Savitribai Phule Pune University
Faculty of Science & Technology

Curriculum Details

For
Bachelor of Vocational (Engineering)
AUTOMOTIVE MECHATRONICS
(Choice Based Credit System)

(With Effect from Academic Year 2024-25)

1. Course Objectives

After successfully completing the vocational course, the student would have acquired relevant appropriate and adequate technical knowledge together with the professional skills and competencies in the field of Automotive Mechatronics so that he/she is properly equipped to take up gainful employment in this Vocation. Thus he/she should have acquired: -

A. Understanding of

(a)   The relevant basic concepts and principles in basic science subjects (Physics, Chemistry and Mathematics) so that the students are able to understand the different vocational subjects.

(b)   The basic concepts in engineering drawing.

(c)   The concepts, principles of working of basic electronic devices and circuits.

(d)   The knowledge of testing procedure of components and circuits by making use of different test instruments.

(e)   The procedure of making P.C.B.

(f)   The concepts and principles used in Radio/Audio/Video Systems and Communication devices and its maintenance.

B. Adequate Professional Skills and Competencies in

(a)   Testing different electronic components.

(b)   Testing the performance of electronic circuits.

(c)   Locating the fault at component level and at the stage level.

C. A Healthy and Professional Attitude so that the student has

(a)   An analytical approach while working on a job.

(b)   An open mind while locating/rectifying faults.

(c)   Respect for working with their own hands.

(d)   Respect for honesty, punctuality and truthfulness

D. NSQF compliant skills in Qualification developed by sector skill council in Electronic and Automobile sector

3. Course Structure:

The course will consist of combination of practice, theory and hands on skills in the electronics sector.

Curriculum:

The curriculum in each of the years of the programme would be a suitable mix of general education and skill components.

Skill Development Components:

- The focus of skill development components shall be to equip students with appropriate knowledge, practice and attitude, to become work ready. The skill development components will be relevant to the industry as per its requirements.

- The curriculum will necessarily embed within itself, National Occupational Standards (NOSs) of specific job roles within the industry. This would enable the students to meet the learning outcomes specified in the NOSs.

- The overall design of the skill development component along with the job roles selected will be such that it leads to a comprehensive specialization in few domains.

- The curriculum will focus on work-readiness skills in each of the year of training.

- Adequate attention will be given in curriculum design to practical work, on the job training, development of student portfolios and project work.

General Education Component:

- The general education component adheres to the normal senior secondary and university standards. It will emphasize and offer courses which provide holistic development. However, theory content will not exceed 40% of the total curriculum.
- Adequate emphasis is given to language and communication skills.

B. Voc. Automotive Mechatronics Syllabus for First Year

Structure for Semester-I

Course Code	Course Name	Teaching Scheme (Hours/Week)		Examination Scheme and Marks						Credits		
		Theory	Practical	ISE	ESE	TW	PR	OR	Total	TH	PR	Total
101	Communication Skills	03		50	50				100	03		03
102	Engineering Graphics	03		50	50				100	03		03
103	Fundamental of Industrial Management	03		50	50				100	03		03
104	Fundamentals of Computers-Lab		02				50	--	50		01	01
105	Engineering Graphics Lab		02				50	--	50	--	01	01
106	On Job Training		24			200			200		12	12
	Total	09	28	150	150	200	100	--	600	09	14	23

Structure for Semester-II

Course Code	Course Name	Teaching Scheme (Hours/Week)		Examination Scheme and Marks						Credits		
		Theory	Practical	ISE	ESE	TW	PR	OR	Total	TH	PR	Total
201	Basics of electrical and Electronic	03		50	50				100	03		03
202	Basics of Mechatronics	03		50	50				100	03		03
203	Digital and Power Electronics	03		50	50				100	03		03
204	Basics of electrical and Electronic-Lab		02				50	--	50		01	01
205	Basics of Mechatronics -Lab		02				50		50		01	01
206	On Job Training		24			200			200		12	12
	Total	09	28	150	150	200	100	--	600	09	18	23

B. Voc. Automotive Mechatronics Syllabus for Second Year

Structure for Semester-III

Course Code	Course Name	Teaching Scheme (Hours/Week)		Examination Scheme and Marks						Credits		
		Theory	Practical	ISE	ESE	TW	PR	OR	Total	TH	PR	Total
301	Electrical Machines & Control systems	03		50	50				100	03		03
302	Measurement Metrology	03		50	50				100	03		03
303	Microcontroller and Programmable Logic Controller	03		50	50				100	03		03
304	Microcontroller and Programmable Logic Controller-Lab		02				50	--	50		01	01
305	Sensors and Transducers-Lab		02				50	--	50	--	01	01
306	On Job Training		24			200			200		12	12
	Total	09	28	150	150	200	100	--	600	09	14	23

Structure for Semester-IV

Course Code	Course Name	Teaching Scheme (Hours/Wee k)		Examination Scheme and Marks						Credits		
		Theory	Practical	ISE	ESE	TW	PR	OR	Total	TH	PR	Total
401	Manufacturing Automation & Ergonomics	03		50	50				100	03		03
402	Project Management	03		50	50				100	03		03
403	Plant Maintenance and Safety	03		50	50				100	03		03
404	Applied Hydraulics and Pneumatics-Lab		02				50	--	50		01	01
405	Computer Numerical Control Machines (CNC)-Lab		02				50		50		01	01
406	On Job Training		24			200			200		12	12
	Total	09	28	150	150	200	100	--	600	09	14	23

B. Voc Automotive Mechatronics Syllabus for Third Year

Structure for Semester-V

Course Code	Course Name	Teaching Scheme (Hours/Week)		Examination Scheme and Marks						Credits		
		Theory	Practical	ISE	ESE	TW	PR	OR	Total	TH	PR	Total
501	Mounting and Communication of sensor (MCS)	03		50	50				100	03		03
502	Rapid Prototyping and 3D Printing	03		50	50				100	03		03
503	Design of Mechatronics	03		50	50				100	03		03
504	Design of Mechatronics-Lab		02				50	--	50		01	01
505	Project Stage-I		02				50	--	50	--	01	01
506	On Job Training		24			200			200		12	12
	Total	09	28	150	150	200	100	--	600	09	14	23

Structure for Semester-VI

Course Code	Course Name	Teaching Scheme (Hours/Week)		Examination Scheme and Marks						Credits		
		Theory	Practical	ISE	ESE	TW	PR	OR	Total	TH	PR	Total
601	Applied Mechatronics	03		50	50				100	03		03
602	Leadership & Quality Management	03		50	50				100	03		03
603	Project Stage-II		04			200			200		04	02
604	On Job Training		24			200			200		12	12
	Total	06	28	100	100	300			600	06	14	20

Subject Name: Communication Skills	
Course Code : **101**	Semester: **I**
Weekly Teaching Hours: TH: **03** Tut: **00**	Scheme of Marking TH: **100** ISE: **50,** ESE**: 50**
Credit:**3**	Scheme of Marking PR: **--**

Unit – I **Communication (8hrs)**

Meaning of Communication, Importance of Communication, Types of communication. Process of communication, Communication network in an organization, Barriers to communication, Essentials of good communication.

Unit – II **Remedial English Gramme (7hrs)**

- Articles, agreement between verb and subject, uses of tenses, Modal and their uses, Prepositions.
- **Understanding and applying Vocabulary:** One word substitutes, Synonyms and Antonyms
  - Word formation:-Prefixes, Bases and Suffixes.

Unit – III **Listening Skills (7hrs)**

The process of listening, Types of listening, Benefits of effective listening, Barriers to listening, listening to announcements at work place.

Unit – IV **Reading Skills (7hrs)**

Process and methodologies of reading, Skimming and scanning, Levels of reading, Proofreading, Summarizing, Precise writing, Unseen comprehension passage, Note taking and reviewing, convert the given information into charts and graphs

Unit – V **Writing Skills (7hrs)**

Main Forms of Written Communication: Notices, Drafting an E-mail. Correspondence: Personal and Official, Notices, Technical Report Writing, Preparing agenda and minutes of meetings

Books:

Name of Authors	Title of the Book
1. Sethi, J & et al	A Practice Course in English Pronunciation
2. Sen, Leena.,	Communication Skills
3. Prasad, P.,	Communication Skills
4. Bansal, R.K. and J.B. Harrison.,	Spoken English
5. Roach Peter.	English Phonetics and Phonology.
6. A.S. Hornby's.	Oxford Advanced Learners Dictionary of Current English,
7. Prasad, P.,	The Functional Aspects of Communication Skills
8. McCarthy, Michael.	English Vocabulary in Use,
9. Rajinder Pal and PremLata.,	English Grammar and Composition
10. Dr. Ashok Kumar Singh,	One Word Substitution

Syllabus
Name of the Course: B. Voc (Foundry Technology)

Subject Name: Engineering Graphics	
Course Code: 102	Semester: I
Weekly Teaching Hours: TH: 03	Marking Scheme ISE TH: 50, ESE TH: 50
Credit:3	

Unit I- Introduction to drawing, lines and lettering   **07 Hrs**
- Definition and classification of drawing
- Drawing instruments such as; drawing board, drawing sheets, drafter.
- Types of pencils, sheets, eraser etc.
- Different types of lines (Straight line, inclined line and curved lines)
- Practice engineering style for letters and numbers as BIS: SP:46-2003

Unit II - Dimensioning and scale   **06 Hrs**
- Importance of dimensioning
- Types (i.e. chain, parallel and progressive etc.) and methods of placing dimensioning, Principles of dimensioning and practice dimensioning technique as BIS: SP: 46-2003, Free hand sketching of straight lines, circle, square, Polygons

Unit III -Introduction to Projection   **07 Hrs**
- Introduction to first and third angle projection,
- Introduction to projection of point, line and plane, Sectioning of solids

Unit IV- Isometric and Orthographic projection   **09 Hrs**
- Orthographic projection of simple geometric solids
- Isometric drawing of simple geometric solids

Unit V- Geometric and dimensioning Tolerance   **07Hrs**
- Component Drawing and interpretation
- Geometric dimension and Tolerance
- Introduction to CAD software used in drawing

Books:
1. N.D. Bhatt and V.M. Panchal   Enginering Drawing Plane and Solid Geometry Forty-Fourth Edition2002, Charotar Publishing House
2. Laxmi Narayan and Vaishwanar Engineering DrawingCharotar Publishing House
3. P.S. Gill Engineering Graphics and Drafting Milenium Edition S.K. Kataria and Sons
4. Jolhe, D. A., (2015), "Engineering Drawing with introduction to AutoCAD", Tata McGraw Hill, New Delhi

Subject Name: Fundamental of Industrial Management	
Course Code : **103**	Semester: **I**
Weekly Teaching Hours: TH: **03** Tut: **00**	Scheme of Marking TH: **100** ISE: **50,** ESE**: 50**
Credit:**3**	Scheme of Marking PR: **--**

Unit – I   **Concept of Quality (08hrs)**

- Quality: Definition, History, Importance
- Approaches to define Quality, Cost of Quality, Hierarchy of Quality Management
  - Introduction to Quality Control.

Unit – II   **Organizational Aspects of Quality Assurance (7hrs)**

- Quality Assurance (QA): Introduction, Definition, Management principles in QA, QA in different stages, QualityPlanning.
- ISO: Introduction, ISO 9000 series of standard, Benefits ofISO.
- ISO 9001, Benefits of ISO 9001.
  - Quality survey: Scope, Types of audit, inspection methods, Quality budget, Vendor Quality Rating

Unit – III   **Problem solving tools and techniques (7hrs)**

- Definition of a problem
- Type of problems, classification of problems
- What is problem solving, barriers to problem solving
- Problem solving tools: Cause and effect diagram, Histogram, flow charts, Check sheets, Histogram, Brain-storming, Pareto charts, Control charts, Scatter Diagram
- 3.5 Problem solving techniques: Brain storming, Flow diagram, PDCA Cycle etc

Unit – IV   **Total Quality Management (7hrs)**

- Basic concept of TQM, features of TQM
- principles of TQM
- leadership concepts
- Quality statements
- Barriers to TQM implementation
- Concept of TPM
  - Quality allied concept: KAIZEN, Poke yoke, JIT, KAPA

Unit – V   **5 S and Safety (7hrs)**

- Detailed concept of 5S and safety used in Industries
  - Integrated Management system.

Books

Name of Authors	Title of the Book	Publisher
1. L.Sganthi&Anand A. Samuel,	Total quality Management	PHI Publication.
2. Poornima M Charantimath,	Total quality Management	Pearson Publication.

Subject Name: Fundamental of Computers Lab.	
Course Code : **104**	Semester: **I**
Weekly Practicals: PR: **02** Tut: **00**	Scheme of Marking TH: **--**
Credit:**1.5**	Scheme of Marking PR: **50**

1. Troubleshooting

2. Practical based on to be exposed/shown various components and supposed how to switch on a computer.

3. Handling Boot Setup, Installation of Operating System, Connecting your client to server, User and Workgroup Handling, General Operating system handling and related topics.

4. WordPad, Notepad, Sticky Note, Snipping tool, Paint

5. M.S. Word

6. MS-Excel- Creating charts, Creating tables

7. MS-PowerPoint

Syllabus
Name of the Course: B. Voc (Foundry Technology)
Semester I

Subject Name: Engineering Graphics Lab	
Course Code: 105	Semester: I
Weekly Practical's: PR: 02	Marking Scheme PR: 50
Credit:01	

Practical No. 1-
 - Prepare drawing sheet by using different types of lines
 - Prepare drawing sheet by Bisection of line, angle, arc.

Practical No. 2-
 - Prepare drawing sheet

  a) To divide line of length 120mm into 9equal parts

  b) To divide a circle into 12 equal parts by using engineering compass
  c) To divide a circle into 8 equal parts by using set square

Practical No. 3-
  - Prepare drawing sheet of projection of point, line & plane.

Practical No. 4-
 - Prepare drawing sheet of orthographic projection
 - Prepare drawing sheet of isometric projection.

Practical No. 5-
Prepare drawing sheet by using any CAD software on any topic mentioned above

Subject Name: Basics of Electrical& Electronics Engineering	
Course Code : **201**	Semester: **II**
Weekly Teaching Hours: TH: **03** Tut: **00**	Scheme of Marking TH: **100** ISE**: 50,** ESE **:50**
Credit:**3**	Scheme of Marking PR: **50**

Unit – I	**D.C Circuits (8hrs)**	
	• Definition of Voltage, Current, Power, Resistance, Inductance and Capacitance with their units, Ohm's law, Kirchhoff's Law, Series -Parallel Circuit, Conversion of Current and Voltage Source.	
Unit – II	**Three Phase A.C Circuits (7hrs)**	
	• Generation of 3 phase E.M.F, Difference between three-phase and single-phase supply, Star connection, Delta Connection and its Conversion.	
Unit – III	**Electrical Machines (7hrs)**	
	• Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Transformer, Induction Motor, Servo & Stepper motors.	
Unit – IV	**Protective Devices & Safety Precautions (7hrs)**	
	• Introduction to PPE (Personal Protective Equipment) & Safety Precautions, Introduction of Relays, Contactors, MCBs, ELCBs, Fuses, Concept of Neutral and Earthing.	
Unit – V	**Semiconductor Devices & its Applications (7hrs)**	
	• Basic idea of semiconductors – P and N type; diodes, zener diodes and their applications, transistor – PNP and NPN, symbols, identification of terminals of transistor, current flowing in a transistor, its characteristics and uses. Characteristics and applications of a thyristor.	

Books

Name of Authors	Title of the Book	Publisher
1. E. Kresyzig	Advanced Engineering Mathematics	John Wiley and Sons.(latest edition).
2. B.S. Grewal	Higher Engineering Mathematics	Khanna Publications
3. R.A Jain and S.R.K Iyengar	Advanced Engineering Mathematics	Narosa Publications
4. N.P Bali	Engineering Mathematics	Laxmi Publications

<table>
<tr><td colspan="2" align="center">Subject Name : Basics of Mechatronics</td></tr>
<tr><td>Course Code : 202</td><td>Semester: II</td></tr>
<tr><td>Weekly Teaching Hours: TH: 03 Tut: 00</td><td>Scheme of Marking TH: 100 ISE: 50, ESE :50</td></tr>
<tr><td>Credit:3</td><td>Scheme of Marking PR: 50</td></tr>
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Unit – I   Introduction (8hrs)

- Introduction to Mechatronics –systems – concepts of Mechatronics approach
- Need for Mechatronics
- Emerging areas of Mechatronics
- Classification of Mechatronic

Unit – II   Sensors (6hrs)

- Sensors and Transducers, Static & Dynamic characteristics of sensors
- Potentiometers, LVDT, Capacitance sensors
- Strain gauges, Eddy current sensors, hall effect sensors,
- Temperature sensors
- Light Sensors

Unit – III   Basic Programmable Logic Controller (PLC) and its Components (6hrs)

- Basic structure
- Input and output processing
- Programming
- Timers, counters
- Selection of PLC Introduction
- Basic commands of PLC

Unit – IV   Stepper and Servo motors (8hrs)

- Basics of Stepper and Servo motors
- Types of Stepper and servo motors
- Construction, working, principle
- Advantages and Disadvantages

Unit – V   Basic of Design of Mechatronics, Pneumatics & Hydraulics system. (8hrs)

- Design Process
- Stages of Design Process
- Traditional & Mechatronics Design concept
- Basics of Pneumatics& Hydraulics system

Books

	Name of Authors	Title of the Book	Publisher
1.	Devdas Shetty & Richard A.Kolk	System design	PWS Publication
2.	W.Bolton	Mechatronics - Electronics control systems in Mechanical Engineering	Pearson
3.	Prof.C.R.Venkataramana	Mechatronics	Sapna Book House
4.	Bradley, Dawson, Burd and	Mechatronics-- Electronics in product & process	---
5.	Alciatore	Introduction to mechatronics & measuring system	TMH
6.	Mahalik	Mechatronics Principles, concept & Applications	TMH
7.	Majumdar	Pneumatic system principle & maintenance	

Subject Name: Digital and Power Electronics

Course Code : **203**	Semester: **II**	
Weekly Teaching Hours: TH: **03** Tut: **00**	Scheme of Marking TH: 100	ISE: 50, ESE:50
Credit:**3**	Scheme of Marking PR: **--**	

Unit – I **Introduction (8hrs)**
- Logic Levels and Pulse Waveforms
- Elements and Functions of Digital Logic
- Digital Integrated Circuits
- Number system and codes
- AND, OR, NAND, NOR, Gate Propagation Delay Time, Power Dissipation Norse Immunity, Fan In & Out, Loading Considerations
- AND – OR Logic AOL Logic, XOR Logic, Universal Properly of NAND and NOR Logic – Half and Full Adders
- Decoders and Encoders – Multiplexers and De-multiplexers

Unit – II **Boolean Algebra and Latches (7hrs)**
- Boolean Operations, Logic Expressions
- Rules and Laws of Boolean Algebra DE Morgan's Theorem
- Simplifications of Boolean Expressions, Karnaugh Map
- Flip Flops, Different Types of Flip Flops, Flip Flops Operations, Operating Characteristics, Applications of Flip Flops

Unit – III **Power Semi-Conductor Devices (7hrs)**
- Study of switching devices
- Diode, SCR, TRIAC, GTO, BJT, MOSFET, IGBT-Static Dynamic characteristics, Triggering and commutation circuit for SCR
- Design of Driver and Snubber circuit

Unit – IV **Cyclo Converter (7hrs)**
- Principle of Cyclo-converter operation.
- Single phase to single phase circuit step up Cyclo converter
- Single phase to single phase circuit step down Cyclo converter

Unit – V **Invrters (7hrs)**
- Single phase and three phase voltage source inverters (both 1200 mod and 1800 mode)
- Voltage & harmonic control
- WM techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM
- Introduction to space vector modulation
- Current source inverter

Books

Name of Authors	Title of the Book	Publisher
1. Morris Mano M.	**Digital Circuits and Logic Design**	**Prentice Hall of India, II Edition, 1996**
2. Reshid, M.H.	**Power Electronics – Circuits Devices and Application**	**Prentice Hall International, New Delhi, 3rd Edition, 2004.**

Subject Name: Basics of Electrical & Electronics Engineering Lab	
Course Code : **204**	Semester: **II**
Weekly Practical's: PR: **02** Tut: **00**	Scheme of Marking TH: **--**
Credit:**01**	Scheme of Marking PR: 50**,** Total: **50**

1. Introduction of tools, symbols and abbreviations.

2. To verify Kirchhoff's current & voltage law.

3. Construction & Working of DOL starter.

4. Construction & Working of Star-Delta starter.

5. Construction & Working of Distribution Board and Extension Board.

6. To perform open circuit test and short circuit test of a single-phase transformer.

Subject Name: Basics of Mechatronics Lab	
Course Code : **205**	Semester: **II**
Weekly Practical's: PR: **02** Tut: **00**	Scheme of Marking TH: **--**
Credit:01	Scheme of Marking PR: **50,** Total: **50**

1. Introduction to Mechatronic Lab, System & it different Components.

2. To study the Application of Electromagnetic relay (Holding the Push button).

3. Operation of Single Acting Cylinder using Pneumatics.

4. Operation of Double Acting Cylinder using Pneumatics.

5. Impulse Pilot operation using Double Acting Cylinder.

6. Operation of Single Acting Cylinder Using Single Solenoid Valve.

Name of the Course: B. Voc (Automobile Mechatronics)
Semester III

Subject Name: Electrical Machines & Control system	
Course Code : **301**	Semester: **III**
Weekly Teaching Hours: TH: **03** Tut: **00**	Scheme of Marking TH: 100 ISE**: 50,** ESE**:50**
Credit:**3**	Scheme of Marking PR: **--**

Unit – I   **D.C.   Machines**: **(8Hrs)**
- Constructional features
- Principles of operation
- EMF equation, Voltage build up phenomenon in a D.C. shunt generator,
- Characteristics of different types of generators.
- Principle of operation of DC motor, back emf,
- Speed and torque equation,
- Various characteristics of different motors

Unit – II   **A.C. Machines: (7Hrs)**
- Constructional features
- Concept of revolving magnetic field, and principle of operation of Three phase induction motors
- Torque slip characteristics and power flow in induction motors
- Induction motor as a transformer, equivalent circuit

Unit – III   **Three Phase synchronous Machine: (7Hrs)**
- Constructional features EMF equation.
- Armature reaction of synchronous generator
- Voltage regulation of generators
- Phasor diagrams and equivalent circuits of synchronous machine
- Starting methods and principle of operation of synchronous motor
- Constructional features EMF equation

Unit – IV   **Control system-Introduction (7Hrs)**
- Introduction to control system,
- Closed loop and open loop systems, examples
- Temperature control, traffic control, numeric control
- General block diagram of a control system, transfer function
- Mason gain formula, Signal Flow graph.

Unit – V   **Components of control systems (7Hrs)**
- Components of control systems, potentiometer.
- Synchro and synchro transmitter and receiver.
- 5.3 Controllers - two position controllers, preparation of controllers, analysis.
- Integrated controllers, electronic PID controllers

Books

Name of Authors	Title of the Book	Publisher
1. D C Kulshreshtha	Basic Electrical Engineering	McGraw Hill Education, 2011.
2. I.J. Nagrath, T.P. Kothari	Basic Electrical Engineering	McGraw-Hill Publishing company Ltd.,
3. Nagsarkar T K and Sukhija M S	Basics of Electrical Engineering	Oxford press
4. GopalM.	Control System Principles and Design	Tata McGraw-Hill, 1998

Subject Name: Measurement & Metrology	
Course Code : **302**	Semester: **III**
Weekly Teaching Hours: TH: **03** Tut: **00**	Scheme of Marking TH: **100** ISE**: 50,** ESE **:50**
Credit:**3**	Scheme of Marking PR: **--**

Unit – I   Introduction to Measurement (9 Hrs)

- Aim, Definition, types, need of inspection, terminologies, methods of measurements, units of measurement, selection of instruments, concept of error (systematic and random), sources of error, Measurement standards, calibration, statistical concepts in metrology.

Unit – II   Linear and Angular Measurements (9 Hrs)

- Linear instruments, Surface plates (size, accuracy and material), slip gauges, Length bars–Calibration of the slip gauges, dial indicator, micrometers. Bevel protractor, spirit levels, sine bar, angle Gauges. Comparators, their types, relative merits and limitation.
- **Miscellaneous measurements:** Taper & Radius measurement.

Unit – III   Measurement of Properties (9 Hrs)

- Temperature, Force, weight, Pressure& flow, Noise, Lux and vibrations. Concept of fitting, tightening and torqueing in a line and its equipment.

Unit – IV   Screw thread and Gear teeth metrology (9 Hrs)

- **Screw Measurement:** Introduction, screw thread terminology, screw thread measurement
- **Gear measurement:** Introduction, types of gears, gear terminology, Gear Teeth Measurement, errors in gears, measurement of spur gear.

Books

Name of Authors	Title of the Book	Publisher
1. Jain R.K	Engineering Metrology	Khanna Publishers, 2005.
2. Gupta. I.C	Engineering Metrology	Dhanpatrai Publications, 2005.
3. Shot bolt	Metrology for Engineers	McGraw Hill, 1990.
4. Backwith, Marangoni, Lienhard	Mechanical Measurements	Pearson Education, 2006.

Subject Name: Microcontroller and Programmable Logic Controller	
Course Code : **303**	Semester: **III**
Weekly Teaching Hours: TH: **3** Tut: **00**	Scheme of Marking TH: 100 **ISE: 50, ESE:50**
Credit:**3**	Scheme of Marking PR: **50**

Unit – I **Introduction (7 Hrs)**
- Comparing Microprocessors and Microcontrollers.
- Technological trends in Microcontrollers development.
- Microcontrollers- 8 bit, 16 bit, 32 bit microcontrollers.
- Applications of microcontrollers

Unit – II **8051 Architecture(7 Hrs)**
- Block diagram, pin. Diagram of 8051.
- Functional descriptions of internal units, registers, PSW, internal RAM ROM, Stack, Oscillator and Clock.
- Counters and timers, Serial data interrupt Serial data transmission and transmission modes.
- Timer flag interrupt. External interrupt, software generated interrupts

Unit – III **8051 Instruction Set And Programming(7 Hrs)**
- 8051 Instruction syntax, addressing modes, Data transfer instructions, logical instructions, arithmetic instructions, Jump and Call instructions.
- Interrupts and interrupt handler subroutines. Writing assembly Language programs.

Unit – IV **Programmable Logic Controllers(7 Hrs)**
- Introduction – Parts of PLC, Principles of operation
- PLC sizes – PLC hardware components – I/O section Analog I/O Section Analog I/O modules –digital I/O modules CPU processor memory module
- Programming devices – PLC programming Simple instructions – Manually operated switches – Mechanically operated and Proximity switches
- Output control devices - Latching relays PLC ladder diagram, Converting simple relay ladder diagram in to PLC relay ladder diagram

Unit – V
- **Timers, Counters and Their Applications (7 Hrs)**
- Timer instructions ON DELAY, OFF DELAY and RETENTIVE Timers
- UP COUNTER, DOWN COUNTER and UP DOWN COUNTERS
- Control instructions – Data manipulating instructions, math instructions; Applications of PLC – Simple materials handling applications.

Books

Name of Authors	Title of the Book	Publisher
1. Kennath J. Ayala	The 8051 Microcontroller Architecture, Programming and Applications,	Penram International Publishing (India), Second Edition, Mumbai.
2. Frank D. Petruzella	Programmable Logic Controllers	McGraw–Hill Book, Company, 1989.
3. B.P. Singh	Microprocessors and Microcontrollers	Galcotia Publications (P) Ltd, First edition, New Delhi, 1997.
4. ---	Embedded Controller Hand book	Intel Corporation, USA.
5. ---	Microcontroller Hand Book	INTEL, 1984.

Subject Name: Microcontroller and programmable logic controller lab	
Course Code : **304**	Semester: **III**
Weekly Practicals: PR: **02** Tut: **00**	Scheme of Marking TH: **--**
Credit:**01**	Scheme of Marking PR: **50,** Total: **50**

1.Familiarization of Micro Controllers (8051) kit

2.Write an Assembly language Programme (ALP) to generate 10 kHz square wave

3. Write an ALP to generate 10 kHz frequency using interrupts.

4. Write an ALP for temperature and pressure measurement.

5. Write an ALP to interface one Microcontroller with other wring serial/parallel communication.

6. Make the Ladder diagram logics gates.

Subject Name: Sensors and Transducers Lab	
Course Code : **305**	Semester: **III**
Weekly Practicals: PR: **02** Tut: **00**	Scheme of Marking TH: **--**
Credit:**01**	Scheme of Marking PR: **50,** Total: **50**

1. Speed measurement using inductive pickup/proximity sensor

2. Measurement to temperature using thermocouple

3. Measurement to temperature using thermistor

4. Measurement to temperature using RTD

5. Measurement of displacement using LVDT & Capacitive transducer,

6. Measurement of displacement using position and velocity measurement using encoders,

Subject Name: Manufacturing Automation & Ergonomics	
Course Code : **401**	Semester: **IV**
Weekly Teaching Hours: TH: **03** Tut: **00**	Scheme of Marking TH: 100 **ISE:50, ESE :50**
Credit:**3**	Scheme of Marking PR: **--**

Unit – I **Introduction (8 Hrs)**
- Types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools. Mechanical feeding and tool changing and machine tool control transfer the automation. Manufacturing automation principles and elements in product realization

Unit – II **Automated Flow LinesAssembly systems and Line balancing (7 Hrs)**
- Methods, Mechanical buffer storage control function, Design and fabrication consideration.
- Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines. Latest technologies being employed in Industry 4.0 era for achieving higher efficiency

Unit – III **Advancement in Manufacturing (7 Hrs)**
- Application of Nanotechnology and allied field, AFM, SEM, TEM, Advanced electronic Packaging.

Unit – IV **Introduction To Robotics (7 Hrs)**
- Classifications of robots, Work envelope, manipulators- Electronic and Pneumatic manipulators, end effectors. Applications of Robots

Unit – V **Introduction to Ergonomics (7 Hrs)**
- Evolution of Ergonomics, Introduction, Definitions of Ergonomics, The Scope of Ergonomics, Aspects of Ergonomics Application Areas of Ergonomics, Man and Machine Interaction.

Books

	Name of Authors	Title of the Book	Publisher
1.	Mikell P. Grover	Automation, Production Systems and Computer-Integrated Manufacturing	Pearson Education, New Delhi. ISBN: 0132393212
2.	Antony Esposito	Fluid power with Applications	Pearson Education India. ISBN:8177585800
3.	Andrew Parr	Hydraulic and Pneumatics	Butterworth-Heinemann. ISBN:0750644192
4.	Bolton. W.	Pneumatic and Hydraulic Systems	Elsevier Science & Technology Books.ISBN:0750638362
5.	N. Viswanandham, Y. Narhari	Performance Modeling of Automated Manufacturing Systems	Prentice-Hall. ISBN: 0136588247
6.	S. R. Mujumdar	Pneumatic system	Tata McGraw Hill. ISBN: 0074602314
7.	W Bolton	Mechatronics: Electronic Control Systems in Mechanical and ElectricalEngineering	Prentice-Hall. ISBN: 0131216333
8.	C D Johnson	Process Control Instrumentation Technology	Prentice Hall of India, New Delhi. ISBN: 8120309871.

Subject Name: Project Management	
Course Code : **402**	Semester: **IV**
Weekly Teaching Hours: TH: **03** Tut: **00**	Scheme of Marking TH: 100 **ISE:50, ESE :50**
Credit:**3**	Scheme of Marking PR: **--**

Unit – I   **Basics of Project Management (7 Hrs)**
- Introduction to Project Management, Objective of Project Management, Project Characteristics, Product Life Cycle Management, Devising Product Life Cycle Management Database

Unit – II   **Project Life cycle (7 Hrs)**
- The Project Life Cycle, Phases of Project Management Life Cycle, Project Management Processes, Project Identification Process, Project Initiation

Unit – III   **Project Planning (7 Hrs)**
- Project Planning, Need of Project Planning, Project Planning Process, Project Identification Process, Project Initiation. Feasibility Studies, Project Break-even point, Project Planning, Need of Project Planning, Project Planning Process.

Unit – IV   **Project Execution and Control (7 Hrs)**
- Project Execution, Project Close-out, Steps for Closing the Project, Project Termination, Project Follow-up, Classification of Projects, Project Performance Measurement, Project Performance Evaluation, Benefits and Challenges of Performance

Unit – V   **Project Performance Measurement and Evaluation (7 Hrs)**
- Measurement and Evaluation, Controlling the Projects, Work Breakdown Structure
- Development of Project Network, PERT, CPM Model. Project Management Information System, Social Cost Benefit Analysis, Steps for Project Success, Case Studies in Project Management, Activity planning through GANTT Chart.

Books

Name of Authors	Title of the Book	Publisher
1. P. Chandra	Projects	7th edition, Tata McGraw Hill
2. S. Chaudhary	Project Management	Tata McGraw Hill
3. Bhavesh M Patel	(2000): Project Management	Vikas publishing house
4. RamarajuThirumalai	(2002): Project Management	Himalaya publishing house
5. Jeffery K. Pinto	(2012): Project Management	2nd edition, Pearson Education

Course Code : **403**	Semester: **IV**	
Weekly Teaching Hours: TH: **03** Tut: **00**	Scheme of Marking TH: **100**	**ISE:50, ESE :50**
Credit:**3**	Scheme of Marking PR: **--**	

Unit – I **Introduction to Maintenance & its Planning (8 Hrs)**
- 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 (7 Hrs)**
- Maintenance Order Release, Goods issue for Maintenance Order, Confirmation of Maintenance Order, Closing of Maintenance Order, Creation of Measuring Document

Unit – III **Preventive Maintenance (7 Hrs)**
- 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 (7 Hrs)**
- 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(7 Hrs)**
- : 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.

Books

Name of Authors	Title of the Book	Publisher
Reinhold A. Carlson, Robert A. Di Giandomenico	Understanding Building Automation Systems (Direct Digital Control, Energy Management, Life Safety, Security, Access Control, Lighting, Building Management Programs)	---
---	Building Automation: Control Devices and Applications	In Partnership with NJATC (2008)
CIBSE (2000)	Building Control Systems, Applications Guide (CIBSE Guide)	---
S. K. Srivastava	MAINTENANCE ENGG. PRINCIPLES, PRACTICES & MANAGEMENT	---

Subject Name: Applied Hydraulics & Pneumatics Lab	
Course Code : **404**	Semester: **IV**
Weekly Practical: PR: **02** Tut: **00**	Scheme of Marking TH: **--**
Credit:**01**	Scheme of Marking PR: **50** Total: **50**

1. Determination of friction factor for a given set of pipes.

2. Determination of the Coefficient of discharge of given Venturi meter.

3. Determination of viscosity by capillary tube viscometer

4. Flow visualization using Reynolds apparatus

5. Study of Counter Balancing Circuit on Hydraulic Trainer

6. Controlling the Speed of the Cylinder Using Metering In and out valve circuit.

Subject Name: Computer Numerical Control Machines lab	
Course Code : **405**	Semester: **IV**
Weekly Practical: PR: **02** Tut: **00**	Scheme of Marking TH: **--**
Credit:**05**	Scheme of Marking PR: **50** Total: **50**

1. To study G codes and M codes

2. To study NC/CNC machining tools.

3. To familiarize with control panel.

4. To familiarize with different co-ordinate systems.

5. To perform setting and off-setting the component.

6. To learn programming technique such as interpolation, helical and compensation and their application

Syllabus
Name of the Course: B. Voc (Automobile Mechatronics)
Semester V

Subject Name: Mounting and Communication of sensor		
Course Code : **501**	Semester: **V**	
Weekly Teaching Hours: TH: **03** Tut: **00**	Scheme of Marking TH: 100	ISE: 50, ESE: 50
Credits :03	Scheme of Marking PR: **--**	

Unit – I   **Sensor Mounting and Location Principle (8hrs)**

Introduction to sensor mounting, different type of sensor mounting, Mounting procedure of different type of robotics sensor (tactile, proximity, pressure, force, velocity, vision sensor etc.).

Unit – II   **Calibration Methods of Sensors (7hrs)**

Introduction to sensor calibration, need of calibration, different types of sensor calibration methods, Measurement characteristic of sensor, Calibration examples for different sensors

Unit – III   **Sensor Interfacing (7hrs)**

Introduction to sensor interfacing, different methodologies of sensor interfacing, IoT devices for sensor interfacing, Sensor interfacing applications.

Unit – IV   **Communication techniques of sensors (7hrs)**

Communication and networking of sensors, control of manufacturing process, detection of machining faults, diagnostic systems, resonance vibration analyzer, sensing motor current for signature analysis, temperature sensing.

Unit – V   **Communication System (7hrs)**

Introduction to DAQ, Components of a Data Acquisition System; Sampling, sing, Sample and hold circuit, Quantization; Analog-to-digital converters (4 bit essive Approximation type ADC); Digital-to-Analog converters (4 bit R2R type DAC)

Books

Name of Authors	Title of the Book	Publisher
1. Walteneus Dargie, Poellabaur	Christian Fundamentals of wireless sensor Network	Wiley edition
2. D Patranabis	Sesnors and transducers	Second Edition PHI publication
3. Horst Ezichos	Measurement, Testing and Sensor Technology	Springer Publication
4. Clarence W. de Silva	Sensor System Fundamentals and application	Taylor and Francis

Subject Name: Rapid Prototyping and 3D Printing	
Course Code : **502**	Semester: **V**
Weekly Teaching Hours: TH: **03** Tut: **00**	Scheme of Marking TH: **100,** ISE: **50**, ESE: **50**
Credit:**3**	Scheme of Marking PR: **--**

Unit – I   Various CAD issues (8hrs)
- Fundamentals of 3D printing and rapid prototyping (RP) technologies
- for 3D printing and rapid prototyping, CAD and RP interfacing, triangular surface modelling and manipulation for 3D printing and additive manufacturing processes.

Unit – II   Reverse engineering (7hrs)
- Digitizing, laser scanning, CT-scanning, point cloud manipulation, data segmentation, surface reconstruction, model further processing.

Unit – III   Liquid based processes for 3D printing and additive manufacturing(7hrs)
- principles of
- Stereo lithography and typical processes, such as the SLA process, solid ground curing and others.
- Powder based processes for 3D printing and additive manufacturing: principles and typical processes, such as selective laser sintering and some other 3D printing processes.

Unit – IV   Solid based processes for 3D printing and additive manufacturing (7hrs)
- principles and typical
- Processes, such as fused deposition modelling, laminated object modelling and others.

Unit – V   Rapid tooling (7hrs)
- Principles and typical processes for quick batch production of plastic and metal parts through quick tooling.
- **Software for RP:** STL files, Overview of Solid view, magic's, mimics, magic communicator, etc. Internet based software, Collaboration tools.

Books

Name of Authors	Title of the Book	Publisher
1. Paul F. Jacobs	Rapid Prototyping & Manufacturing: Fundamentals of Stereo lithography	Society of Manufacturing Engineers, Dearborn, 1992
2. Chua Chee Kai and Leong Kah Fai	3D Printing and Additive Manufacturing - Principles and Applications (with Companion Media Pack)	Fourth Edition of Rapid Prototyping, World Scientific Publishing Co., October 2014
3. Gurumurthi	Rapid Prototyping Materials	IISc Bangalore

Subject Name: Design of Mechatronics	
Course Code : **503**	Semester: **V**
Weekly Teaching Hours: TH: **03** Tut: **00**	Scheme of Marking TH: **100**, ISE: **50**, ESE: **50**
Credit:**3**	Scheme of Marking PR: **--**

Hours

Unit – I   Introduction To Mechatronics System Design (7hrs)   08
- Need for Mechatronics in Industries - Benefits
- Mechatronics approach - Challenges before R&D in Mechatronics.
- Integrated design issues in Mechatronics - Mechatronics key elements
- The Mechatronics design process.
- Advanced approaches in Mechatronics.

Unit – II   Principles Of Modeling & Simulation (7hrs)   07
- Introduction - Model categories.
- FIELDS OF APPLICATION - Bottom up design - Top down design Relationship of design strategies to modeling - Modeling for the specification - Modeling for the design.
- MODEL DEVELOPMENT - Structural modeling - Physical modeling - Experimental modeling.
- Model verification - Model validation - Model simplification.
- SIMULATORS & SIMULATION - Circuit - Logic – Multi-body - Block Diagram Finite element and Software simulation.

Unit – III   Basic System Models (7hrs)   07

- Mathematical models.
- Mechanical system building blocks.
- Electrical system building blocks.
- Fluid system building block

Unit – IV   Case Studies On Mechatronic System (7hrs)   07

- Introduction –Fuzzy based Washing machine – pH control system – Autofocus Camera
- exposure control– Motion control using D.C.Motor& Solenoids, Control of pick and place robot

Unit – V   Advanced Applications In Mechatronics System Design (7hrs)   07
- Sensors for condition monitoring
- Mechatronic control in automated manufacturing.
- Artificial intelligence in mechatronics.
- Fuzzy logic applications in mechatronics.
- Micro sensors in mechatronics.

Books

Name of Authors	Title of the Book	Publisher
1. Georg Pelz	Mechatronic Systems: Modeling and simulation with HDL's	Joh wileyandsons Ltd, 2003.
2. Devdas Shetty, Richard A. Kolk	Mechatronics System Design	Thomson Learning Publishing Company, Vikas publishing house, 2001.
3. Bolton	Mechatronics - Electronic Control systems in Mechanical and Electrical Engineering	2nd Edition, Addison Wesley Longman Ltd., 1999
4. Bishop, Robert H	Mechatronics Hand book	CRC Press, 2002.
5. Bradley, D.Dawson, N.C. Burd and A.J. Loader	Mechatronics: Electronics in Products and Processes	Chapman and Hall, London, 1991.

Subject Name: Design of Mechatronics Lab	
Course Code : **504**	Semester: **V**
Weekly Practical: PR: **02** Tut: **00**	Scheme of Marking TH: **--**
Credit:**01**	Scheme of Marking PR: **50,** Total: **50**

1. To study implementation of motion control system.

2. To study implementation of compensator design.

3. To study implementation of dynamic tuning of controller gains.

4. To study and Implementation of digital control algorithms for process control with minicomputers

5. To study Implementation, testing and debug of interface module.

6. Familiarization with various sensors, actuators, and process in the Automatic Control laboratory

Syllabus
Name of the Course: B. Voc (Foundry Technology)
Semester V

Project Work- Stage I	
Course Code: 505	
Working Hrs:PR:04	TW: 100, Total Marks: 100
Credit:2	

Students are allowed to select the topic of their project work subject to approval of the scope by the faculty. Maximum 4 students can work in group for a common topic. Students are expected to visit the site, shops, etc. They can discuss the topic with manufactures, owners, consultants.

Syllabus
Name of the Course: B. Voc (Automobile Mechatronics)
Semester VI

Subject Name: Applied Mechatronics	
Course Code :**601**	Semester: **VI**
Weekly Teaching Hours: TH: **03** Tut: **00**	Scheme of Marking TH: 100**,** ISE: **50**, ESE: **50**
Credit:**3**	Scheme of Marking PR: **--**

Unit – I   **Introduction (6hrs)**
- Introduction
- Power Electronics Vs Linear Electronics
- Scope & Applications

Unit – II   **Power Semiconductor Devices (6hrs)**
- Introduction
- Basic Structure, Characteristics, Operation, Limitations Power Diodes
- BJTs & MOSFETs Thyristors, GTOs IGBTs

Unit – III   **Converters (8hrs)**
- Introduction
- Control of dc – converters
- Buck Converter
- Boost Converter
- Buck - Boost Converter
- Full Bridge dc - dc Converter

Unit – IV   **Ac To Ac Converters (8hrs)**
- Single phase and Three phase AC voltage controllers–Control strategy- Power Factor Control – Multistage sequence control -single phase and three phase cyclo converters –Introduction to Matrix converters.

Unit – V   **Phase Controlled Rectifiers (8hrs)**
- Introduction
- Thyristor Circuits
- Single Phase Converters
- Three Phase Converters

Books

Name of Authors	Title of the Book	
1. James Homphires&Lestie Sheets	Industrial Electronics	---
2. M.H. Rashid	Power Electronics Circuits Devices & Applications	---
3. P.C. Sen, KjeldThorborg	Power Electronics	---

Subject Name: Leadership & Quality Management	
Course Code : **602**	Semester: **VI**
Weekly Teaching Hours: TH: **03** Tut: **00**	Scheme of Marking TH: 100**,** ISE: 50, ISE:50
Credit:**3**	Scheme of Marking PR: **--**

Unit – I   **Concept of Leadership (8hrs)**
- Trait and Behavioral Approaches, Contingency Approach, Leadership and Values, Leadership Behaviors, Courage and Moral Leadership

Unit – II   **Motivation and Empowerment(6hrs)**
- Leadership Diversity, Leader as Social Architect, Leadership and Change

Unit – III   **Problem Solving Methods (8hrs)**
- Resource Management, Work effectively in a Team, Process and Product Quality Monitoring,
- Evolution of Quality Management, Concepts of Product and Service Quality, Introduction to Process Quality, Graphical and statistical techniques for Process Quality Improvement,

Unit – IV   **7 QC Tools, Control Charts (6 hrs)**
- TQM, Benchmarking, Quality Audit, Quality Circles, OEM Guidelines, Quality Function Deployment

Unit – V   **Robust Design and Taguchi Method (8hrs)**
- Design Failure Mode & Effect Analysis, Product Reliability Analysis, Case study on Six Sigma in Product Development, Kaizen, 5S, etc.

Books

Name of Authors	Title of the Book	Publisher
1. Daft, Richard L	Leadership	Cengage Learning India Pvt. Ltd., New Delhi.
2. Hughes, Richard L, Robert C., Ginnett and Gordon J, Curphy	Leadership – Enhancing the Lessons of Experienc	Tata McGraw Hill Co. Ltd, New Delhi
3. D. C. Montgomery	Introduction to Statistical Quality Control	John Wiley & Sons, 3rd Edition.
4. Mitra A	Fundamentals of Quality Control and Improvement	PHI, 2nd Ed., 1998
5. Besterfield, D H et al	Total Quality Management	3rd Edition,Pearson Education, 2008

Syllabus	
Name of the Course: B. Voc (Foundry Technology)	
Semester VI	
Project Work-Stage II	
Course Code: 603	Semester: VI
Working Hrs, PR: 04	TW:200, Total Marks: 200
Credit:02	

Students are allowed to select the topic of their project work subject to approval of the scope by the faculty. Maximum 4 students can work in group for a common topic. Students are expected to visit the site, shops, etc. They can discuss the topic with manufactures, owners, consultants. The project report comprising drawing, sketches, photographs and description must be elaborate to cover the topic in its entirety. The Drawing should specify sizing followed by report writing.

The oral examination based on the project work submitted, shall be conducted in the presence of an external examiner.