Home Automation System based on IoT for controlling lights and fans.
11. To calculate and draw different electrical parameter using MATLAB/Simulink for a circuit.
12. Energy audit of labs and rooms of different block.
13. Introduction to digital electronics lab- nomenclature of digital ICs, specifications, study of the data sheet, concept of Vcc and ground, verification of the truth tables of logic gates using TTL ICs.
14. Implementation of the given Boolean function using logic gates in both SOP and POS forms.
15. Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.
16. Implementation and verification of Decoder/De-multiplexer and Encoder using logic gates.
17. Implementation of 4x1 multiplexer using logic gates.

(Semester I)
(5.VP.02) Pneumatics Lab

1. Operating of single acting cylinder
2. Operating of double acting cylinder
3. Impulse pilot operation of single acting cylinder
4. Maintained pilot operation of single acting cylinder
5. Operation of single acting cylinder using dual pressure (AND) valve
6. Operating of single acting cylinder – controlled from different positions using shuttle (OR) valve
7. Controlling the speed of double acting cylinder using Metering IN flow control valve
8. Controlling the speed of double acting cylinder using Metering OUT flow control valve
9. Operating of double acting cylinder using memory valve.
10. Single cycle operation of double acting cylinder using limit switch and memory valve
11. Single and Multiple cycle operation of a double acting cylinder using limit switch and memory valve

(Semester I)
(5.VP.03) Language Lab

LIST OF PRACTICALS

1. Locating a Book in Library
2. To look up words in a Dictionary: meaning and pronunciation of words as given in the standard dictionary using symbols of phonetics
3. To seek information from an Encyclopedia
4. Listening pre-recorded English language learning programme
5. Paper reading before an audience (reading unseen passages)
6. Study of spelling Rules
7. Study of essentials of a good speech to respond and comprehend visual, oral themes, situations or stimulus and practice before select gathering
8. Exercises on use of different abbreviations
9. Greetings for different occasions
10. Introducing oneself, others and leave taking
11. Exercises on writing sentences on a topic

(SEMESTER II)

(5.GV.05) Sensor and Transducer

Unit I

Block Schematics of Measuring Systems, Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag

Unit II

Sensor, Proximity Sensors, Pneumatic Sensors, Light Sensors, Tactile Sensors, Fiber Optic Transducers, Digital Transducers, Recent Trends – Smart Pressure Transmitters, Selection of Sensors, Rotary – Variable Differential Transformer, Synchronous and Resolvers, Induction Potentiometers, Micro Electromechanical Systems.

Unit III

Measurement of temperature using Thermistor, Thermocouple & RTD, Concept of thermal imaging, Flow Sensors: Ultrasonic & Laser, Level Sensors: Ultrasonic & Capacitive.

Unit IV

Intelligent Sensors: General Structure of smart sensors & its components, Characteristic of smart sensors: Self calibration, Self-testing & self-communicating, Application of smart sensors: Automatic robot control & automobile engine control

Reference Books:

1. Arun K Ghosh, "Introduction to Transducers", PHI Publication.
2. Bela G. Liptak, "Process Measurement and Analysis, Vol. 1", CRC Press Publication

(Semester II)

(5.GV.06) Manufacturing Technology- I

Unit I:

(A) General Introduction: (a) Scope of subject "Workshop Technology" in engineering (b) different shop activities and broad division of the shops on the basis of nature of work done such as (i) Wooden Fabrication-carpentry (ii) Metal Fabrication (shaping and Forming, Smithy, sheet metal and Joining-welding, Riveting, Fitting and Plumbing).

(B) Carpentry: (a) Fundamental of wood working operations (b) Common Carpentry Tools- Their classification, size, specification (name of the parts and use only): (i) Marking and measuring tools (ii) Holding and supporting tools: (iii) Cutting and Sawing Tools: (iv) Drilling and Boring Tools (v) Striking Tools-Mallet and Claw hammer (vi) Turning Tools & Equipment (vii) Miscellaneous Tools

Unit II:

(A) Joining of Timber Components for Fabrications Works: Assembly of joints (Preparation steps and tools used only) Mortise, Tenon, Rivet, Groove, Tongue, Dowel, operations in assembly-simple lap and butt, Mortise, Tenon, Dovetail, Miter & bridle joints.

Metal Fabrication

(B) Metal Shaping-Smithy: (i) Operations involved (concept only) (ii) Tool and equipment used (Names, size, specification for identification only) (iii) Heating and fuel handling equipment (iv) Holding and supporting tools (v) Striking Tools (vi) Cutting tools (vii) Punching & Drifting Tools (viii) Bending Tools and figures (ix) Forming & Finishing Tools (x) Defects Occurring & its remedy

Unit III

Sheet metal Working-Tools and operation: (1) Operations involved (Names and concept only) (2) Sheet metal joints (3) Tools and equipment used (Name, size, specifications for identification only) (4)

Marking tools (5) Cutting and shearing Tools (6) Straightening tool

(7) Striking Tools (8) Holding Tools (9) Supporting Tools (10) Bending tools (11) Punching-Piercing and Drafting tools (12) Burring Tools-Files (13) Defects Occurring & its remedy

Unit IV

(A) Metal Joining During Fabrication-

(a) Permanent Joining: (i) Welding methods (ii) Electric welding

(b) Soldering & Brazing:(i) Its concept, comparison with welding as joining method and classification (ii) Soldering operation (iii) Materials Used (iv) Defects Occurring & its remedy

(B) Riveting- (i) Its comparison with welding as joining method. (ii) Rivets and Materials. (iii) Operation involved (iv) Tools and equipment used (Names, Size, specification and uses)), Elementary knowledge about working of pneumatic, hydraulic and electric riveter. Temporary Joining (Fasteners & their uses), General Idea about temporary fasteners & their uses

(C) Familiarity with the Use of Various Tools Used in Mechanical Engineering Workshop (a) Marking & Measuring Tools (b) Holding Tools (c) Cutting Tools (d) Files (e) Thread Cutting Tools (h) Miscellaneous Tools. They should be shown physically to each student for familiarity.

Reference Books:

1. Workshop Technology, Vol. I: Hazra&Chaudhry
2. Workshop Technology, Vol. I: BS Raghuwanshi
3. KaryashalaTakniki, JKKapoor

(Semester II)

(5.GV.07) Pneumatic & Hydraulic Systems

Unit I

Properties of air – Perfect Gas Laws – Compressor – Filters, Regulator, Lubricator, single acting cylinder, double acting cylinder, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit – Cascade method — Problems, Introduction to pneumatic logic circuits.

Unit II

ISO symbols and guiding rules for designing hydraulic and pneumatic system, Solenoid valve, Electro Pneumatic System – Elements – Ladder diagram – Problems, Introduction to fluidics and pneumatic logic circuits.

Unit III

Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids – Properties of fluids and selection – Basics of Hydraulics – Pascal's Law – Principles of flow – Friction loss – Work, Power and Torque Problems, Sources of Hydraulic power: Pumping Theory – Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of Linear and Rotary – Fixed and Variable displacement pumps – Problems.

Unit IV

Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning – Hydraulic motors – Control Components: Direction Control, Flow control and pressure control valves – Types, Construction and Operation – Servo and Proportional valves – Applications – Accessories: Reservoirs, Pressure Switches – Applications – Fluid Power ANSI Symbols – Problems.

Text Books:

1. Anthony Esposito, Fluid Power with Applications, Pearson Education 2005.
2. Majumdar S.R., Oil Hydraulics Systems- Principles and Maintenance, Tata McGraw-Hill, 2001

(Semester II)
(5.GV.08) Basics of Industrial Robotics

UNIT - I

Robotics-Introduction-classification with respect to geometrical configuration (Anatomy), Controlled system & chain type: Serial manipulator & Parallel Manipulator. Components of Industrial robotics-precision of movement-resolution, accuracy & repeatability-Dynamic characteristics- speed of motion, load carrying capacity & speed of response-Sensors-Internal sensors: Position sensors,& Velocity sensors, External sensors: Proximity sensors, Tactile Sensors, & Force or Torque sensors.

UNIT - II

Grippers - Mechanical Gripper-Grasping force-Engel Berger-g-factors-mechanisms for actuation, Magnetic gripper, vacuum cup gripper-considerations in gripper selection & design, Industrial robots specifications. Selection based on the Application.

UNIT - III

Kinematics-Manipulators Kinematics, Rotation Matrix, Homogenous Transformation Matrix, Direct and Inverse Kinematics for industrial robots. Differential Kinematics for planar serial robots

UNIT - IV

Control- Interaction control, Rigid Body mechanics, Control architecture- position, path velocity, and force control systems, computed torque control, adaptive control, and Servo system for robot control.
Programming of Robots and Vision System-Lead through programming methods- Teach pendent- overview of various textual programming languages like VAL etc. Machine (robot) vision:

TEXT BOOKS:

1. Industrial Robotics / Groover M P /Mc Graw Hill
2. Introduction to Robotics / John J. Craig/ Pearson

REFERENCE BOOKS:

1. Theory of Applied Robotics /Jazar/Springer.
2. Robotics / Ghosal / Oxford

(Semester II)
(5.VP.04) Mini Project

On the basis of learning in the vocational diploma, a project to be taken up by the student strengthening his/her vocational skills

(Semester II)
(5.VP.05) Applied Robotic Control Lab

1. How to move a robotics ARM and prepare a program on simulation software
2. Write a program and simulate for welding task
3. Write a program and simulate the task of pick & place
4. Simulation of a 3- finger gripper in Kuka sim pro with the help of a “move tower” project
5. Palletizing of boxes using Kuka sim pro industrial robot and a vacuum gripper
6. Sensing strategy and robot path creation for interrupted welding lines at car underbody
7. How to move a robotics arm and prepare a program on robotic ARM KR-10.
8. Write a program for task of pick & place on robotic ARM KR-10.
9. Write a program for welding task on robotic ARM KR-10.

(Semester II)
(5.VP.06) Sensor and Transducer Lab

1. Voltage and Current Detection Circuitry
2. Temperature and Pressure Detection Circuitry
3. Water flow and Level detection Circuitry
4. Position Indication (LVDT,Pot)
5. Proximity sensors(inductive)
6. Distance (Ultrasonic) sensor
7. Light sensor
8. Humidity sensor
9. Rainfall and Soil moisture Sensor
10. Motion sensor
11. Measurement of Power and Energy
12. Accelerometer sensor

(SEMESTER III)
(6.GV.01) Manufacturing Technology- II

Unit I

GENERAL PROCESS: Classification and elementary idea of metal forming processes on the basis of the properties of deformability (Plasticity), fusibility and divisibility viz., Rolling, Forging, Drawing, Extruding, Spinning, Pressing, Punching, Blanking, Welding, Soldering, Brazing, Metal cutting processes-turning, Drilling, Boring, Shaping, Grinding, Elementary idea of machines used for the above processes.

UNIT II

TESTING OF WELDS & RELEVANT WELDING CODES: (a) Destructive methods (b) Non-destructive methods-visual, X-ray, Y-ray, Magnetic particles, fluorescent, penetrant and ultrasonic testing.

UNIT III

FOUNDRY PRACTICE PATTERN & MOULDING: The pattern materials used, Types of pattern allowances and pattern layout, Colour scheme patterns defects, Types of cores and their utility. Moulding and Pouring: Classification of mould materials according to characteristics, Types of sands and their importance test, parting powders and liquids, Sand mixing preparation, Moulding defects

UNIT IV

MELTING AND POURING: Brief idea of refractory material and fluxes, Fuels and metallic materials used in foundry. Melting furnaces used in foundry such as pit furnace, Tilting and cupola furnaces, their construction and operation, metals and alloys. Additions to molten metal, Closing and pouring of the moulds.

Reference Books:

1. Workshop Technology, Vol. I: BSRaghuvanshi
2. Production Technology, Vol. I: Hazra&Chaudhry

(Semester III)
(6.GV.02) Electrical Machines for Automation

Unit I

STEPPER MOTORS: Constructional features – Principle of operation – Types, Hybrid Stepper motor. Modes of Excitation – Static and Dynamic characteristics of stepper motors – introduction to Drive systems, Sizing of stepper motors - Applications.

Unit II

SERVOMOTORS: Types – Constructional features - Principle of operation – Feedback system - Sizing of servomotors – Applications.

Unit III

PERMANENT MAGNET BRUSHLESS DC MOTORS: Principle of operation – Types, control of BLDC Motors- Applications. PERMANENT MAGNET SYNCHRONOUS MOTORS: Principle of operation, control of PMSM Motors - Applications.

Unit IV

GEARED MOTORS: Design Principle – Types of Gearboxes – Selection of a Gear Unit – Operation Factor – Equivalent Power –Factors that affect operation factor – Geared Motor Applications

LINEAR MOTORS: Linear Induction motor classification – Construction – Principle of operation – DC Linear motor (DCLM) types –DCLM Control applications – Linear Synchronous motor (LSM) – Types–Applications.

TEXT BOOKS:

1. Kenjo T, —Stepping Motors and their Microprocessor Controls, Clarendon Press London, 2003.
2. J. R. Hendershot, Timothy John Eastham Miller, Design of Brushless Permanent-magnet Machines, Motor Design Books, 2010.

REFERENCES:

1. Jacek F. Gieras, Zbigniew J. Piech, Bronislaw Tomczuk, Linear Synchronous Motors: Transportation and Automation Systems, CRC Press, New York, 2011.
2. Bonfiglioli Riduttori, —Gear Motor Handbook, Springer, 1995.
3. Wilfried Voss, — A Comprehensive Guide to Servo Motor Sizing, Copperhill Media, 2007.

(Semester III)

(6.GV.03) Fundamentals of Mechatronics

UNIT – I

Introduction: Definition – Trends - Control Methods: Stand alone , PC Based (Real Time Operating Systems, Graphical User Interface, Simulation) - Applications: identification of Sensors and actuators in Washing machine, Automatic Camera, Engine Management, SPM, Robot, CNC, FMS, CIM.

UNIT – II

Signal Conditioning : Introduction – Hardware - Digital I/O , Analog input – ADC , resolution, Filtering Noise using passive components – Resistors, capacitors – Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass , high pass , notch filtering

UNIT – III

Precision Mechanical Systems : Modern CNC Machines – Design aspects in machine structures, guideways, feed drives, spindle and spindle bearings, measuring systems, control software and operator interface, gauging and tool monitoring.

UNIT – IV

Electromechanical Drives: Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.

(Semester III)
(6.GV.04) Machine Tools

Unit I

Classification of Metal Removal Process and Machines Mechanics of Metal Cutting: Geometry of single point cutting tool and tool angles, tool nomenclature in ASA, ORS, NRS and interrelationship, introduction of mechanism of chip formation and types of chips, chip breakers, orthogonal and oblique cutting, cutting forces and power required, theories of metal cutting, thermal aspects of machining and measurement of chip tool interface temperature, friction in metalcutting.

Unit II

Machinability: Concept and evaluation of machinability, tool life, mechanisms of tool failure, tool life and cutting parameters, machinability index, factors affecting machinability, Cutting fluids, types, properties, selection and application methods, General Purpose Machine Tools: tooling, attachments and operations performed, selection of cutting parameters, Simple calculation of time for machining.

Unit III

Special Purpose Machine Tools: Automatic lathes, capstan and turret lathe machines, tracer attachment in machine tools, mechanical-copying machines, Hydraulic tracing Devices, Electric tracing systems, Automatic tracing, Abrasive Processes: Abrasives, natural and synthetic, manufacturing, nomenclature, selection of grinding wheels, wheel mounting and dressing, characteristic terms used in grinding, machines for surface and cylindrical grinding, their constructional details and processes, surface finishing, honing, lapping, super finishing, polishing and buffing processes.

Unit IV

Thread and Gear Manufacturing: Casting, thread chasing, thread cutting on lathe, thread rolling, die threading and tapping, thread milling, thread grinding, Gear Manufacturing Processes: Hot rolling, stamping, powder metallurgy, extruding etc. gear generating processes, gear hobbling, gear shaping, gear finishing processes, shaving, grinding, lapping, shot blasting, phosphate coating, gear testing.

Reference Books:

1. Machine Design, Sadhu Singh, Khanna Publishing House
2. Machine Design Data Book, Sadhu Singh, Khanna Publishing House

(Semester III)
(6.AV.01) Environment & Ecology

UNIT – I

Introduction: Waterborne diseases – protected water supply – Population forecasts, design period – types of water demand – factors affecting – fluctuations – fire demand – water quality and testing – drinking water standards: sources of water - Comparison from quality and quantity and other considerations – intakes – infiltration galleries.

UNIT – II

Layout and general outline of water treatment units – sedimentation – principles – design factors – coagulation-flocculation clarifier design – coagulants - feeding arrangements. Filtration – theory – working of slow and rapid gravity filters – multimedia filters – design of filters – troubles in operation - comparison of filters – disinfection – theory of chlorination, chlorine demand - other disinfection practices- Miscellaneous treatment methods.

UNIT – III

Distribution systems requirement –method and layouts -Design procedures- Hardy Cross and equivalent pipe methods pipe – joints, valves such as sluice valves, air valves, scour valves and check valves water meters – laying and testing of pipe lines – pump house – Conservancy and water carriage systems – sewage and storm water estimation – time of concentration – storm water overflows combined flow

UNIT - IV

characteristics of sewage – cycles of decay – decomposition of sewage, examination of sewage – B.O.D. Equation – C.O.D. Design of sewers – shapes and materials – sewer appurtenances manholes – inverted siphon – catch basins – flushing tanks – ejectors, pumps and pump houses – house drainage – components requirements – sanitary fittings-traps – one pipe and two pipe systems of plumbing – ultimate disposal of sewage – sewage farming – dilution.

TEXT BOOKS:

1. Environmental Engineering by H.S Peavy, D. R. Rowe, G. Tchobanoglous, McGraw Hill Education (India) Pvt Ltd, 2014
2. Environmental Engineering by D. P. Sincero and G.A Sincero, Pearson 2015.
3. Water Supply & Environmental Engineering by A.K. Chatterjee.
4. Water Supply and sanitary Engineering by G.S. Bindi, Dhanpat Rai & Sons Publishers.

REFERENCES:

1. Water and Waste Water Technology by Steel, Wiley
2. Waste water engineering by Metcalf and Eddy, McGraw Hill, 2015.
3. Water and Waste Water Engineering by Fair Geyer and Okun, Wiley, 2011
4. Water and Waste Water Technology by Mark J Hammar and Mark J. Hammar Jr. Wiley, 2007.

(Semester III)
(6.VP.01) Mechatronics lab

LIST OF EXPERIMENTS

1. Design and testing of fluid power circuits to control
(i) Velocity (ii) direction and (iii) force of single and double acting actuators
2. Design of circuits with logic sequence using Electro pneumatic trainer kits.
3. Simulation of basic Hydraulic, Pneumatic and Electric circuits using software
4. Circuits with multiple cylinder sequences in Electro pneumatic using PLC
5. Speed Control of AC & DC drives
6. Servo controller interfacing for DC motor
7. PID controller interfacing
8. Stepper motor interfacing with 8051 Micro controller
(i) Full step resolution (ii) half step resolution
9. Modeling and analysis of basic electrical, hydraulic and pneumatic systems using LAB VIEW
10. Computerized data logging system with control for process variables like pressure flow and temperature.

(Semester III)
(6.VP.02) Manufacturing Technology Lab

1. Turning job: One job consisting of minimum three turning operations like, taper turning, Chamfering, knurling, threading etc.
2. Foundry job: Sand Mold Casting.
3. Welding job: An arc welding job consisting of minimum two types of joints.
4. Demonstration of CNC job: Developing program and performing job on CNC lathe

(SEMESTER IV)
(6.GV.05) Tool and Die Making

Unit I

Tool holders: Tool holders for turning and milling carbide inserts-types, ISO-designation and applications, Tool holding and tool mounting systems for conventional milling and drilling machine tools.

Unit II

Locating and clamping devices: Concept, meaning and definitions of location and clamping, Use of locating and clamping principles in day-to-day supervision on shop floor, Degree of freedom-concept and importance, 3-2-1 principle of location, Locators-Types, Sketches with nomenclature, Working, Applications, Fool proofing and ejecting

Unit III

Clamping devices: Types, Sketches with nomenclature, Working, Applications

Unit IV

Jigs and fixtures: Concept, meaning, differences and benefits of jigs and fixtures, Types, sketches with nomenclature, working and applications of jigs, Types, sketches with nomenclature, working and applications of fixtures.

Reference Books:

1. Tool Engineering BY Albert A Dowd

(Semester IV)
(6.GV.06) CNC Technology

Unit I

INTRODUCTION:

History - Advantages and disadvantages of CNC, block diagram of CNC - Principle of operation- Features available in CNC systems

TYPES OF CNC MACHINES : Types and constructional features of machine tools- Turning centres, machining centres, grinding machines

Unit II

Design considerations – Axis representations, Various operating modes of a CNC machine. Control Units: Functions of CNC, system hardware, Contouring control - interpolation, Parameters and diagnosis features. Interfacing with keyboard, monitor, field inputs, outputs, Role of PLC in CNC machines.- hardware and I/O configuration.

Unit III

DRIVE UNITS: Axis drive arrangements, ball screw, timing belts and couplings, Analog and digital drives. Control and Feedback Devices: MCCB, MCB, control relays, contactors, overload relays, cables & terminations. Applications of feedback devices in CNC machines- Absolute and incremental encoders, resolvers, linear scales, Proximity switches, limit switches

Unit IV

NC PART PROGRAMMING PROCESS: Axis notation, EIA and ISO codes, Explanation of basic codes. Tooling concepts, machining methods, part geometry and writing of tool motion statements, Development of simple manual part programs for turning operations

(Semester IV)
(6.GV.07) Internet of Things

UNIT I

Introduction: IOT concepts, IOT Standards, Components of IOT System, Relevance of IOT for the future, IOT Applications, IOT for smart cities, IOT in Indian Scenario, Challenges in IOT implementation.

UNIT II

Introduction –smart objects, IoT market, environment, opportunities, IoT for buildings, Cloud computing, device connectivity, Analytics, Real time analytics, Trend analytics, Predictive analytics, IBM Watson cognitive computing

UNIT III

Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.

UNIT IV

Network & Communication Aspects in IoT: Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

Drones and IoT: IoT drone projects, How to use Blue mix to control a drone, AR-Drone, Zombie drone video.

Reference text book :

1. The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities

(Semester IV)

(6.GV.08) Microprocessors and Microcontrollers

UNIT I

Introduction of Microprocessor of 8085:

Introduction of Microprocessors, Microcomputer System, Difference between Microcontrollers & Microprocessors

UNIT II

Architecture of Microprocessor of 8085 & 8051 Microcontroller:

8085 Microprocessor Architecture, Address, Data And Control Buses, Pin Functions, De-multiplexing of Buses, Generation Of Control Signals, Memory Interfacing, Architecture of 8051, Pin Function of 8051 microcontroller

UNIT III

Introduction To 8-bit AVR Microcontroller:

Overview of AVR family, AVR Microcontroller architecture, Register, AVR status register, ROM space and other hardware modules, ATmega32 pin configuration & function of each pin.

UNIT IV

AVR Assembly Language Programming:

Addressing modes of AVR, Data transfer Arithmetic, Logic and Compare, Rotate and Shift, Branch and Call instructions. AVR data types and assembler directives, AVR assembly language programs, AVR I/O Port Programming, Time delay loop.

Text Books :

1. Ramesh Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", Penram International Publication (India) Pvt. Ltd.
2. DV Hall, "Microprocessors Interfacing", Tata McGraw Hill Publication.
3. N. Senthil Kumar, M. Saravanan, S. Jeevananthan, "Microprocessors and Microcontrollers", Oxford University Press Publication.
4. Getting Started with the MSP430 Launchpad by Adrian Fernandez, Dung Dang, Newness publication ISBN-13: 978-012411588011
5. MSP430 microcontroller basics 1st Edition by John H. Davies (Author), Newnes Publication ISBN-13: 978-0750682763

Reference Books:

1. http://processors.wiki.ti.com/index.php/MSP430_LaunchPad_Low_Power_Mode
2. http://processors.wiki.ti.com/index.php/MSP430_16-Bit_UltraLow_Power_MCU_Training
3. AK Roy & KM Bhurchandi, "Advance Microprocessor and Peripherals (Architecture, Programming & Interfacing)", Tata McGraw Hill Publication.

(Semester IV)

(6.AV.02) Universal Human Values & Ethics

UNIT I

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority,

Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT II

Understanding Harmony in the Human Being - Harmony in Myself Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’, Understanding the needs of Self (‘I’) and ‘Body’ - Sukh and Suvridha, Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer), Understanding the characteristics and activities of ‘I’ and harmony in ‘I’, Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

UNIT III

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship Understanding harmony in the Family- the basic unit of human interaction,

Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family!.

UNIT IV

Understanding Harmony in the Nature and Existence – Whole existence as Co-existence

Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

UNIT V

Implications of the above Holistic Understanding of Harmony on Professional Ethics Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.

Text Books:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

References:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA

2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.

(Semester IV)
(6.VP.03) (IoT Lab)

1. Water Level Monitor
2. Smart Meeting Rooms
3. Smart Garden System
4. Smart Parking System
5. Smart Garage Door
6. Weather Monitoring System
7. Air Pollution Monitoring System
8. Health Monitoring System
9. Smart Water Irrigation System

(Semester IV)
(6.VP.04) (Microprocessors and Microcontrollers lab)

1. Controlling Light using Touch Sensor and 8051 Microcontroller.
2. 8051 Microcontroller based Frequency Counter.
3. Android Controlled Robot using 8051 Microcontroller.
4. RFID Interfacing with 8051 Microcontroller.
5. Digital Thermometer using LM35 and Microcontroller.
6. Displaying an Image on Graphical LCD using 8051 Microcontroller.
7. Digital Clock using 8051 Microcontroller.
8. Interfacing ADC0808 with 8051 Microcontroller.
9. Digital Code Lock using 8051 Microcontroller.
10. Bluetooth Controlled Home Automation System using 8051.

(SEMESTER V)
(7.GV.01) EMBEDDED PROCESSORS

Unit -I

INTRODUCTION: ARM Design Philosophy, Registers, Program Status Register, Instruction Pipeline, Interrupts and Vector Table, Architecture Revision, ARM Processor Families, features, advantages & suitability in embedded application.

Unit -II

ARM PROCESSOR PROGRAMMING: Instruction set, programming in assembly language. Simple C Programs using Function Calls, Pointers, Structures, Integer and Floating Point Arithmetic, Assembly Code using Instruction Scheduling, Register Allocation, Conditional Execution and Loops.

Unit -III

ARM CORTEX PROCESSORS: Introduction improvement over classical series and advantages for embedded system design. CORTEX A, CORTEX M, CORTEX R processors series, ARM-CM3 Based Microcontroller LPC1768: Features, Architecture, System Control, Clock & Power Control, GPIO, Pin Connect.

Unit -IV

APPLICATIONS: Block interfacing with RGB LED, Seven Segment, TFT Display, and Motor control using PWM. Concept of USB, CAN, and Ethernet based communication using microcontrollers.

TEXT BOOK:

1. Steve Furber, —ARM System-on-Chip Architecture, Pearson Education, 2009.
2. Andrew Sloss, —ARM System Developer 's Guidel, Morgan Kaufmann Publishers, 2009.

REFERENCES:

1. Jonathan W Valvano, Embedded Systems: Real-Time Operating Systems for the Arm Cortex-M3, Create space dependent publisher, 2012.
2. James Lang Bridge, —Professional Embedded ARM Development, John Wiley & Sons, 2014.
3. Jonathan W. Valvano, Brookes / Cole —Embedded Microcomputer Systems, Real Time Interfacing, Thomas Learning, 1999.
4. ARM architecture reference manual: - www.arm.com.

(Semester V)
(7.GV.02) ROBOTICS AND MATERIAL HANDLING SYSTEMS

Unit I

INTRODUCTION: Types of industrial robots, Load handling capacity, general considerations in Robotic material handling. **ROBOTS FOR INSPECTION:** Robotic vision systems, image representation, object recognition and categorization.

Unit II

OTHER APPLICATIONS: Application of Robots in continuous arc welding, Spot welding, Spray painting, assembly operation, cleaning, robot for underwater applications. **END EFFECTORS:** Gripper force analysis and gripper design for typical applications, design of multiple degrees of freedom, active and passive grippers.

Unit III

SELECTION OF ROBOT: Factors influencing the choice of a robot, robot performance testing, economics of robotisation, Impact of robot on industry and society.

Unit IV

MATERIAL HANDLING: concepts of material handling, principles and considerations in material handling systems design, conventional material handling systems - industrial trucks, monorails, rail guided vehicles, conveyor systems, cranes and hoists, advanced material handling systems, automated storage and retrieval systems(ASRS), bar code technology, radio frequency identification technology.

TEXT BOOKS:

1. Richard D Klafter, Thomas Achmielewski and MickaelNegin, —Robotic Engineering – An integrated Approach|| Prentice HallIndia,New Delhi, 2001.
2. Mikell P Groover, "Automation, Production Systems, and Computer-Integrated Manufacturing", Pearson Education, 2015.

REFERENCES:

1. James A Rehg, —Introduction to Robotics in CIM Systems||, Prentice Hall of India, 2002.
2. Deb S R, "Robotics Technology and Flexible Automation", Tata McGraw Hill, New Delhi, 1994.
2. Margaret E. Jefferies and Wai-Kiang Yeap, "Robotics and Cognitive Approaches to Spatial Mapping", Springer-Verlag Berlin Heidelberg 2008.

(Semester V)

(7.GV.03) Modern Automated and Intelligent Electric Vehicles

UNIT-I:

Introduction

Introduction to electric and hybrid electric vehicles, History of hybrid and electric vehicles, Social and environmental importance of electric and hybrid electric vehicles

UNIT-II:

Introduction to Automated, Connected, and Intelligent Vehicles, Introduction to the Concept of Automotive Electronics, Automotive Electronics Overview, History & Evolution, Infotainment, Body, Chassis, and Power train Electronics, Advanced Driver Assistance Electronic Systems

UNIT-III:

Connected and Autonomous Vehicle Technology, Basic Control System Theory applied to Automobiles Overview of the Operation of ECUs, Basic Cyber-Physical System Theory and Autonomous Vehicles, Role of Surroundings Sensing Systems and Autonomy, Role of Wireless Data Networks and Autonomy

UNIT-IV:

Sensor Technology for Advanced Driver Assistance Systems, Basics of Radar Technology and Systems, Ultrasonic Sonar Systems, Lidar Sensor Technology and Systems, Camera Technology, Night Vision Technology Other Sensors, Use of Sensor Data Fusion, Integration of Sensor Data to On-Board Control Systems

Advanced Driver Assistance System Technology, Basics of Theory of Operation, Applications – Legacy Applications – New, Applications - Future, Integration of ADAS Technology into Vehicle Electronics, System Examples, Role of Sensor Data Fusion Autonomous Vehicles, Driverless Car Technology, Moral, Legal, Roadblock Issues, Technical Issues, Security Issues

Reference Books:

1. Electric & Hybrid Vehicles, A.K. Babu, Khanna Publishing House
2. Automotive Fuel Technology-Electric, Hybrid and Fuel-Cell Vehicles: Jack Erjavec& Jeff Arias
3. Electric and Hybrid Vehicles: Design Fundamentals: Iqbal Husain
4. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory and Design: Mehردادehsani, Yimingao, AliEmadi.
5. Mullett, Wireless Telecommunications Systems and Networks, Thomson – Delmar Learning, ISBN#1-4018-8659-0, 2006
6. Mullett, Basic Telecommunications: The Physical Layer, Thomson – Delmar Learning, ISBN#1-4018-4339-5, 2003

(Semester V)

(7.GV.04) IMPLEMENTATION OF QUALITY MANAGEMENT SYSTEM

UNIT-I:

INTRODUCTION – Need for Quality – Definitions of Quality – Dimensions of Product and Service Quality – Basic Concept of TQM – Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT-II:

STRATEGIC QUALITY PLANNING – Quality Councils – Employee Involvement – Empowerment – Team and Team Work – PDCA Cycle – 5S – Supplier Selection and Supplier Rating.

UNIT-III:

SEVEN TOOLS OF QUALITY – New Management Tool – Concepts, Methodology, Applications to Manufacturing, Service Sector Including IT – Bench Marking – Reason to Bench Mark, Bench Mark Process – FMEA Types.

UNIT-IV:

PRODUCTION PLANNING & CONTROL – Concepts of Productivity – Importance – Modes of Calculating Productivity – Cost of Quality - SERVQUAL – Quality Improvement Strategies.

REFERENCES:

1. Jiju Antony; David Preece Routledge, —Understanding, Managing and Implementing Quality: Frameworks, Techniques and Cases, Routledge, 2002.
2. Dale H. Besterfield., —Total Quality Management, Pearson, 2011. .
3. Hubert K.Rampersad, —Total Quality Management, Springer International Publishing

(Semester V)
(7.AV.01) Indian Constitution

UNIT I

Constitution' meaning of the term,, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy

UNIT II

Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha

UNIT III

Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

UNIT IV

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Panchayati raj: Introduction, Panchayati Raj: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

References

1. 'Indian Polity' by Laxmikanth
2. 'Indian Administration' by SubhashKashyap
3. 'Indian Constitution' by D.D. Basu
4. 'Indian Administration' by Avasthi and Avasthi

(Semester V)
(7.VP.01) Electro-pneumatics Lab

1. Operation of a single acting cylinder using single solenoid valve (direct actuation of solenoid)
2. Operation of a double acting cylinder using single solenoid valve (direct actuation of solenoid)
3. Operation of a single acting cylinder using single solenoid valve (use relay for actuation of solenoid)
4. Operation of a double acting cylinder using single solenoid valve (use relay for actuation of solenoid)
5. Apply AND logic using two manual controls for forward stroke of a double acting cylinder (direct actuation of solenoid)
6. Apply OR logic using two manual controls for forward stroke of a double acting cylinder (direct actuation of solenoid)
7. Apply AND logic using two manual controls with relay for forward stroke of a double acting cylinder (use relay for solenoid actuation)
8. Apply OR logic using two manual controls with relay for forward stroke of a double acting cylinder (use relay for solenoid actuation)
9. Operation of a single acting cylinder using single solenoid valve (use separate manual controls for forward stroke and return stroke)
10. Operation of a double acting cylinder using single solenoid valve (use separate manual controls for forward stroke and return stroke)

(Semester V)

(7.VP.02) Modern Automated and Intelligent Vehicles Lab

LIST OF PRACTICALS (more experiments can be added according to facility available)

1. Study and compare different charging stations.
2. Analysis of different control system on Simulator.
3. Analysis of Battery Cooling System on Simulator.
4. Analysis of Battery Monitoring System on Simulator.
5. Analysis of Emission control system on Simulator
6. Analysis of Control Units on Simulator.

(SEMESTER VI)
(7.GV.05) Programmable Logic Controllers

UNIT I

PLC BASICS

Programmable Logic Controllers (PLCs): Introduction; definition & history of the PLC; Principles of Operation; Various Parts of a PLC: CPU & programmer/ monitors; PLC input & output modules; Solid state memory; the processor; I/O modules; power supplies. PLC advantage & disadvantage; PLC versus Computers, PLC Application. Programming equipment; proper construction of PLC ladder diagrams; process scanning consideration; PLC operational faults.

UNIT II

PLC Hardware Components

The I/O section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O specifications, The CPU, Memory design, Memory Types, Programming Devices, Selection of wire types and size.

UNIT III

Various INPUT /OUTPUT Devices and its interfacing with PLC.

Different types of Input devices : Switches: Push button Switches, Toggle Switches, Proximity switches, Photo switches, Temperature Switch, Pressure Switch, and Level Switch, Flow Switches, manually operated switches, Motor starters, Transducers and sensors, Transmitters etc. Their working, specification and interfacing with PLC. Different types of Output devices : Electromagnetic Control Relays, Latching relays, Contactors, Motors, Pumps, Solenoid Valves etc. Their working, specification and interfacing with PLC.

UNIT IV

Basics of PLC Programming

Processor Memory Organization, Program Scan, PLC Programming languages, Relay type instructions, Instruction addressing, Branch Instructions, Internal Relay Instructions, Programming Examine if Closed and examine If Open instructions, Entering the ladder diagram, Modes of operation. Creating Ladder Diagrams from Process Control Descriptions. Ladder diagram & sequence listing; large process ladder diagram construction, flow charting as programming method, Industrial Examples.

(Semester VI)
(7.GV.06) Field and Service Robotics

UNIT I

INTRODUCTION: History of service robotics – Present status and future trends – Need for service robots - applications examples and Specifications of service and field Robots. Non-conventional Industrial robots.

UNIT II

PLANNING AND NAVIGATION: Introduction-Path planning overview- Road map path planning- Cell decomposition path planning Potential field path planning. Obstacle avoidance - Case studies: tiered robot architectures.

UNIT III

FIELD ROBOTS : Ariel robots- Collision avoidance-Robots for agriculture, mining, exploration, underwater, civilian and military applications, nuclear applications, Space applications.

UNIT IV

HUMANOIDS: Wheeled and legged, Legged locomotion and balance, Arm movement, Gaze and auditory orientation control, Facial expression, Hands and manipulation, Sound and speech generation, Motion capture/Learning from demonstration, Human activity recognition using vision, touch, sound, Vision, Tactile Sensing, Models of emotion and motivation. Performance, Interaction, Safety and robustness, Applications, Case studies.

(Semester VI)

(7.AV.01) Essence of Indian Traditional Knowledge

UNIT I

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge through indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge through formal knowledge

UNIT II

Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

UNIT III

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

UNIT IV

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

References:

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, PratibhaPrakashan 2012.
3. VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Arnakulam
4. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata

(Semester VI)

(7.VP.03) Major Project

On the basis of learning in the B.Voc. Programme, i.e. Level 5 to Level 7, a project to be taken up by the student strengthening his/ her vocational skills.