

Annexure-III

SHRI VISHWAKARMA SKILL UNIVERSITY

(A STATE GOVT SKILL UNIVERSITY ESTABLISHED BY GOVT.OF HARYANA)

Name of the Skill Faculty: Skill Faculty of Engineering & Technology

**Name of the Programme/Course: B. Voc. (Mechatronics) with
Hero MotoCorp Ltd.**

Duration of the course: 3 Years (6Semesters)

Batch-2019-2022 Onwards

Semester-I

Category	Subject Code	Subject Name	Credits			Marks							Hrs		
						Theory			Practical			Total			
			T	P	TO	I	E	TO	I	E	TO	(T+P)	T	P	TO
General Education Component	ENG-501 ENG-501L	Communication Skills	3	1	4	15	35	50	35	15	50	100	45	30	75
	ME-505 ME-505L	Workshop Technology	3	1	4	15	35	50	35	15	50	100	45	30	75
	MTH-501	Applied Mathematics	4	0	4	30	70	100	-	-	-	100	60	-	60
	CSE-501 CSE-501L	Fundamental of Computers	3	1	4	15	35	50	35	15	50	100	45	30	75
	IMS-501 IMS-501L	Fundamental of Industrial Management and Safety	3	1	4	15	35	50	35	15	50	100	45	30	75
	Total			16	4	20	90	210	300	140	60	200	500	240	120
Skill Education Component	ME-506L	Basics of Mechatronics	0	4	4	-	-	-	70	30	100	100	0	120	120
	ME-503 ME-503L	Measurement and Metrology	3	1	4	15	35	50	35	15	50	100	45	30	75
	ME-501L	Engineering Graphics and Drawing	0	4	4	-	-	-	70	30	100	100	-	120	120
	Total			3	9	12	15	35	50	175	75	250	300	45	270
Grand Total			19	13	32	105	245	350	315	135	450	800	285	390	675

Semester-II															
Category	Subject Code	Subject Name	Credits			Marks							Hrs		
						Theory			Practical			Total			
			T	P	TO	I	E	TO	I	E	TO	(T+P)	T	P	TO
General Education Component	OET- 502	* MOOC/ Online Course-1 (Industrial Automation & Control)	2	0	2	30	70	100	0	0	0	100	30	0	30
	OMS -501	Entrepreneurship (MOOC/ Online Course-II)	2	0	2	30	70	100	0	0	0	100	30	0	30
	Total		4	0	4	60	140	200	0	0	0	200	60	0	60
Skill Education Component	OJT-501	On Job Training (OJT)	0	24	24	-	-	0	245	105	350	350	0	1080	1080
	Total		0	24	24	0	0	0	245	105	350	350	0	1080	1080
Grand Total			4	24	28	60	140	200	245	105	350	550	60	1080	1140

*Note: Relevant Mooc /Online Course will be offered as per the availability

Job Roles: Level-5(Sr. Maintenance Technician)

Semester-III

Category	Subject Code	Subject Name	Credits			Marks							Hrs		
						Theory			Practical			Total			
			T	P	TO	I	E	TO	I	E	TO	(T+P)	T	P	TO
General Education Component	PHY-601 PHY-601L	Applied Physics	3	1	4	15	35	50	35	15	50	100	45	30	75
	EE-603 EE-603L	Electrical Machines & Control systems	2	2	4	15	35	50	35	15	50	100	30	60	90
	ME-605 ME-605L	Hydraulics and Pneumatics	3	1	4	15	35	50	35	15	50	100	45	30	75
	ECE-601 ECE-601L	Digital and Power Electronics	3	2	5	15	35	50	35	15	50	100	45	60	105
	EVS-601	EVS	4	0	4	30	70	100	-	-	-	100	60	-	60
	Total			15	6	21	90	210	300	140	60	200	500	225	180
Skill Education Component	ME-606L	Plant Maintenance and Safety	0	4	4	-	-	-	70	30	100	100	0	120	120
	ECE-604 ECE-604L	Microcontroller and Programmable Logic Controller	3	1	4	15	35	50	35	15	50	100	45	30	75
	ME-607L	Fundamental of CNC Machines Programming	0	4	4	-	-	-	70	30	100	100	0	120	120
	Total			3	9	12	15	35	50	175	60	250	300	45	270
Grand Total			18	15	32	105	245	350	315	120	450	750	270	450	720

Semester-IV																	
Category	Subject Code	Subject Name	Credits			Marks									Hrs		
						Theory			Practical			Total					
			T	P	TO	I	E	TO	I	E	TO	(T+P)	T	P	TO		
General Education Component		*MOOC/ Online Course-III	2	0	2	30	70	100	0	0	0	100	30	0	30		
		Value Education & Professional ethics (MOOC/ Online Course-IV)	2	0	2	30	70	100	0	0	0	100	30	0	30		
	Total		4	0	4	60	140	200	0	0	0	200	60	0	60		
Skill Education Component	OJT-601	On Job Training (OJT)	0	24	24	-	-	0	245	105	350	350	0	1080	1080		
	Total		0	24	24	0	0	0	245	105	350	350	0	1080	1080		
Grand Total			4	24	28	60	140	200	245	105	350	550	60	1080	1140		

*Note: Relevant Mooc /Online Course will be offered as per the availability

Job Role: Level 6(Assistant Supervisor)

Semester-V

Category	Subject Code	Subject Name	Credits			Marks							Hrs		
						Theory			Practical			Total			
			T	P	TO	I	E	TO	I	E	TO	(T+P)	T	P	TO
General Education Component	ECE-702 ECE-702L	Sensors and Transducers	2	1	3	15	35	50	35	15	50	100	30	30	60
	CSE-701 CSE-701L	Industry 4.0	3	1	4	15	35	50	35	15	50	100	45	30	75
	IMS-704	Leadership & Quality Management	4	0	4	30	70	100	-	-	-	100	60	-	60
	MTE-701 MTE-701L	Applied Mechatronics	3	1	4	15	35	50	35	15	50	100	45	30	75
	ME-705 ME-705L	Manufacturing Automation & Ergonomics	3	1	4	15	35	50	35	15	50	100	45	30	75
	Total			15	4	20	90	210	300	140	60	200	500	225	120
Skill Education Component	EE-703L	PLC and SCADA	0	4	4	-	-	-	70	30	100	100	0	120	120
	MTE-702 MTE-702L	Design of Mechatronics	3	1	4	15	35	50	35	15	50	100	45	30	75
	ETP-701	Project	0	4	4	-	-	-	70	30	100	100	-	120	120
	Total			3	9	12	15	35	50	175	75	250	300	45	270
Grand Total			18	13	32	105	245	350	315	135	450	800	270	390	660

Semester-VI															
Category	Subject Code	Subject Name	Credits			Marks							Hrs		
						Theory			Practical			Total			
			T	P	TO	I	E	TO	I	E	TO	(T+P)	T	P	TO
General Education Component		*MOOC/ Online Course-V	2	0	2	30	70	100	0	0	0	100	30	0	30
		Consumer Affairs(MOOC/ Online Course-VI)	2	0	2	30	70	100	0	0	0	100	30	0	30
	Total		4	0	4	60	140	200	0	0	0	200	60	0	60
Skill Education Component	OJT-701	On Job Training (OJT)	0	24	24	-	-	0	245	105	350	350	0	1080	1080
	Total		0	24	24	0	0	0	245	105	350	350	0	1080	1080
Grand Total			4	24	28	60	140	200	245	105	350	550	60	1080	1140

*Note: Relevant Mooc /Online Course will be offered as per the availability

Job Roles: Level-7 (Supervisor)

Syllabus
1st Year (First Semester)
for
B.Voc. (Mechatronics)
Industry Partner
HERO
Session (2019-2022) onwards

SUBJECT: Communication Skills

CODE: ENG-501

CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
3	45	15	35	50

Objectives

- To inculcate in students professional and ethical attitude, effective communication skills, teamwork, skills, multidisciplinary approach and an ability to understand engineer's social responsibilities.
- To inculcate in students written communication skills.

Learning Outcomes

- The syllabus introduces students to have basic skill set of channelizing information, self-development, decision making and interpersonal skills.

Unit	Topic	Key Learning
I	Communication	<ul style="list-style-type: none">• Meaning of Communication, Importance of Communication, Types of communication. Process of communication• Communication network in an organization• Barriers to communication, Essentials of good communication
II	Remedial English Grammar Understanding and applying Vocabulary	<ul style="list-style-type: none">• Articles, agreement between verb and subject, uses of tenses, Modal and their uses, Prepositions.• One word substitutes, Synonyms and Antonyms Word formation:-Prefixes, Bases and Suffixes.
III	Listening Skills	<ul style="list-style-type: none">• The process of listening, Types of listening, Benefits of effective listening• Barriers to listening, listening to announcements at work place.
IV	Reading Skills	<ul style="list-style-type: none">• 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.
V	Writing Skills	<ul style="list-style-type: none">• Main Forms of Written Communication: Notices, Drafting an E-mail• Correspondence: Personal and Official, Notices,• Technical Report Writing, Preparing agenda and minutes of meeting

Suggested Readings:

- Sethi, J & et al. A Practice Course in English Pronunciation, Prentice Hall of India, New Delhi.
- Sen, Leena. Communication Skills, Prentice Hall of India, New Delhi.

- Prasad, P. Communication Skills, S.K. Kataria& Sons.
- Bansal, R.K. and J.B. Harrison. Spoken English, Orient Language.
- Roach Peter. English Phonetics and Phonology.
- A.S. Hornby's. Oxford Advanced Learners Dictionary of Current English, 7th Edition.
- Prasad, P. The Functional Aspects of Communication Skills, Delhi.
- McCarthy, Michael. English Vocabulary in Use, Cambridge University Press.
- Rajinder Pal and PremLata. English Grammar and Composition, Sultan Chand Publication.
- Idioms & Phrases (English-Hindi), Arihant Publication (India) Pvt. Ltd.
- One Word Substitution, Dr. Ashok Kumar Singh, Arihant Publications (India) Pvt, Ltd

Shri Vishwakarma Skill University

Subject Name: Communication Skills Lab

Paper Code: ENG-501L

CATEGORY: General Education Component

List of Experiments:

Credit	Hours	Marks		
1	30	I	E	To
		35	15	50

1. Greeting and starting of conversation.
2. Nonverbal communication techniques during conversation.
3. Verbal communication techniques during conversation.
4. Group discussion.
5. Extempore public speaking.
6. Reading activity
7. Situational dialogues /Role play.
8. PPT presentation technique
9. Outcome based communication skill assignments

Shri Vishwakarma Skill University

SUBJECT: Work Shop Technology

CODE: ME-505

CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
3	45	15	35	50

Learning Outcomes

- Exposure to mechanical workshop layout and safety aspects.
- Understand the functions of various machines and cutting tools used in machine shop
- Practical real time job preparation using various operations related to machine shop such as filing, drilling, milling, turning, grinding, welding etc.
- Practice job preparation on welding shop.
- Learn to use different measuring tools like vernier calliper, micrometer, height gauge etc.
- Practice job preparation in fitting shop

Unit	Topic	Key Learning
I	Introduction to Manufacturing and Metal cutting	<ul style="list-style-type: none">• Definition of manufacturing process, its classification types, primary and secondary manufacturing processes• selection of a manufacturing process, types of production. Machine Tools; Definition,• its functions and classification, introduction to machining operations and common features of metal cutting• Definition and working principle of single point cutting tool, geometry of single point cutting tool, tool signature, orthogonal and oblique cutting• chips formation, types of chips, cutting Parameters- Cutting speed, feed and depth of cut.
II	Cutting Tool Materials, Surface coating & Introduction to welding processes	<ul style="list-style-type: none">• Properties and uses of cutting tool material viz; High-speed steel, tungsten carbide, cobalt steel cemented carbides, ceramics and diamond• Introduction, Function and its types, Specification and selection of cutting fluid• Surface coatings, types, composition of the paints and purpose of usage.• Electric arc welding: working principle, use of AC and DC current in welding• TIG welding, MIG welding, Introduction to gas welding.
III	Lathe and Grinding machines	Introduction, working principle, its construction and specifications. <i>Lathe classification; Bench, Tool room, Capstan and Turret, Automatic and Special purpose lathes.</i>

		<ul style="list-style-type: none"> • <i>Lathe Operations:</i> Plain and step turning, Taper turning; taper calculations, methods of taper turning, parting off, drilling, boring, knurling • Screw cutting on lathe-introduction to right and left threads, lathe setting for screw cutting-simple and compound gear trains • Cutting parameters- Speed, feed and depth of cut, machining time. • <i>Lathe Accessories:</i> Centres; live and dead centre, Chucks; three jaw universal chuck, four jaw independent chuck, magnetic chuck, air or hydraulic chuck, Lathe carriers or dogs • Driving plate, Face plate, angle plate, mandrels, rests; steady and follower. • <i>Lathe Attachments;</i> Grinding attachment, Milling attachment, Taper turning attachment • Introduction- Abrasive tools, stones and sticks, grinding wheels– materials, specifications, selection of grinding wheels • Truing and dressing of grinding wheels, abrasives-natural and artificial, speed, feed and depth of cut, use of coolants • <i>Types of grinding machines;</i> cylindrical grinders, surface grinders, centreless grinders, special grinding machines
IV	Drilling, Reaming and Boring machines	<ul style="list-style-type: none"> • Introduction, tools for drilling, its classification, twist drills, twist drill parts and terminology, some important drill dimensions and important angles of drill, drill size and specifications, straight flute drills, • <i>Drilling machine types;</i> Portable, Bench, Radial, Universal, Multiple spindle, Gange, Horizontal and automatic drilling machines • <i>Drilling machine operation;</i> Drilling, Spot facing, Reaming, Boring, Counter boring, Counter Sinking, tap drill size • <i>Drilling machine operation;</i> Drilling, Spot facing, Reaming, Boring, Counter boring, Counter Sinking, tap drill size • Reaming Machine; Introduction, Reamer terminology, Types of reamers-hand reamers, machine reamers, adjustable and taper reamers

		<ul style="list-style-type: none"> • Boring Machines: Introduction, Horizontal boring machines, Vertical boring machines
V	Milling machines and Introduction to Jigs & Fixtures	<p>Introduction, working principle, principal parts, Size and specification, up milling and down milling, <i>Milling machine types:</i> Column and Knee type-hand, plain or horizontal, vertical, universal, Universal milling machine, Planer type milling machine or plan mill. <i>Milling cutters:</i> Plain, Side, End, Face, Metal slitting, Angle milling, Form milling, Woodruff-Key and T-slot milling cutters, Materials for milling cutters, cutting speed and feed.</p> <ul style="list-style-type: none"> • Milling operations; Plain or Slab, Face, Angle, Form, Straddle and Gang, Slot and Groove, Keyway, Side, End, Profile, Gear milling operations • Importance and use of jigs and fixtures, types of jigs, principle of location, locating and clamping devices, advantages of jigs and fixtures

Suggested Readings:

1. Comprehensive Workshop Technology (Manufacturing Processes), by S. K. Garg, Laxmi Publication
2. Elements of Workshop Technology, S. K. Hajra Choudhury, Hajra Choudhury A K

Reference Book:

1. Production Technology by R. K. Jain, Khanna Publishers

SUBJECT: Work Shop Technology Lab

CODE: ME-505L

CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

Objectives

Learning Outcomes

- Exposure to mechanical workshop layout and safety aspects.
- Understand the functions of various machines and cutting tools used in machine shop
- Practical real time job preparation using various operations related to machine shop such as filing, drilling, milling, turning, grinding, welding etc.
- Practice job preparation on welding shop.
- Learn to use different measuring tools like vernier calliper, micrometer, height gauge etc.
- Practice job preparation in fitting shop.

List of Practicals

1. To prepare jobs in fitting shop
2. To prepare jobs on Lathe machine
3. To prepare job on milling machine
4. To prepare job using TIG and MIG welding
5. Prepare job on drilling machine
6. To prepare job on surface grinder

SUBJECT: Applied Mathematics

CODE: MTH-501

CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
4	60	30	70	100

Objectives

1. Acquire knowledge in matrix theory, a part of linear algebra, which has wider application in engineering problems.
2. To make the student knowledgeable in the area of Permutation and combination, trigonometric functions and to solve engineering problems based on the above concepts.
3. To make the student knowledgeable with basic and applied mathematics for further application.

Learning Outcomes

- The graduates will become familiar with fundamentals of various Mathematical concepts.
- Students will be able to set up and solve linear systems/linear inequalities graphically/geometrically and algebraically
- Students will be able to formulate problems in the language of sets and perform set operations, and will be able apply the Fundamental Principle of Counting, Multiplication Principle.
- Solve equations and inequalities, both algebraically and graphically, and Solving and model applied problems.

Unit	Topic	Key Learning
I	Algebra	<ul style="list-style-type: none">• Set theory• Permutation and Combination• Binomial theorem (expansion without proof)• Types of functions – linear, quadratic, polynomial, exponential and logarithmic
II	Trigonometric functions	<ul style="list-style-type: none">• Review of ratio of some standard angles (0, 30, 45, 60, 90 degrees)• Addition, subtraction and product formulae• Multiple and submultiples angles (2A, 3A, A/2)• Height and distance
III	Determinants and matrix	<ul style="list-style-type: none">• Introduction to Determinant and matrices• Algebra of matrices (up to third order)• Inverse of matrix by Adjoint method (up to second order)• Solution of system of linear equations by Cramer's rule
IV	Differential calculus	<ul style="list-style-type: none">• Rules of differentiation – simple standard forms (involving one variable)• Derivatives of algebraic and trigonometric functions• Differentiation of function of a function• Chain rule

V	Integral calculus	<ul style="list-style-type: none">• Integral of standard forms• Simple integration by substitution• Integration by parts and by fractions (for linear factor only)• Evaluation of definite integrals
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Suggested Readings:

- NCERT- 11th and 12th Mathematics.
- Advanced Engineering Mathematics, E. Kresyzig, John Wiley and Sons. (latest edition).
- Higher Engineering Mathematics, B.S. Grewal, Khanna Publications
- Advanced Engineering Mathematics, R.A Jain and S.R.K Iyengar. Narosa Publications.
- Engineering Mathematics, N.P Bali, Laxmi Publications.

Shri Vishwakarma Skill University

SUBJECT: Fundamentals of Computer
CODE: CSE-501
CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
3	45	15	35	50

Objectives

- The syllabus introduces students to basic information and communication technology and proper paradigms that need to be implemented to develop any kind of computer applications. The course will help in developing the basic technical skills by hands on experience.

Learning Outcomes

- Students will be able to the use the computer for basic purposes of preparing personnel/business letters, viewing information on Internet, sending mails, using internet banking services etc.
- Understand basic computer operations and ICT applications.
- Understand Network troubleshooting.
- Undertake data entry services

Unit	Topic	Key Learning
I	Introduction to Computer System:	1.1 What is Computer, Basic Applications of Computer; Block Diagram of Computer System 1.2 Input / Output Devices, Computer Memory, Concepts of Hardware and Software, Data and Information; Applications of IECT. 1.3 Computer Virus: Definition, Types of viruses, Characteristics of viruses, Anti-virus software, 1.4 Introduction to number system
II	Operating System	<ul style="list-style-type: none"> • Overview of operating system: Definition, Functions of operating system, Need and its services, Types of operating system, Batch Processing, Spooling, Multiprocessing, Multiprogramming • , Time-Sharing, On-Line Processing, Real-Time Processing Basics of window operating system • Comparison between DOS and windows, Switching between DOS and windows • Comparison between Unix and Windows
III	Understanding Office Applications	<ul style="list-style-type: none"> • Introduction to MS Word, Introduction to MS Excel and its applications, Introduction to MS PowerPoint, Menus, Shortcuts, • Document types, Formatting documents • spread sheet and presentations, working with Spreadsheets, Different templates, Macros, Mail merge

IV	Networking	<ul style="list-style-type: none"> • Network Technologies, Introduction to Internet and protocols: TCP/ IP, Network connecting devices, Topologies • HTTP, HTTPS DNS, Hub, Switches • Router, Repeater, Firewalls, Digital Signature.
		<ul style="list-style-type: none"> •
V	Introduction to World Wide Web and ERP	<ul style="list-style-type: none"> • WWW and Web Browsers Introduction, Objectives, Concept of internet • Overview of search engines, popular search engines in use, Surfing the web and websites, Hosting your websites, Planning and Developing the websites, Internet service provider. • Defining ERP, Origin and Need for an ERP System, Benefits of an ERP System, ERP Tools and Software, ERP Selection Methods and Criteria, ERP Selection Process, ERP Vendor Selection, ERP Implementation Lifecycle, Pros and cons of ERP implementation, Factors for the Success of an ERP Implementation, Introduction to SAP

Suggested Readings:

Text Books

1. Computers and Beginners by Jain, V.K.;
2. Computer Fundamentals by Anita Goel, Pearson.

Reference Books

1. Introduction to Information Technology, Leon Tech World by Leon and Leon
2. Foundations of Computing, BPB Publication by Sinha, Kr. Pradeep and Preeti Sinha;
3. Word Processing and Typing by Sharon Spencer, Heinemann.
4. MS Office by S.S. Srivastava, Firewall Media.
5. Microsoft Office 2010 by Bittu Kumar, V & S Publications
6. Data Communication and Networking by Behrouz.A. Forouzan, McGraw Hill

Web Links <http://cec.nic.in/E-Content/Pages/default.aspx>

Subject Name: Fundamental of Computers Lab

Paper Code: CSE-501L

CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

List of Experiments

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
8. MS-Outlook
9. Case study on Operating systems (Windows/ Ubuntu/ Android/IOS)
10. Networking
11. Software: Preparatory and open domain.
12. Internet skills

Shri Vishwakarma Skill University

Subject Name: Fundamental of Industrial Management and Safety

Paper Code: IMS-501

CATEGORY: General Education Component

Course Objectives:

1. Understanding the knowledge of Quality Control, inspection and quality assurance management used in the organization.
2. Develop the skill for using tool and techniques for quality in Industry
3. Apply elementary knowledge of quality concepts for quality assurance.

Learning Outcome:

- 1 Students will be able to understand the daily management system related to Quality in the shop floor.
- 2 Students will be able to understand all the required processes, ensuring implementation of the same and providing basic inputs for its improvement.
- 3 Student will be able to ensure that the final products manufactured by is as per the quality norms set by the organization.
- 4 Student will able to solve different type of problems in their manufacturing processes.
- 5 Ensure implementation of 5S activities at the shop floor/ office area. Students will be able to analyses the root cause problems in the product & process by using different problem solving techniques.
- 6 Students will able to apply 5S and safety in their work place.

Credit	Hours	Marks		
		I	E	To
3	45	15	35	50

Unit	Topic	Key Learning
I	Concept of Quality, Quality Control and Inspection	1.1 Quality: Definition, History, Importance 1.2 Approaches to define Quality, Cost of Quality, Hierarchy of Quality Management 1.3 Introduction to Quality Control. 1.4 Inspection and its types.
II	Organizational Aspects of Quality Assurance	2.1 Quality Assurance (QA): Introduction, Definition, QA in different stages, Quality Planning. 2.2 ISO: Introduction, ISO 9000 series of standard, Benefits of ISO. 2.3 ISO 9001, Benefits of ISO 9001. 2.4 Quality survey: Scope, Types of audit, inspection methods, Quality budget
III	Problem solving tools and techniques	3.1 Definition of a problem 3.2 Type of problems, classification of problems 3.3 What is problem solving, barriers to problem solving 3.4 Problem solving tools: Introduction to Cause and effect diagram, Histogram, flow chart, Check sheets, Histogram, Pareto charts, Control charts, Scatter Diagram
IV	Total Quality Management	4.1 Basic concept of TQM 4.2 principles of TQM

		4.3 Barriers to TQM implementation 4.4 leadership concepts 4.5 Introduction to TPM 4.6 Quality allied concept: KAIZEN, Poke yoke, JIT, CAPA
V	5 S and Safety	5.1 Detailed concept of 5S and safety used in Industries 5.2 Introduction to Integrated Management system

Suggested Readings:

1. Total quality Management by L.Sganthi&Anand A. Samuel, PHI Publication.
2. Total quality Management by Poornima M Charantimath, Pearson Publication.

Web Reference

www.slideshare.net/MALLURSB/unit-1-quality-total-quality-tqm
<http://smallbusiness.chron.com/quality-important-business-57470.htm>
<https://totalqualitymanagement.wordpress.com/2008/09/12/cost-of-quality>
<https://accountlearning.com/approaches-to-total-quality-management/>
<https://prezi.com/a8qypxkz5uee/hierarchy-of-quality-management>
www.asiainspection.com/quality-control-services/product-and-manufacturing-inspections
<http://whatis.techtarget.com/definition/quality-control-QC>
<http://searchsoftwarequality.techtarget.com/definition/quality-assurance>
www.slideshare.net/Genesys.../the-8-principles-of-quality-assurance-trainin
<http://electronicstechnician.tpub.com/14085/css/Qa-Forms-And-Records-113.htm>
<http://www.businessdictionary.com/definition/quality-planning.html>
<http://smallbusiness.chron.com/build-quality-assurance-program-12955.html>
<http://asq.org/learn-about-quality/iso-9000/overview/overview.html>
<https://www.isoqsltd.com/about-us/what-is-iso>
<https://www.iso.org/iso-9001-quality-management.htm>

Subject Name: Fundamental of Industrial Management and Safety Lab

Paper Code: IMS-501L

CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

List of Experiments

- 1 Draw and Demonstrate the process flow diagram
- 2 Draw and demonstrate problem statement, target /Goal Setting
- 3 Draw and demonstrate Pareto diagram
- 4 Draw and Demonstrate cause and effect diagram
- 5 Data validation and why –why Analysis
- 6 Identification and knowledge of different types of personal protective equipment used in Industry.
- 7 To determine different type of accident, occur in industry.
- 8 To determine different types of first aid used in industry.
- 9 To determine different types of electrical safety used in Industry.
- 10 To determine different types of mechanical safety used in Industry.
- 11 To determine different types of work safety used in Industry.
- 12 To determine HIRA (Hazard identification and risk assessment) in industry.

SUBJECT: Basics of Mechatronics Lab

CODE: ME-506L

CATEGORY: Skill Education Component

Credit	Hours	Marks		
		I	E	To
4	30	70	35	100

Objectives

- To synergies the combination of mechanical, electronics, control engineering and computer.
- Providing a focused laboratory environment to the engineering students to apply and absorb Mechatronics concepts.
- To provide a common ground where students could perform experimental study regarding fundamental sequence control by utilizing various sensors and actuators.

Learning Outcomes

- Practical application of Relay
- Various operations by Pneumatic and hydraulic.
- Operation of Displacement and temperature sensors
- Use of mechanical, electrical components in automation
- Various components of pneumatic and hydraulic operations.

List of Practical's

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.
7. Operation of Double Acting Cylinder Using Single Solenoid Valve.
8. Measurement of displacement using LVDT.
9. Measurement of temperature using thermocouple, thermistor and RTD
10. Introduction of PLC (programmable logic controller).

Subject Name: Measurement of Meteorology

Paper Code: ME-503

CATEGORY: Skill Education Component

Credit	Hours	Marks		
		I	E	To
3	45	15	35	50

Course Objectives:

1. Understand metrology, its advancements & various measuring instruments
2. To study the fundamentals of modern measurement tools and laid standard procedures.
2. To study fundamentals of inspection methods and systems.
3. To acquaint with operation of precision measurement tools and equipment.

Learning Outcomes: Learner will be able to...

1. Explain different measuring instruments to measure the qualitative and quantitative characteristics of different mechanical components.
2. Evaluate quality of job, machine and instruments.
3. Perform calibration of measuring instruments.
4. Analyse parts/instruments for dimensional accuracy and functionality.
5. Describe functioning of force, torque, pressure, vibration and temperature measuring devices.
6. Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design.
7. Understand the objectives of metrology, methods of measurement, selection of measuring instruments, standards of measurement and calibration of instruments.

Unit	Topic	Key Learning
I	Introduction to Measurement	<ul style="list-style-type: none">• 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.
II	Linear and Angular Measurements (to be taught partially in practical sessions)	<ul style="list-style-type: none">• 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.
III	Measurement of Properties	<ul style="list-style-type: none">• Temperature, Force, weight, Pressure & flow, Noise, Lux and vibrations, Concept of fitting, tightening and torqueing in a line and its equipment.

IV	Screw thread and Gear teeth metrology: (To be taught partially in Practical Session)	<ul style="list-style-type: none"> • Screw Measurement: Introduction, screw thread terminology, screw thread measurement • Gear Measurement: Introduction, types of gears, gear terminology, Gear Teeth Measurement, errors in gears, advanced measurement of spur gear.
V	Linear Tolerance and GD&T	<ul style="list-style-type: none"> • Limits, fits and tolerances: Interchangeability, selective assembly, limits, fit and tolerances, limit gauging, design of limit gauges, computer aided tolerance • Measurement of GD&T parameters: Measurement of straightness, flatness, squareness, parallelism, roundness, cylindricity, non-contact profiling systems. • Interferometry • Measurement of surface finish: Introduction, terminology, specifying roughness on drawings, surface roughness parameters, factors affecting surface roughness, ideal surface roughness, methods, precautions, surface microscopy, surface finish software.

Text Book

Engineering Metrology, R.K. Jain, Khanna Publishers, Delhi, 2009.

Reference Books

Engineering Metrology, Gupta I.C., Dhanpat Rai Publications.

Engineering Metrology and Measurements, N.V.Raghavendra and L.Krishnamurthy, Oxford University Press.

Metrology and Measureemnt, Anand K Bewoor and Vinay A Kulkarni, McGraw Hill.

Subject Name: Measurement of Meteorology Lab

Paper Code: ME-503L

CATEGORY: Skill Education Component

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

Objectives:

1. To study the fundamentals of linear measuring instruments and their calibration.
2. To study fundamentals of inspection methods and systems.
3. To acquaint with operation of precision measurement tools and equipment's.
4. To study different gauges and instrument used at shop floor.

Learning Outcomes: Learner will be able to...

1. Apply inspection gauge and checking systems.
2. Demonstrate the understanding of measuring instruments and their principle.
3. Analyze simple parts for dimensional accuracy and functionality using different instruments.
4. Analyze importance of GD & T in quality maintenance.

Experiments-

1. To demonstrate dimensional measurement of given specimen using linear Measuring Instruments (Vernier calipers, scale, measuring tape, micrometer etc.)
2. To check bore diameter of given specimen using bore dial gauge.
3. To measure Gear parameters using flange micrometer and to learn various gear terminologies.
4. To demonstrate measurement of various screw thread parameters using instruments and gauges. (Thread ring gauge, Pitch gauge, Bench micrometer etc)
5. To measure intensity of light in a room for different conditions using lux meter and analysis of the result.
6. To study various gauges used in industry for inline inspection such as Feeler gauge, snap gauge, ring gauge, plug gauge, calipers and other similar gauges.
7. To check and demonstrate inspection of Outer Diameter and Internal Diameters of given components using Air pressure gauges.
8. To measure angle of a given specimen using Slip gauges and Sine bar.
9. To demonstrate Coordinate measuring machine.
10. To measure total composite error (TCE) and Teeth to Teeth error (TTE) for given gear specimen using gear roll tester/Parkinson gear tester.
11. To perform spindle alignment test on lathe using dial gauge.
12. To perform spindle alignment test on milling.

Student need to perform at least 8 experiments from above list.

**Subject Name: Engineering Graphics and drawing
Lab**

Code: ME-501L

CATEGORY: Skill Education Component

Credit	Hours	Marks		
		I	E	To
4	120	70	30	100

OBJECTIVES

1. Understand and appreciate the importance of Engineering Graphics in Engineering
2. Understand the basic principles of Technical/Engineering Drawing
3. Understand the different steps in producing drawings according to BIS conventions

OUTCOMES

1. The student will become familiar with fundamentals of various science and technology subjects and thus acquire the capability to applying them
2. The graduates will become familiar with fundamentals of engineering design. Understanding the concept generation, design optimization and evaluation.
3. Students will be able to effectively design various engineering components and make process plan for the production.

SKILL SET

1. Projection of various components according to BIS specifications.
2. Assembly of data and information of various components in visualized way
3. Interpretation of technical graphics assemblies

CONTENTS

1. Introduction to drawing, lines and lettering:

- 1.1. Definition and classification of drawing
- 1.2. Drawing instruments such as; drawing board, drawing sheets, drafter.
- 1.3. Types of pencils, sheets, eraser etc.
- 1.4. Different types of lines (Straight line, inclined line and curved lines)
- 1.5. Practice engineering style for letters and numbers as BIS: SP:46-2003

Hands on training:

- Prepare drawing sheet by using different types of lines
- Prepare Drawing Sheet Using Alphabets.
- Prepare drawing sheet by Bisection of line, angle, arc.

2. Dimensioning and scale:

- 2.1. Importance of dimensioning
- 2.2. Types (i.e. chain, parallel and progressive etc.) and methods of placing dimensioning (i.e. aligned and unidirectional)
- 2.3. Principles of dimensioning and practice dimensioning technique as BIS: SP: 46-2003.
- 2.4. Free hand sketching of straight lines, circle, square, Polygons

Hands on training:

- To divide line of length 120mm into 9 equal parts
- Divide a circle into 12 equal parts by using engineering compass
- Prepare drawing sheet by free hand sketching.

3. Introduction to Projection:

- 3.1.** Introduction to first and third angle projection
- 3.2.** Introduction to projection of point, line and plane
- 3.3.** Sectioning of solids

Hands on training:

- Practice for projection of point
- Practice for projection of line
- Practice for projection plane
- Practice for sectioning of different solids.

4. Isometric and Orthographic projection

- 4.1.** Isometric drawing of simple geometric solids
- 4.2.** Orthographic projection of simple geometric solids.

Hands on training:

- Prepare drawing sheet of orthographic projection
- Prepare drawing sheet of isometric projection.
- Orthographic drawings of Bolts and Nuts, Bolted Joints, Screw threads, Screwed Joints.

5. Geometric and dimensioning Tolerance

- 5.1** Component Drawing and interpretation
- 5.2** Geometric dimension and Tolerance
- 5.3** Introduction to software used in drawing

Hands on training:

- **Prepare drawing sheets by using GD&T in drawing**

Text Book

1. Engineering Drawing Plane and Solid Geometry: N.D. Bhatt and V.M. Panchal, Forty-Fourth Edition 2002, Charotar Publishing House.
2. Engineering Drawing: Laxmi Narayan and Vaishwanar, Charotar Publishing House.
3. Engineering Graphics and Drafting: P.S. Gill, Milenium Edition, S.K. Kataria & Sons.
4. Engineering Graphics using AUTOCAD 2007 : T. Jeyapoovan, First Edition 2002, Vikas Publishing House.

**MOOCs Course syllabus
(1st Year-Second Semester)**

for

B.Voc. (Mechatronics)

Industry Partner

HERO

Session (2019-2022) onwards

SUBJECT:MOOC/online Course-I (Industrial Automation & Control)**CODE: OET502****CATEGORY:** General Education Component

Credit	Hours	Marks		
		I	E	To
2	30	30	70	100

Course Objectives:

This course provides an overall exposure to the technology of Industrial Automation and Control as widely seen in factories of all types both for discrete and continuous manufacturing. The course will focus on a wide range of related topics from the advantage and architecture of automation systems, measurement systems including sensors and signal conditioning, discrete and continuous variable control systems, hydraulic, pneumatic and electric actuators, industrial communication and embedded computing and CNC Machines.

Course Outcomes:

Students will be able to

- Describe the major role of automation in the industry.
- Define the parameters of PID Controller and its tuning.
- Understand the basics of sequence control and PLC
- Describe the principle of operation of hydraulic and pneumatic systems and understand its advantages.
- Describe the functionality of DC motor and Switching operations.

Unit	Topic	Key Learning
I	Introduction	Introduction to industrial automation, Role of automation system in industry, Type of Automation System, Architecture of industrial automation system
II	Automatic control system	Introduction to automatic control system, PID controller: Definition, Parameters of PID Controller and tuning of PID controllers
III	Sequencing Control	Introduction to sequencing control, Parameters of PLC, Scan Cycle, Relay Logics
IV	Hydraulic and Pneumatics Control System	Pascal Law, Components of Hydraulic and pneumatic system, Direction control valve, Advantages of Hydraulic and Pneumatic system
V	DC motor	Main Features of the DC Motor, Block diagram of DC motor control loops, Switch mode DC-DC converter for DC Motor control, BLDC Motor

Text Books:

1. Industrial Instrumentation, Control and Automation, S. Mukhopadhyay, S. Sen and A. K. Deb, Jaico Publishing House, 2013
2. Electric Motor Drives, Modelling, Analysis and Control, R. Krishnan, Prentice Hall India, 2002

Reference Books:

1. Hydraulic Control Systems, Herbert E. Merritt, Wiley, 1991
2. Chemical Process Control, An Introduction to Theory and Practice, George Stephanopoulos, Prentice Hall India, 201

SUBJECT: Entrepreneurship (MOOC /online Course-II)

CODE: OMS-501

CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
2	30	30	70	100

Course Objectives:

- The course will create awareness among the students about the entrepreneurship and factors that will help in facilitating the entrepreneurial development with a focus on new ventures/ start-ups.
- Enable the students to develop the insight needed to discover and create entrepreneurial opportunities.
- Successfully start and manage their own businesses to take the advantage of these opportunities.

Course Outcomes:

- To understand the nature of entrepreneurship
- To understand the function of the entrepreneur in the successful, commercial application of innovations
- To confirm an entrepreneurial business idea
- To identify personal attributes that enable best use of entrepreneurial opportunities
- To explore entrepreneurial leadership, management style and legal issues.

Units	Topics	Learning outcomes
Unit-1	Introduction to Entrepreneurship	Introduction to Entrepreneurship, Entrepreneurial Mindset, Characteristic of an Entrepreneur, Advantages and disadvantages of Entrepreneurship
	Recognise Opportunity	Purpose of all businesses, Types of Entrepreneurial organizations, Types of Enterprises
	Creativity & Innovation	Marketing, 4Ps of Marketing, Process of Marketing, Marketing Mix, 7Ps of Marketing
	Conception & Ideation	Business Plan and its elements, Application of Business Plan
	Are you a risk taker?	Entrepreneurs, types of Entrepreneurs, Roles and Responsibilities of Entrepreneurs, Qualities of an Entrepreneur
	Identify Your Customer	Customer segmentation, Criteria for selling customer value proposition, Customer Lifecycle
Unit-2	Self Confidence and Resilience	4 Ps of Entrepreneurship, Qualities of successful entrepreneur, Self-confidence, Positive attitude, Overcoming the fears, Recover from Failure
	Success and Failure Stories of Famous Entrepreneurs – 1	Steve Jobs Success Story, Mumbai Dabbawala delivery success Story
	Never Give Up	Importance of Focusing energy on Business, Importance of Business Networking and its advantages

	Competition Analysis	Competition Analysis, Factors affecting competition strategies, Prerequisites of successful enterprise
	Risks – Identification and Mitigation	Business Risk, Types of Business Risks, Risk Identification, Risk Mitigation,
	Getting Money for Business	Concept Of Funding, Basics terms of Accounting, Types of Funding,
Unit-3	Dream and Achieve	Vision, Mission and Goals, Business Ethics, SMART goals, entrepreneurial work ethics
	Leadership and Team Spirit	Lead by example, Importance of Embracing diversity, Role of Emotional Intelligence to be a leader.
	Success and Failure Stories of Famous Entrepreneurs – 2	
	Serving the Society	Roles of Entrepreneurs in society, Selfless Entrepreneurship,
	Taking Ownership	Taking complete ownership, taking control over the business
	Adapt to Change	Porters competition strategies, Factors affecting business,
	Discover Yourself	Qualities of the successful entrepreneur
Unit-4	Problem Solving: Introduction to Critical Thinking	Critical Thinking, Applying critical thinking, REASON Model of Critical Thinking
	Problem Solving: Introduction to Creative Thinking	Creative thinking, Importance and benefits of Creative thinking, Creative thinking in problem solving
	Problem Solving: Introduction to Decision Making	Decision making, Effective decision-making process
Unit-5	4Ps of Marketing	4Ps- Product, Place, Price, Promotion, Apply 4Ps to marketing Strategy into action
	Costs in Entrepreneurship	Cost, types of Costs, Introduction to Accounting Basics, main methods of Accounting, Financial Documents, P&L statements, Working capital
	Applicable Sources of funding and Regulatory and Statutory rules	Regulatory and statutory rules for an Entrepreneur, Business Loans for startups and MSMEs by Indian Government
	Analysis of success and failure stories	Analysis of success and failure stories, Key skills involved in the successes of entrepreneurs

Identification of one's entrepreneurial skills and knowledge	Identify various skills and characteristics o be an entrepreneur, Effective Ways to Build Entrepreneurial Skills, Develop or Improve your Entrepreneurial Skills.
Legal Issues	Intellectual Property Rights, patents, trademarks, copyrights, trade secrets, licensing, franchising

Text Books:

1. Dollinger, MJ, Entrepreneurship- Strategies and Resources, Pearson Education.
2. Desai,Vasant, Entrepreneurship Development, Himalaya Publishing House.
3. Gupta, C.B. and Srinivasan, P., Entrepreneurship Development, Sultan Chand & Sons.

Reference Books:

1. Charanthimath, P.M., Entrepreneurship Development and Small Business Enterprise, Pearson Education.
2. Havinal, Veerbhadrappa, Management and Entrepreneurship, 1st Edition, New Age International Publishers, 2008.

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Syllabus
(2ndYear-Third Semester)
for
B.Voc. (Mechatronics)
Industry Partner
HERO

Session (2019-2022) onwards

Subject Name: Applied Physics

Credit	Hours	Marks		
		I	E	To
3	45	15	35	50

Paper Code: PHY-601

Objectives

- The aim of this subject is to provide the students with the basic concepts of measurement, properties of fluid, laser and fibre optics, Nanoscience etc.

Learning Outcomes

- Able to explain different system of units used in measurement system.
- Able to explain different properties of fluid
- Able to explain simple and compound machines.
- Able to explain the properties of laser.
- Able to explain concept of photoconductivity

Unit-I

Mechanical Measurement: Basics of Measurements: Introduction, General measurement system, systems of units (FPS, CGS and SI units), Thermometry: Thermoelectric temperature measurement, Resistance thermometry.

Unit-II

Properties of Matter and Thermal Physics: Definition and types of stress and strain, Hooke's law, Fluid properties – density, Specific weight, Specific gravity, Surface tension, Viscosity, Pressure - atmospheric pressure, gauge pressure, absolute pressure, Pascal's law, buoyancy, Introduction to laminar and turbulent flow. Modes of heat transfer- thermal conductivity.

Unit-III

Simple Machines: Definition of simple and compound machine (examples), definition of load, effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines, definition of an ideal machine, reversible and self-locking machines. Working principle and application of simple screw jack and worm & worm wheel.

Unit-IV

Laser and Fibre Optics: Characteristics of Lasers, Spontaneous and stimulated emission of radiation, Ruby laser, Helium-Neon Laser, Applications of lasers. Principle of optical fibre, Acceptance angle and acceptance cone - Numerical aperture - Types of optical fibres and refractive index profiles, Application of optical fibres.

Unit- V

Photoconductivity and Nanoscience: Photoconductivity & Photovoltaics: application of photoconductivity, photovoltaic cells, solar cell and its characteristics. Introduction to Nano materials - Basic principles of Nanoscience & Technology, applications of nanotechnology.

Suggested Readings:

- Applied Physics Vol. I, TTTI Publication; Tata McGraw Hill, Delhi
- Basic Applied Physics by RK Gaur; Dhanpat Rai Publications
- Comprehensive Practical Physics - Volume I and II by JN Jaiswal; Laxmi Publishers
- Numerical Problems in Physics-Volume I and II by RS Bharaj; Tata McGraw Hill
- Simple Course in Electricity and Magnetism by CL Arora; S Chand and Co, New Delhi
- Fundamental Physics - Volume I and II by Gomber and Gogia; Pardeep Publications, Jalandhar

Subject Name: Applied Physics Lab

Paper Code: PHY-601L

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

Objectives

- Students will be able to learn how physics and other disciplines have impacted and continue to impact each other and society.

Learning Outcomes

- Able to perform experiments of screw jack and worm and worm wheel.
- Able to determine force constant using Hooke's law
- Able to perform Bernoulli's theorem.

List of Practical's

1. To find the mechanical advantage, velocity ratio and efficiency of a screw jack.
2. To find the mechanical advantage, velocity ratio and efficiency of a worm and worm wheel.
3. To determine force constant of spring using Hooke's law
4. To determine the Moment of Inertia using a Flywheel.
5. To verify the Bernoulli's Theorem.
6. To study the variation of magnetic field with distance and to find the radius of coil by Stewart and Gee's apparatus.
7. To study the characteristics of Cu-Fe thermo couple.
8. To find the value of Planck's constant by using a photo electric cell.
9. To determine the energy gap of a semiconductor diode.
10. Solar Cell: To study the V-I Characteristics of solar cell.
11. Light emitting diode: Plot V-I and P-I characteristics of light emitting diode.
12. Photoelectric effect: To determine work function of a given material.
13. LASER: To study the characteristics of LASER sources.
14. Optical fibre: To determine the bending losses of Optical fibres.

SUBJECT: Electrical Machines & Control system

CODE: EE-603

CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
2	30	15	35	50

Objectives

- To prepare students to perform the analysis of any electromechanical system.
- To empower students to understand the working of electrical equipment used in everyday life.
- To prepare the students for advanced courses in robotics.

Learning Outcomes

- The ability to formulate and then analyse the working of D.C Machine
- The ability to formulate and then analyse the working of A.C Machine.
- The ability to explain the three phase synchronous machine.
- The student acquires the knowledge control system.
- Ability to identify the components of control system

Unit	Topic	Key Learning
I	D.C. Machines:	<ul style="list-style-type: none">• 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
II	A.C. Machines:	<ul style="list-style-type: none">• 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
III	Three Phase Synchronous Machine:	<ul style="list-style-type: none">• 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.
IV	Control system-Introduction	<ul style="list-style-type: none">• 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.

V	Components of control systems	<ul style="list-style-type: none"> • Components of control systems, potentiometer. • Synchro and synchro transmitter and receiver. • Controllers - two position controllers, preparation of controllers, analysis. Integrated controllers, electronic PID controllers
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Suggested Readings:

- D C Kulshreshtha: Basic Electrical Engineering: McGraw Hill Education, 2011.
- I.J. Nagrath, T.P. Kothari., Basic Electrical Engineering, McGraw-Hill Publishing company Ltd.,
- Nagsarkar T K and Sukhija M S, —Basics of Electrical Engineering, Oxford press
- GopalM. Control System Principles and Design, Tata McGraw-Hill, 1998

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SUBJECT: Electrical Machines & Control systems lab

CODE: EE-603L

CATEGORY: General Education Component

Credit	Hours	Marks		
2	60	I	E	To
		35	15	50

Objectives

To expose the students, the operation of electric drives to gain hands on experience

Learning Outcomes

- Ability to perform load test on D.C. shunt motor
- Ability to perform speed control test
- Ability to do characteristics of different electrical motors

List of Practical's

1. To perform load test on DC shunt generator
2. To perform speed control of DC shunts motor.
3. To perform load test of DC shunt motor.
4. To perform no load and block rotor test of 3 phase induction motor.
5. To study DC speed control system.
6. To perform the dc **position** control system.
7. To study linear system simulator
8. To use a synchronous pair as error detector.
9. To perform and study potentiometer as an error detector.
10. To perform synchro transmitter receiver pair

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SUBJECT: Hydraulics & Pneumatics**CODE: ME-605****CATEGORY:** General Education Component

Credit	Hours	Marks		
		I	E	To
3	45	15	35	50

Objectives

- To introduce the industrial hydraulics and pneumatics, their parts, functions and their structure. To give the required information about hydraulics and pneumatics and to teach the fundamentals of hydraulic and pneumatic circuit design

Learning Outcomes

- Working principle of various components used in hydraulic & pneumatic systems.
- learn about various components such as hydraulic Pumps systems, Hydraulic Actuators and Valve
- To learn about basic principles of Pneumatics
- To understand pneumatic elements, their working, uses
- To learn about the hydraulic & pneumatic circuits

Unit	Topic	Key Learning
I	Introduction	<ul style="list-style-type: none"> Need and importance of hydraulic and pneumatic, Hydrostatic and hydrodynamic definitions, properties of fluid, Pascal's law, Continuity equation and Bernoulli's equation. Advantages and limitations of hydraulic and pneumatic systems
II	Hydraulic Pump	<ul style="list-style-type: none"> Type, construction, working applications and selection criteria. Other Elements such as filters, manifold, receivers, coolers and connectors. Hydraulic Actuators- Type, working and applications. Control Valves- Type, designation, symbols, working and applications, Hydraulic Pipes- Type, materials, designations, pressure ratings and selection criteria. Piping Layout, Concept, rules/norms
III	Fundamentals of Pneumatics	<ul style="list-style-type: none"> Compressible fluid flow, mass flow rate, compressible fluid- Type, properties and applications
IV	Pneumatic Element	<ul style="list-style-type: none"> Pipes- Type, applications and properties. Air Compressor- Type (Reciprocating and rotary), working and selection. Pneumatic Cylinders- Type, symbol, cushion, assemblies, mounting and, Pneumatic Valves- Type, symbols, working, applications and selection. Air Motors- Type, working and applications. Other Elements - Air receivers, filters, pressure regulator, lubricator. Introduction to Solenoid valves- their working and types
V	Hydraulic and Pneumatic Circuits	<ul style="list-style-type: none"> Concept, Meaning and ISO symbols. Brief on designing of hydraulic and pneumatic circuits. Applications

Suggested Readings:

- Fluid Mechanics & Hydraulic Machines, R. K. Rajput, S. Chand Limited**
- A Textbook of Fluid Mechanics and Hydraulic Machines, R. K. Bansal
- A Textbook Of Fluid Mechanics, R. K Rajput, S. Chand Limited**
- Hydraulics and Pneumatics, Andrew Par

SUBJECT: Hydraulics& Pneumatics Lab

CODE: ME-605L

CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

Objectives

- To introduce and provide hand on experience to students to design and test hydraulic circuit to Control press, flow etc.
- To provide hands on experience to design and test the pneumatic circuit to perform basic Operations

Learning Outcomes

- Ability to design and test hydraulic, pneumatic circuit
- Upon Completion of this subject, the students can able to have hands on experience in flow measurements using different devices and also perform calculation related to losses in pipes and also perform characteristic study of pumps, turbines etc.,

List of Practical's

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.
7. Single Cycle Automation of Double Acting Cylinder Using Limit Switch.
8. Operation of double acting cylinder using double solenoid valve.
9. Single Cycle Automation of Multiple Cylinders in Sequence ($A^+B^+A^-B^-$).
10. To prepare basic hydraulic and pneumatic circuits on fluid sim.

SUBJECT: Digital and Power Electronics**CODE: ECE-601****CATEGORY:** General Education Component

Credit	Hours	Marks		
		I	E	To
3	45	15	35	50

Objectives

- To simplify the mathematical expressions using Boolean functions – simple problem
- Study & design the combinational & sequential circuits.
- Get an overview of different types of power semiconductor devices

Learning Outcomes

- Understand the basic gates and the number.
- To simplify Boolean function.
- Discuss trade-offs involved in power semiconductor switches.
- Analyse different types of power converters.
- Analyse issues involved in controlling of AC and DC drives.
- Realize drive considerations for different industrial applications

Unit	Topic	Key Learning
I	Introduction	<ul style="list-style-type: none"> • 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 Noise 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 Demultiplexers
II	Boolean Algebra and Latches:	<ol style="list-style-type: none"> 1. 2. <ul style="list-style-type: none"> • 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
III	Power Semi-Conductor Devices	<ul style="list-style-type: none"> • 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

IV	Cyclo Converter	<ul style="list-style-type: none"> • 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
V	Inverters	<ul style="list-style-type: none"> • 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

Suggested Readings:

- Morris Mano M., —Digital Circuits and Logic Design||, Prentice Hall of India, II Edition, 1996.
- Reshid, M.H., Power Electronics – Circuits Devices and Application, Prentice Hall International, New Delhi, 3rd Edition, 2004.

SUBJECT: Digital and power Electronics lab

CODE: ECE-601L

Credit	Hours	Marks		
		I	E	To
2	60	35	15	50

CATEGORY: General Education Component

Objectives

- To introduce the students different power electronics components and use of them in electronic circuits.
- To study characteristic of different power electronics of components.

Learning Outcomes

- Ability to use SCR, MOSFET, TRIAC in electronic circuit
- Ability to perform characteristic study on the electronics components.

List of Practical's

1. Single phase Semi / Full Converter with R & R-L load.
2. Three phase Semi / Full Converter with R load.
3. To draw the firing characteristics of DIAC.
4. To draw UJT characteristics
5. Observe the output wave UJT relaxation oscillator.
6. Single phase AC voltage controller using SCRs for R load
7. Single-Phase PWM bridge inverter for R load.
8. Configuring NAND and NOR logic gates as universal gates.
9. Implementation of Boolean Logic Functions using logic gates and combinational circuits
10. Construction of half adder and full adder
11. Verification of state tables of RS, JK, T and D flip-flops
12. Implementation & verification of Decoder/Demultiplexer and Encoder/ multiplexer using logic gates.

Subject Name: Environmental Studies (EVS)

T P C

Paper Code: EVS-601

4 - 4

Total Marks :100

Theory (External):70Theory (Internal):30 =100

OBJECTIVES

1. To develop foundation on principles of Environmental Studies and concept of structure and function of different compartments of the Environment.
2. To develop basic understanding between social thoughts and environmental issues in traditional and modern societies and enable the students to critically examine the close association between various environmental issues and human health.
3. To make them understand various perspectives on sustainability by looking into different ways of conservation of the natural resources and their management, which can be achieved through developing a foundation on ecological, social, economic, legal and ethical dimensions of the environmental studies on a robust interdisciplinary foundation.
4. To make them aware about various entrepreneurship option in green and circular economy

LEARNING OUTCOME

On completion of this course, students will be able to:

CO1: To have an in depth domain knowledge of their environment and interdisciplinary perspective of environmental studies.

CO2: Graduate will develop a sense of community responsibility by becoming aware of environmental issues in the large social context.

CO3: To develop analytical competence, critical thinking, problem solving competence, decision making, ability to work independently, capacity for creativity, contribute to societal well-being & sustainability

CO4: To gain competence for ecological and green entrepreneurship, research and Innovation

Program Outcome

1. Skills of sustainability as a practice in life, society and industry.
2. Acquisition of values and attitudes towards understanding the complex environmental-economic-social challenges.
3. Skills of critical thinking and problem solving in any environmental issues in a participatory approach

CONTENT

Unit I Environmental Studies

1.1 Nature, Scope and Importance

1.2 Need for Public Awareness,

1.3 Renewable and Non-Renewable Resources

1.4 Role of an Individual in Conservation of Natural Resources

Unit II Ecosystems

2.1 Concept, Structure and Function of an Ecosystem

2.2 Energy Flow in the Ecosystem

2.3 Ecological Pyramids and ecological Succession

2.4 Types of Ecosystem: Forest Ecosystem, Grassland Ecosystem, Desert ecosystem, Aquatic Ecosystems.

Unit III Environmental Pollution

- 3.1 Environmental Pollution: Definition, Causes, Effects and Control Measures
- 3.2 Different Types of Pollutions, Air Pollution, Water Pollution Soil Pollution
- 3.3 Marine Pollution, Noise Pollution
- 3.4 Thermal Pollution, Nuclear Hazards

Unit IV Waste Management

- 4.1 Overview of types of waste: solid and liquid
- 4.2 Solid waste management, Municipal solid waste management techniques: Bio Composting, Vermicomposting, Incineration, Landfill sites
- 4.3 Liquid waste management: Waste water and Standards for its discharge given by CPCB
- 4.4 Waste water treatment: Effluent Treatment Plant and Sewage treatment plant (STP)

Unit V National Environmental policies and legislation on Environmental Protection and International conventions

- 5.1 Environmental Policies and legislations in India: Constitutional rights and duties. Wildlife Protection Act 1972, Forest Conservation Act 1980, Water (Prevention and control of Pollution) Act 1974, Air (Prevention and Control of Pollution) Act, 1981, Environment Protection Act, 1986
- 5.2 Concept of sustainability and sustainable development
- 5.3 Environmental issues: Climate change, global warming, acid rain, ozone layer depletion
- 5.4 International Conventions: Kyoto Protocol, Montreal protocol, Vienna convention

Suggested Readings:

References/ Textbook(s) Used in Class

1. Perspectives in Environmental Studies By Anubha Kaushik, C. P. Kaushik, New Age International, 2006
2. Environmental studies by R.J. Ranjit Daniels and Jagdish Krishnaswamy, Reprint Edition 2014, Wiley India Pvt limited.
3. Textbook of Environmental Studies: For Undergraduate Courses Erach Bharucha, 2011 Universities Press
4. Environmental Studies by Benny Joseph, Tata McGraw-Hill Publishing Company limited, New Delhi.

Additional References

1. Fundamentals of Ecology by Odum, E.P., Odum, H.T. & Andrews, J. 1971. Philadelphia: Saunders.
2. World Commission on Environment and Development. 1987. Our Common Future. Oxford: Oxford University Press.
3. Divan, S and Rosencranz, A (2002). Environmental law and policy in India: Cases, Material and Statutes, 2nd Edition. Oxford University Press, India.

SUBJECT: Plant Maintenance and safety Lab

CODE: ME-606L

CATEGORY: Skill Education Component

Credit	Hours	Marks		
4	120	I	E	To
		35	15	50

Objectives

- Maintenance of equipment in industries is very critical issue to ensure quality and quantity of production. Industries are not able to survive and progress if proper maintenance of equipment is not done. In the absence of proper maintenance, industries are busy in every day firefighting to repair the breakdowns and manage production in very unsafe manner. This course provides information about wear, corrosion, lubrication, preventive maintenance; decision tree to diagnose faults, important provisions of factory act, alignment of equipment etc. This course also provides basic knowledge and skills regarding maintenance problems, their causes and remedies in industries

Learning outcomes

- Recognize troubles in mechanical elements.
- Assemble, dismantle and align mechanisms in sequential order.
- Carry out plant maintenance using tri-bology, corrosion and preventive maintenance

List of Practicals

1. Preparatory Activity:

Study and demonstrate use of various types of tools. (Fix spanners, box spanners, ring spanners, allen keys, types of pliers, screw drivers, bearing puller, etc.).

1. Measurement of Wear:

Measure wears of anyone of the following.

- a. Machine guide ways.
- b. Shaft –sleeve
- c. Piston –cylinder.
- d. Bearing.

3. Corrosion:

Each student will collect corroded component from field and identify the types of corrosion and possible causes. Student will also suggest prevention methods.

4. Fault Tracing and Decision Tree:

Develop decision tree for location of fault for any two items from following.

- A. Internal combustion (IC) engine.
- b. Boiler.
- c. Pump.
- d. Machine tool.
- e. Air compressor.
- f. Electric motor.

5. Maintenance of Mechanical Based Equipment/Device/Machine.

Maintenance of any two from following. Batch may be divided in to two groups and each group may be given one case. a. Head stock. b. Tail stock. c. Feed box. d. Indexing head. g. Internal combustion (IC) engine. h. Pump.

6. Preventive Maintenance:

Prepare a preventive maintenance schedule of any workshop having- air compressors, car washing pumps, tyre changer, lifts, welding machines, and wheel alignment

SUBJECT: Microcontroller and Programmable Logic Controller

Credit	Hours	Marks		
		I	E	To
3	30	15	35	50

CODE: ECE-604

CATEGORY: Skill Education Component

Objectives

- Understand the basic concept of microprocessors.
- Learn about architectures of 8051 microcontrollers.
- Learn to write the program.
- Learn about the PLC

Learning Outcomes

- Know about microprocessor & microcontroller.
- Start to write the program using microprocessor & microcontroller
- Gain the detailed knowledge in microprocessor & microcontroller.
- Know the basic of programmable logic controller hardware and software.
- Learn about timer and counter use in PLC

Unit	Topic	Key Learning
I	INTRODUCTION	<ul style="list-style-type: none"> • Comparing Microprocessors and Microcontrollers. • Technological trends in Microcontrollers development. • Microcontrollers- 8 bit, 16 bit, 32 bit microcontrollers. • Applications of microcontrollers
II	8051 ARCHITECTURE	<ul style="list-style-type: none"> • 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
III	8051 INSTRUCTION SET AND PROGRAMMING	<ul style="list-style-type: none"> • 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.
IV	Programmable Logic Controllers	<ul style="list-style-type: none"> • 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

V	Timers, Counters and Their Applications	<ul style="list-style-type: none">• 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.
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Suggested Readings:

- Kenneth J. Ayala. The 8051 Microcontroller Architecture, Programming and Applications,
- Penram International Publishing (India), Second Edition, Mumbai.
- Frank D. Petruzella. "Programmable Logic Controllers", McGraw-Hill Book, Company, 1989.
- B.P. Singh, Microprocessors and Microcontrollers, Galcotia Publications (P) Ltd, First
- edition, New Delhi, 1997.
- Embedded Controller Hand book, Intel Corporation, USA.
- Microcontroller Hand Book, INTEL, 1984.

SUBJECT: Microcontroller and programmable logic controller lab

CODE: ECE-604L

CATEGORY: Skill Education Component

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

Objectives

- To introduce and train the students to use microcontroller and PLC for actuation, control of Speed.

Learning Outcomes

- Ability to use microcontroller and PLC to control different motor/equipment.

List of Practical's

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 using serial/parallel communication.
6. Make the Ladder diagram logic gates.
8. Actuation of Single Acting Cylinder with ON Delay Timer Using PLC.
9. Control of Double Acting Cylinder with UP Counter Using PLC.
10. Operation of Single Acting Cylinder with AND Logic Using PLC
11. Operation of Single Acting Cylinder with OR Logic Using PLC.
12. Automation of Single Acting Cylinder Using PLC.
13. Automation of Double Acting Cylinder Using PLC.

SUBJECT: Fundamental of CNC Machines Programming lab

CODE:ME-607L

CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
4	120	70	30	100

Objectives

To make students in depth knowledge about CNC Machines, Machine setting, Tools used, tool offset setting of CNC Machines and programming.

Learning Outcomes

- 1.To be able to differentiate between conventional & CNC Machine in respect to working, components, operation.
2. To understand setting up of tooling for CNC. One should have knowledge of types of cutting tools & tool material used.
3. To understand tool & work holding devices used & locating principle
4. To take tool offsets and work-offset on CNC machine.
5. To be able make CNC program.

List of Experiments

1. Introduction to CNC and Understanding of Panel board.
2. Types of programs like Fanuc, Siemens, Mitsubishi, Allen Bradley etc.
3. Movement of Axis, tool change, use of hands wheel, Jog and manual data input.
4. Study of ATC with demonstration and Setting and adding new tool in ATC.
5. Practically finding out tool parameters on tool pre setter machine.
6. Finding out coordinates for work and tool.
7. Performing tool offset for milling machine.
8. Performing Work offset for milling machine
9. Performing tool offset for Lathe machine.
10. Performing Work offset for Lathe machine.
11. To study G codes and M codes.
12. To learn and execute programming technique such as interpolation, helical, compensation and their application.
13. CNC Part programming, sub programming and execution of an operation on milling machine.
- 14.CNC Part programming, sub programming and execution of an operation on drilling machine.
- 15.CNC Part programming and sub programming on types of pockets.
16. Write and execute a program for CNC Machines for a process of a complex drawing part.

Syllabus
(2nd Year-Fourth Semester)
for
B.Voc. (Mechatronics)
Industry Partner
HERO
Session (2019-2022) onwards

Shri Vishwakarma Skill University

Subject Name: (MOOC/Online Course-III)

Credit	Hours	Marks		
2	30	I	E	To
		30	70	100

CODE:

CATEGORY: General Education Component

MOOC Course / Online Course: As per the availability of Current NPTEL calendar.

Shri Vishwakarma Skill University

Subject Name: Value Education & Professional ethics (Mooc/Online-IV)

Credit	Hours	Marks		
		I	E	To
2	30	30	70	100

CODE:

CATEGORY: General Education Component

Objectives:

At the end of course students will attain

- Understanding of Human values for self (NiYama), and for interaction with outer world (Yama).
- Ability to exhibit Professional Ethics in performing a professional task with excellence—योग: कर्मसुकौशलम्.
- Understanding of Professional Ethics that demands to see the unseen with emphasis on Sustainable development / eco-friendly implementation of the task.
- Ability to work in team with human values and professional ethics

UNIT I: Human Values-1:

Morals, **Values** (Niyam): -Understanding values, Types of values, Role of tracking values for individual & social wellbeing. And Ethics (Yama):

Integrity: - Understanding integrity and role of integrity in social harmony –Trustworthiness

Work **Ethics** – Service-Learning – Civic Virtue – Respect for others – Living Peacefully –Caring – Sharing.

Honesty: -Understanding honesty and its role in personal and social –Courage – **Value** Time.Co-operation:

-Understanding cooperation and significance of cooperation its family, work team and social cohesiveness, wellbeing and development – Commitment.

Tutorial Module: Rational Behavior versus Ethical Behavior:Case Studies (from Yoga-Sutra, Bhagwat Geeta, Panchatantra, Autobiography of Mahatma Gandhi) or any other literatures.

UNIT II: Human Values-2

Empathy: Basic **Concept on Empathy**– Self-confidence – Spirituality- Character.

Truthfulness: - Understanding truthfulness, need for truthfulness and role of truthfulness in relationship, social interaction, integrity, faiths & dependence – Customs and Traditions -Value Education – Human Dignity – Human Rights – Fundamental Duties – Aspirations and Harmony (I, We & Nature) – Gender Bias – Emotional Intelligence– Emotional Competencies – Conscientiousness.

Being, body, brain & mind: - Effective & efficient use of body, brain and mind is personal and social well being

Value Judgments, Facts & Values, how values are justified, Aesthetics, Selection of Values, Universal Values, Human Values, Value Education

Tutorial Module: Empathy and its types: Case Studies from Yoga-Sutra, Bhagwat Geeta, Panchatantra, Autobiography of Mahatma Gandhi or any other literature.

UNIT III: Professional Ethics aiming at excellence and Harmony

Value Based Life and Profession, Professional Ethics and Right Understanding, Competence in Professional Ethics, Issues in Professional Ethics – The Current scenario.

Positive and constructive dynamism of power, politics and leadership.

Tutorial Module: Ethical decision making: Case Studies (from Yoga-Sutra, Bhagwat Geeta, Panchatantra, Autobiography of Mahatma Gandhi or any other literature)

UNIT.IV Professional Ethics: Global Prospective.

Globalization and MNCs –Cross Culture Issues – Business Ethics – Media Ethics – Environmental Ethics – Endangering Lives – Bio Ethics – Computer Ethics – War Ethics

Tutorial Module: Ethics and Social Networks:Case Studies (from Yoga-Sutra, Bhagwat Geeta, Panchatantra, Autobiography of Mahatma Gandhi or any other literature)

UNIT V: Duties and Rights in Profession

Concept of Duty – Professional Duties – Collegiality – Techniques for Achieving Collegiality – Senses of Loyalty – Consensus and Controversy – Professional and Individual Rights – Confidential and Proprietary Information – Conflict of Interest-Ethical egoism – Collective Bargaining – Confidentiality – Gifts and Bribes, Plagiarism

Tutorial Module: Ethics in Corporate: Case Studies (from Yoga-Sutra, Bhagwat Geeta, Panchatantra, Autobiography of Mahatma Gandhi or any other literature)

REFERENCES:

- 1. New Approaches in Ethics for the Caring Professions: Taking Account of Change for Caring Professions 2005 Edition,**
by Richard Hugman
Publisher: Red Globe Press; 2005 edition (9 July 2018)
- 2. Rethinking Values and Ethics in Social Work 1st ed. 2017 Edition, Kindle Edition**
by Richard Hugman (Author), Jan Carter (Author)
Publisher: Red Globe Press; 1st ed. 2017 edition (16 September 2017)
- 3. Professional Ethics and Human Values** Paperback – 2015
by A. Alavudeen (Author), R. Kalil Rahman (Author), M. Jayakumaran (Author)
Publisher:Laxmi Publications; First edition (2015)
- 4. A Foundation Course in Human Values and Professional Ethics** Paperback – 30 Apr 2010
by R.R. Gaur (Author), R. Sangal (Author), G.P. Bagaria (Author)
Publisher: Excel Books (30 April 2010)
- 5. Living Issues in Philosophy (9th Edition) (1995)**
By : Titus, Smith and Nolan
Publisher: Oxford University Press, New York
- 6. Foundation of Ethics and Management**
By : B P Banerjee
Publisher: Excel Books, 2005

Assessment Methodology

- Self Assessment

- Peer Learning
- Assessment Rubrics for Behavioral Skills
- Pedagogy:
- Case study based & Group Discussion.

Shri Vishwakarma Skill University

Syllabus
(3rd Year-Fifth Semester)

for

B.Voc. (Mechatronics)

Industry Partner

HERO

Session (2019-2022) onwards

SUBJECT: Sensors and Transducers

CODE: ECE-702

CATEGORY: Skill Education Component

Credit	Hours	Marks		
		I	E	To
2	30	15	35	50

Objectives

- To introduce the concept, classification and calibration of different types of sensors. The objective of this course is to impart basic knowledge about the different sensors and their applications in robotics

Learning Outcomes

- Study the classification, characteristics and calibration of mechanical, electrical, optical, thermal, magnetic, chemical and biological sensors.
- Get exposure to displacement, force, torque, tactile, pressure, flow and temperature sensors.
- Learn the applications of different sensors in robotics.

Unit	Topic	Key Learning
I	Principles of Sensors	<ul style="list-style-type: none">• Sensor classification, characteristics and calibration of mechanical, electrical, optical, thermal, magnetic, chemical and biological sensors, sensor reliability
II	Displacement Sensors	<ul style="list-style-type: none">• principles of variable resistance, variable inductance, variable reluctance• synchros and resolver, variable capacitance, Hall Effect device, digital displacement sensors.
III	Force, Torque, Tactile and Pressure Sensors and Transducers	<ul style="list-style-type: none">• 3.1 Different types of load cells, digital force transducer, pressure transducer, transmission type, driving type and absorption type dynamometer• 3.2 tactile sensors using contact closure, magnetic, piezoelectric, photoelectric, capacitive and ultrasonic methods, manometer, elastic elements, electrical and piezoelectric pressure transducers, Pirani gage.
IV	Flow Sensors	<ul style="list-style-type: none">• Head type flow meter, electromagnetic flow meter, rota meter, anemometer, ultrasonic flow meter.
V	Temperature Sensors	<ul style="list-style-type: none">• 5.1 Resistance and mechanical type temperature sensors, thermocouples, thermistor, optical pyrometer. Sensors in Robotics: Potentiometers, synchros and resolvers, optical encoders, tactile and proximity sensors, non-contact ranging sensors, ultrasonic transducers, optoelectric sensors, gyroscopes.

Suggested Readings:

- Doebelin, E.O., Measurement systems, Applications and Design, McGraw Hill (2011).
- Nakra, B. C. and Chaudhry, K. K., Instrumentation Measurement and Analysis, Tata McGraw Hill (2008). 87th Senate approved Courses Scheme & Syllabus for B.E. Mechatronics Engg. (2014).
- Murthy, D.V.S., Transducers and Instrumentation, Prentice Hall of India Private Limited (2003).
- Sawhney, A.K., A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai and Co. (P) Ltd. (2007).
-

SUBJECT: Sensors and Transducers Lab

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

CODE: ECE-702L

CATEGORY: Skill Education Component

Objective

- To provide knowledge sensors and signal processing
- To provide hand experience to measure different signal using sensor and processing them in Required form.

Required form.

Learning Outcomes

- Ability to use the sensors for the measurement of different signals and use of signal Processing techniques to convert them to useful signal.

List of Practical's

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,
7. Flow measurement using rotameter.
8. Measurement of weight using strain gauge.

SUBJECT: Industry 4.0**CODE: CSE-701****CATEGORY: General Education Component**

Credit	Hours	Marks		
		I	E	To
3	45	15	35	50

Objectives

- Objective of the course is to provide an introduction to Industry 4.0, Internet of Things (IoT) and related topics.
- Students will be introduced to technological and business challenges and opportunities as well as ethical concerns related to IoT

Learning Outcomes

- Understand the concept of Industry 4.0
- Learn about **Industry 4.0 Technologies**
- Understand the concepts of Internet of Things
- Understand the concepts AI

Unit	Topic	Key Learning
I	Introduction of Industry 4.0	<ul style="list-style-type: none"> • Industry 4.0 definition • Benefits of Industry 4.0 • Industrial Revolutions and Future View • The digital transformation of industry and the fourth industrial revolution • Principles of “Smart Factory” • Industry 4.0 strategy and implementation • Industry 4.0 challenges and risks
		•
II	Industry 4.0 Technologies	<ul style="list-style-type: none"> • Articulate how key IoT technologies can improve organizational productivity and add value • Human-machine interaction • Advanced robotics and 3-D printing • Lean Manufacturing • Touch interfaces, virtual reality and augmented-reality systems • Cloud Computing
III	Introduction to IoT	<ul style="list-style-type: none"> • Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT,
IV	IoT& M2M	<ul style="list-style-type: none"> • Machine to Machine, Difference between IoT and M2M, Software define Network
V	Introduction of Artificial intelligent	<ul style="list-style-type: none"> • Foundations, scope, problems, and approaches of AI. Intelligent agents: reactive, deliberative, goal-driven, utility-driven, and learning agents

Suggested Readings:

Reference Books:

1. Vijay Madiseti, ArshdeepBahga, “Internet of Things: A Hands-On Approach”
2. WalteneusDargie,ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Pract

SUBJECT: Industry 4.0 Lab

CODE: CSE-701 L

CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

Objectives

- Able to understand Arduino/Raspberry Pi hardware & Software
- An understanding of a class of 3D printing and rapid prototyping (RP) technologies for rapid product development, including reverse engineering, 3D printing and additive manufacturing, and rapid tooling
- A holistic view of various applications of these technologies in relevant fields

Learning Outcomes

- Able to use the Arduino/Raspberry Pi hardware & Software
- To create new three-dimensional object files from scratch.
- Prepare and optimize those files for 3D printing
- Successfully fabricate the file design through a 3D printing service provider using appropriate material and method selections.

List of Practical's

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
4. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
6. To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
7. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to Smartphone using Bluetooth.
8. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
9. To develop physical 3D Mechanical structure using any one of the rapid prototyping processes.
10. study components of a real robot and its DH Parameter.
11. Demonstration on AR and VR. Technology.

SUBJECT: Leadership & Quality Management

CODE: IMS-704

CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
4	60	30	70	100

Objectives:

- To understand the need of quality and quality control
- Know about the importance of leadership skill in industries
- Understand the responsibilities of workmen for quality management in industry

Learning Outcomes:

- The purpose of this course is to put quality management into perspective, and to highlight its critical importance, as well as to present in-depth ideas on different methodologies, tools and techniques proposed for product and process improvement.

Unit-I

Concept of Leadership, Trait and Behavioural Approaches, Contingency Approach, Leadership and Values, Leadership Behaviour, Courage and Moral Leadership, Motivation and Empowerment, Leadership Diversity

Unit-II

Problem Solving Methods, Resource Management, Work effectively in a Team, Process and Product Quality Monitoring,

Unit-III

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, TQM, Benchmarking, Quality Audit, Quality Circles, OEM Guidelines, Quality Function Deployment, Zero defect and zero effect approach

Unit-V

Robust Design and Taguchi Method, Design Failure Mode & Effect Analysis, Product Reliability Analysis, Case study on Six Sigma in Product Development, Kalzen, 5S, etc.

Suggested Readings:

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

SUBJECT: Applied Mechatronics

CODE: MTE-701

CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
3	45	15	35	50

Objectives

- To expose the students to applied Mechatronics

Learning Outcomes

- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and various configurations

Unit	Topic	Key Learning
I	INTRODUCTION	<ul style="list-style-type: none">IntroductionPower Electronics Vs Linear ElectronicsScope & Applications
II	Operational Amplifiers	<ul style="list-style-type: none">Introduction, Block diagram representation of a typical Op-amp, schematic symbol, characteristics of an Op-amp, ideal op-amp, equivalent circuit, ideal voltage transfer curve, open loop configuration, differential amplifier, inverting & non –inverting amplifier, Op-amp with negative feedback(excluding derivations).
III	CONVERTERS	<ul style="list-style-type: none">IntroductionControl of dc – convertersBuck ConverterBoost ConverterBuck - Boost ConverterFull Bridge dc - dc Converter
IV	AC TO AC CONVERTERS	<ul style="list-style-type: none">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 .
V	PHASE CONTROLLED RECTIFIERS	<ul style="list-style-type: none">IntroductionThyristor CircuitsSingle Phase ConvertersThree Phase Converters

Suggested Readings:

- Industrial Electronics - James Homphires&Lestie Sheets
- Power Electronics Circuits Devices & Applications - M.H. Rashid
- Power Electronics - P.C. Sen, KjeldThorborg

SUBJECT: Applied Mechatronics Lab

CODE: MTE-701L

CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

Objectives

- To introduce the students different power electronics components and use of them in electronic circuits.
- To study characteristic of different power electronics components.

Learning Outcomes

- Ability to use SCR, MOSFET, TRIAC in electronic circuit
- Ability to perform characteristic study on the electronics components

List of Practical's

1. Static Characteristics of Power diode & Schottky diode and to study reverse recovery of Power Diode & Schottky diode.
2. Draw the Characteristics of IGBT
3. Draw the Characteristics of GTO
4. Draw the voltage and current wave form for buck converter.
5. To study the boost converter.
6. Draw the waveform for full bridge dc-dc converter.
7. Draw the characteristic of single phase converter.
8. Draw the characteristic of three phase converter

SUBJECT: Manufacturing Automation & Ergonomics

CODE: ME-705

CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
3	45	35	15	50

Objectives

- To introduce a student to industry 4.0 Manufacturing technologies.
- Application based learning of advance technologies and their feasibility in incorporation with existing setup

Learning Outcomes

- To explain general functioning of automation systems
- Explain & Implement the skills required for automation, control and monitoring of industrial processes.
- Knowledge of Flexible manufacturing systems and their implementation in various stages.
- To understand concepts of Ergonomics and Work study and their application in industry scenario.

Unit	Topic	Key Learning
I	Introduction	<ul style="list-style-type: none"> • 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
II	Automated Flow Lines Assembly systems and Line balancing	<ul style="list-style-type: none"> • 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
III	Advancement in Manufacturing	<ul style="list-style-type: none"> • Application of Nanotechnology and allied field, AFM, SEM, TEM, Advanced electronic Packaging
IV	Introduction To Robotics	<ul style="list-style-type: none"> • Classifications of robots, Work envelope, manipulators- Electronic and Pneumatic manipulators, end effectors. Applications of Robots
V	Introduction to Ergonomics	<ul style="list-style-type: none"> • Evolution of Ergonomics, Introduction, Definitions of Ergonomics, The Scope of Ergonomics, Aspects of Ergonomics Application Areas of Ergonomics, Man and Machine Interaction

Suggested Readings:

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 Electrical Engineering" Prentice-Hall. ISBN: 0131216333
8. C D Johnson, "Process Control Instrumentation Technology", Prentice Hall of India, New Delhi. ISBN: 81203098

SUBJECT: Manufacturing Automation & Ergonomics

CODE: ME-705L

CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

Objectives

- Students will learn about basics of robots and its applications
- Student will learn about Manufacturing automation system

Learning Outcomes

- Student will able describe the functioning of the Auto flow lines, numerical control system
- Student will able to explain the concept of Automated material handling system and inspection system
- Able to kwon the Virtual CNC and Virtual high performance machining system

List of Practicals

1. Study of Auto flow lines.
2. Study of Numerical control system.
3. Study of different types of robots based on configuration and application
4. Study of Automated material handling system.
5. Study of Automated inspection system.
6. Study of Group technology.
7. Study of CAPP systems.
8. Study of Virtual CNC
9. Study of Virtual High Performance Machining System (MACHPRO)}

SUBJECT: PLC & SCADA Lab

CODE: EE-703L

CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
4	120	70	30	100

Objectives

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain PLCs and SCADA systems used in different applications.

Learning Outcomes

- Identify different components of PLC.
- Select appropriate PLC module for given application.
- Develop PLC ladder program for a given application.
- Configure SCADA components as per requirement.
- Develop a simple SCADA application.

List of Practical's

1. Programmable Logic Controller Experiments

- 1.1 Water level controller using programmable logic controller
- 1.2 Batch process reactor using programmable logic controller
- 1.3 Speed control of ac servo motor using programmable logic controller
- 1.4 Lift control system using plc
- 1.5 Star delta starter using plc

2. SCADA Experiments

a) Experiments on Transmission Module

Local Mode

1. Simulation of Faults
Line to Ground Faults (LG)
Line to Line Faults (LL)
2. Ferranti Effect
3. Transmission Line
Resistive Loading
Inductive Loading
4. Transformer Loading
Resistive Loading
Inductive Loading

b) Experiments on Distribution Module

Local Mode

- Relay Co-ordination
- PF Control/Voltage Regulation
- Transformer Loading

Remote Mode

- Relay Co-ordination
- PF Control/Voltage Regulation
- Transformer Loading

SUBJECT: Design of Mechatronics
CODE: MTE-702
CATEGORY: Skill Education Component

Credit	Hours	Marks		
		I	E	To
3	45	15	35	50

Objectives

- To present architecture of the mechatronics system design
- To study on broad spectrum, the characteristics of the mechanical and electrical systems and their selection for automation.
- Development of process plan and templates for design of mechatronic systems

Learning Outcomes

- Interface different component for a mechatronic system.
- Indigenously design and develop a mechatronic system.
- Mechatronics system designing.
- Modeling and simulation.
- Advanced application in mechatronic system design

Unit	Topic	Key Learning
I	INTRODUCTION TO MECHATRONICS SYSTEM DESIGN	<ul style="list-style-type: none"> • 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.
II	PRINCIPLES OF MODELING & SIMULATION	<ul style="list-style-type: none"> • 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.
III	BASIC SYSTEM MODELS	<ul style="list-style-type: none"> • Mathematical models. • Mechanical system building blocks. • Electrical system building blocks. • Fluid system building block
IV	CASE STUDIES ON MECHATRONIC SYSTEM	<ul style="list-style-type: none"> • 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
V	ADVANCED APPLICATIONS IN MECHATRONICS SYSTEM DESIGN	<ul style="list-style-type: none"> • Sensors for condition monitoring • Mechatronic control in automated manufacturing. • Artificial intelligence in mechatronics. • Fuzzy logic applications in mechatronics. • Micro sensors in mechatronics.

Suggested Readings:

- Georg pelz, Mechatronic Systems: Modeling and simulation with HDL's, John wileyandsons Ltd, 2003.
- Devdasshetty, Richard A. Kolk, "Mechatronics System Design", Thomson Learning Publishing Company, Vikas publishing house, 2001.
- Bolton, -Mechatronics - Electronic Control systems in Mechanical and Electrical Engineering-, 2nd Edition, Addison Wesley Longman Ltd., 1999.
- Bishop, Robert H, Mechatronics Hand book, CRC Press, 2002.
- Bradley, D.Dawson, N.C. Burd and A.J. Loader, Mechatronics: Electronics in Products and Processes, Chapman and Hall, London, 1991.

Shri Vishwakarma Skill University

SUBJECT: Design of Mechatronics Lab

CODE: MTE-702L

CATEGORY: Skill Education Component

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

Objectives

- Students will be exposed to electronics devices and their controls used in industrial environment

Learning Outcomes

- The student will be able to use the concept of control motion system
- The student will be able to use the different type of sensor and actuator
- The students will be able to use advanced sensors and actuators in the up gradation of automobiles

List of Practical's

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
7. To study Sensors for Motion Control Encoders, resolvers, decoders, tachogenerators

SUBJECT: Project

CODE: ETP-701L

CATEGORY: Skill Education Component

Credit	Hours	Marks		
		I	E	To
4	120	70	30	100

Objectives

- Team work for designing and fabrication of an original Mechatronics system.
- Decision making and design considerations for an individual/team projects

Learning Outcomes

- Work effectively in a team with a concept from initial stage to the final stage.
- Learn detailed designing and fabrication of mechatronics system.
- Apply all the learnings of the course for proper implementation of the project work.

List of Practical's

- Each student either individually or in a group, will be assigned a mechatronic system design project involving problem definition, selection, analysis, synthesis, optimization and detailing for production.
- Assembly and detailed production drawings will be prepared for the presentation of the design along with a printed report, PPT presentation and soft copy submission of work using software tools for final evaluation by a committee. Specialized software may be used for the design modelling, synthesis, optimization, analysis and for production drawings.
- Use of conventional / unconventional manufacturing processes for the fabrication of the physical prototype. The final manufacturing and working of the system will be required to be analysed.
- The course concludes with a final showcase using poster/ presentation along with comprehensive viva
- **Quality circle dairy Preparation & presentation on real world problem**

Syllabus
(3rd Year-Sixth Semester)
for
B.Voc. (Mechatronics)
Industry Partner
HERO
Session (2019-2022) onwards

Shri Vishwakarma Skill University

Subject Name: MOOC/Online Course-V

CODE:

CATEGORY: General Education Component

MOOC Course / Online Course: As per the availability of Current NPTEL calendar.

Credit	Hours	Marks		
2	30	I	E	To
		30	70	100

Shri Vishwakarma Skill University

SUBJECT: Consumer Affair (MOOC/Online Course-VI)

CODE:

CATEGORY: General Education Component

Credit	Hours	Marks		
		I	E	To
2	30	30	70	100

Objectives.

- This paper seeks to familiarize the students with their rights and responsibilities as a consumer, the social framework of consumer rights and legal framework of protecting consumer rights. It also provides an understanding of the procedure of redress of consumer complaints, and the role of different agencies in establishing product and service standards.
- The student should be able to comprehend the business firms' interface with consumers and the consumer related regulatory and business environment.

Learning Outcomes

- Able to understand the conceptual framework of consumer affair
- Able to explain the consumer protection law in India
- Able to explain the Grievance Redressal Mechanism under the Indian Consumer Protection Law
- Able to explain the Role of Industry Regulators in Consumer Protection
- Able to explain the Contemporary Issues in Consumer Affairs

Unit	Topic	Key Learning
I	Conceptual Framework	<ul style="list-style-type: none"> • Consumer and Markets: Concept of Consumer, Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets, E-Commerce with reference to Indian Market, Concept of Price in Retail and Wholesale, Maximum Retail Price (MRP), Fair Price, GST, labelling and packaging along with relevant laws, Legal Metrology. • Experiencing and Voicing Dissatisfaction: Consumer buying process, Consumer Satisfaction/dissatisfaction-Grievances-complaint, Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000 suite.
II	The Consumer Protection Law in India	<ul style="list-style-type: none"> • Objectives and Basic Concepts: Consumer rights and UN Guidelines on consumer protection, Consumer goods, defect in goods, spurious goods and services, service, deficiency in service, unfair trade practice and restrictive trade practice. • Organizational set-up under the Consumer Protection Act: Advisory Bodies: Consumer Protection Councils at the Central, State and District Levels; Adjudicatory Bodies: District Forums, State Commissions and National Commission: Their Composition, Powers, and Jurisdiction (Pecuniary and Territorial), Role of Supreme Court under the CPA with important case law.
III	Grievance Redressal Mechanism under the Indian Consumer Protection Law	<ul style="list-style-type: none"> • Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties. • Leading Cases decided under Consumer Protection law by Supreme Court/National Commission: Medical Negligence; Banking; Insurance; Housing & Real Estate; Electricity and

		Telecom Services; Education; Defective Products; Unfair Trade Practices.
IV	Role of Industry Regulators in Consumer Protection	<ul style="list-style-type: none"> • Banking: RBI and Banking Ombudsman • Insurance: IRDA and Insurance Ombudsman • Telecommunication: TRAI • Food Products: FSSAI • Electricity Supply: Electricity Regulatory Commission • Real Estate Regulatory Authority
V	Contemporary Issues in Consumer Affairs	<ul style="list-style-type: none"> • Consumer Movement in India: Evolution of Consumer Movement in India, Formation of consumer organizations and their role in consumer protection, Misleading Advertisements and sustainable consumption, National Consumer Helpline, Comparative Product testing, Sustainable consumption and energy ratings. • Quality and Standardization: Voluntary and Mandatory standards; Role of BIS, Indian Standards Mark (ISI), Ag-mark, Hallmarking, Licensing and Surveillance; Role of International Standards: ISO an Overview

Note: Unit 2 and 3 refers to the Consumer Protection Act, 1986. Any change in law would be added appropriately after the new law is notified.

Suggested Readings:

- Khanna, Sri Ram, SavitaHanspal, Sheetal Kapoor, and H.K. Awasthi. Consumer Affairs” (2007) Delhi University Publication; pp. 334/
- Aggarwal, V. K. (2003). Consumer Protection: Law and Practice. 5th Ed. Bharat Law House, Delhi, or latest edition.
- Girimaji, Pushpa (2002). Consumer Right for Everyone Penguin Books.
- Nader, Ralph (1973). The Consumer and Corporate Accountability. USA, Harcourt Brace Jovanovich, Inc.
- Sharma, Deepa (2011). Consumer Protection and Grievance-Redress in India: A Study of Insurance Industry (LAP LAMBERT Academic Publishing GmbH & Co.KG, Saarbrucken, Germany; pp.263 pp.
- Empowering Consumers e-book, www.consumeraffairs.nic.in
- EBook www.bis.org
- The Consumer Protection Act, 1986