

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: **B. Voc. (Mechanical-Manufacturing) with
Industry Partner: Hero MotoCorp**

Duration of the course: **6 Semesters/3 Years**

Batch: **2021-2024 (onwards)**

Credit Allocation:

Type	No. of hrs.	Credit
Theory	15	1
Practical	30	1
On-the-Job Training (OJT)	45	1

B.Voc Mechanical Manufacturing: Hero MotoCorp (Batch 2021-24) 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	*OET-503	*MOOC/ Online Course-I (Manufacturing Technology I &II)	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.

B.Voc Mechanical Manufacturing: Hero MotoCorp (Batch 2021-24) onwards

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	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	Fundamentals 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-502L	Fundamentals of CNC Machines	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

Job Roles: Level-5

Machining Supervisor (ASC/Q3505) /

Assembly Line Supervisor (ASC/Q3602) /

Heat Treatment Shop Supervisor (ASC/Q3902) /

QA Standards Incharge (ASC/Q6305) /

Painting Supervisor (ASC/Q3305)

B.Voc Mechanical Manufacturing: Hero MotoCorp (Batch 2021-24) onwards

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		*MOOC/ Online Course-III	2	0	2	30	70	100	0	0	0	100	30	0	30
		Value Education and 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.

B.Voc Mechanical Manufacturing: Hero MotoCorp (Batch 2021-24) onwards

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	PHY-601 PHY-601L	Applied Physics	3	1	4	15	35	50	35	15	50	100	45	30	75
	EE-501 EE-501L	Basic Electrical and Electronics Engineering	3	1	4	15	35	50	35	15	50	100	45	30	75
	IMS-601	Quality Control and Reliability Engineering	4	0	4	30	70	100	-	-	-	100	60	-	60
	ME-603 ME-603L	Automobile Engineering	3	1	4	15	35	50	35	15	50	100	45	30	75
	EVS-601	EVS	4	0	4	30	70	100	-	-	-	100	60	-	60
	Total			17	3	20	105	245	350	105	45	150	500	255	90
Skill Education Component	ME-601L	CAD Lab	0	4	4				70	30	100	100	0	120	120
	MTE-601 MTE-601L	Basics of Mechatronics	3	1	4	15	35	50	35	15	50	100	45	30	75
	ME-602L	CNC Machines Programming	0	4	4				35	15	50	50		120	120
	Total			3	9	12	15	35	50	140	60	200	250	45	270
Grand Total			20	12	32	120	280	400	245	105	350	750	300	360	660

Job Roles: Level-6

Assembly Line Machine Setter (ASC/Q3603) /

Machine Setter / Master Technician (ASC/Q3506) /

Manager Heat Treatment/Metallurgist (ASC/Q3903) /

Manager Supplier Quality (ASC/Q6302) /

Manager Customer Quality (ASC/Q6304) /

Painting & Surface Treatment Shift- In Charge (ASC/Q3306)

B.Voc Mechanical Manufacturing: Hero MotoCorp (Batch 2021-24) onwards

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		*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.

B.Voc Mechanical Manufacturing: Hero MotoCorp (Batch 2021-24) onwards

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	MSE-701 MSE-701L	Material Science and Heat Treatment	3	1	4	15	35	50	35	15	50	100	45	30	75
	ME-605 ME-605L	Hydraulics and Pneumatics	3	1	4	15	35	50	35	15	50	100	45	30	75
	IMS-701	Work Study and Ergonomics	4	0	4	30	70	100	-	-	-	100	60	-	60
	RA-602 RA-602L	Industrial Robotics and Material Handling Systems	3	1	4	15	35	50	35	15	50	100	45	30	75
	CSE-701 CSE-701L	Industry 4.0	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	ETP-701L	Project	0	4	4	-	-	-	70	30	100	100	0	120	120
	ME-702 ME-702L	Computer Integrated Manufacturing Systems	3	1	4	15	35	50	35	15	50	100	45	30	75
	ME-703L	AUTO CAD –II/ Solid works/ Catia	0	4	4	-	-	-	35	15	50	50	-	120	120
	Total			3	9	12	15	35	50	140	60	200	250	45	270
Grand Total			19	13	32	105	245	350	280	120	400	750	285	390	675

Job Roles: Level-7

Manager-Manufacturing Quality (ASC/Q6306)

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

for

B.Voc. (Mechanical Manufacturing)

Industry Partner: Hero MotoCorp

Batch (2021-2024) onwards

Shri Vishwakarma Skill University

*MOOC/ Online Course-I (Manufacturing Process Technology I&II)

Subject Code: OET-503

Credit	Hours	Marks		
2	30	I	E	To
		30	70	100

Course Objectives:

The objective of this course is to give an exposure on the basic manufacturing, casting and machining, advance machining, metal forming and joining processes in domain of mechanical engineering which is very essential for engineers to acquire desired skills.

Course Outcomes- Student will be able to

- 1.) Recognize and describe various manufacturing processes and their principles used in the manufacturing sector.
- 2.) Understand the casting process, related component and the preparation of these component.
- 3.) Analyze machining process of manufacturing and its related principles and mathematical formulations.
- 4.) Explain advanced machining processes presently in use for precision manufacturing of products.
- 5.) Identify and explain various metal forming and joining processes of manufacturing and their related principles.

Unit	Topic	Key Learning
I	Basics of Manufacturing Processes	<ul style="list-style-type: none"> • Introduction, History of Manufacturing Process, broad classification, Introduction to non-conventional processes, Stress- strain diagram for different types of materials, basic material properties, wear & mechanism of wear, metal & alloys, alloying and related properties, basic heat treatment processes.
II	Introduction to Casting Process	<ul style="list-style-type: none"> • Introduction to casting, types of pattern and moulds, pattern allowances, mould making procedure, gating system and its classification, cooling and solidification of casting.
III	Machining Processes	<ul style="list-style-type: none"> • Introduction, basic machining processes- turning, milling, drilling, mechanism of chip formation, types of chip produced in metal cutting, tool life: wear and failure, Taylor's tool life equation, simple problems,
IV	Advanced Machining Processes	<ul style="list-style-type: none"> • Introduction to micro-manufacturing, advanced machining processes, Classification, Introduction to etching and additive techniques, Introduction to- Abrasive Jet machining process, Ultrasonic machining process, Electrochemical machining process, Electric Discharge Machining.
V	Metal forming and joining processes	<ul style="list-style-type: none"> • Metal forming processes- bulk deformation, sheet metal forming, Introduction to-rolling, forging, extrusion and drawing. Sheet metal working processes. Classification of joining processes, Welding- classification, basic principle of solid state welding, Liquid state welding- types and principle, Brazing, Soldering.

Suggested Readings:

1. Fundamentals of Modern Manufacturing: Materials, Processes, and Systems by Mikell P. Groover
2. Manufacturing Engineering and Technology, 4e by Kalpakjian
3. Manufacturing Science by Amitabha Ghosh and Mallick

*MOOC/ Online Course-II (Entrepreneurship)

Subject Code: OMS-501

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.

Shri Vishwakarma Skill University

Syllabus
(1st Year-Second Semester)
for
B.Voc. (Mechanical Manufacturing)
Industry Partner: Hero MotoCorp
Batch (2021-2024) onwards

Shri Vishwakarma Skill University

Communication Skills

Subject Code: ENG-501

Credit	Hours	Marks		
		I	E	To
03	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

Communication Skills Lab

Subject Code: ENG-501L

Credit	Hours	Marks		
1	30	I	E	To
		35	15	50

List of Experiments:

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

Work Shop Technology

Subject Code: ME-505

Credit	Hours	Marks		
3	45	I	E	To
		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	<p>Introduction, working principle, its construction and specifications.</p> <p><i>Lathe classification; Bench, Tool room, Capstan and Turret, Automatic and Special purpose lathes.</i></p>

		<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

Work Shop Technology Lab

Subject Code: ME-505L

Credit	Hours	Marks		
1	30	I	E	To
		35	15	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.

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

Applied Mathematics

Subject Code: MTH-501

Credit	Hours	Marks		
4	60	I	E	To
		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

		<ul style="list-style-type: none"> • 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

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

Fundamentals of Computer

Subject Code: CSE-501

Credit	Hours	Marks		
3	45	I	E	To
		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 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.
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>

Fundamentals of Computer Lab

Subject Code: CSE-501L

Credit	Hours	Marks		
1	30	I	E	To
		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

Fundamental of Industrial Management and Safety

Subject Code: IMS-501

Credit	Hours	Marks		
		I	E	To
3	45	15	35	50

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.

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

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

Fundamental of Industrial Management and Safety Lab

Paper Code: IMS-501L

Credit	Hours	Marks		
1	30	I	E	To
		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.

Fundamentals of CNC Machines Lab

Subject Code: ME-502L

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 and setting of CNC Machines.

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.

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 presetter 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.

Process

1. Interpretation and understanding of the component Drawing
2. To conceptualize the process based on location points, resting points and clamping points. Which surfaces and operations (drilling, milling, tapping, boring, reaming, to be done.
3. Writing down detail process operation by operation using different jigs and fixtures as conceptualized.
4. Organising fixtures tools, toolings, material for machining the component.

Preparing machine for production

1. Select or write the program for machining the component.
2. Arranging the tools and setting them on presenters.
3. Loading the tools on Auto tool changer as per the program
4. Load the fixture

Measurement of Meteorology

Subject Code: ME-503

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 Tolerancing 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 tolerancing • 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

1. Engineering Metrology, Gupta I.C., Dhanpat Rai Publications.
2. Engineering Metrology and Measurements, N.V.Raghavendra and L.Krishnamurthy, Oxford University Press.
3. Metrology and Measureemnt, Anand K Bewoor and Vinay A Kulkarni, McGraw Hill.

Measurement of Meteorology Lab

Subject Code: ME-503L

Credit	Hours	Marks		
1	30	I	E	To
		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 atleast 8 experiments from above list.

Engineering Graphics and Drawing Lab

Subject Code: ME-501L

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 9equal 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. Jeyapooan,m First Edition 2002, Vikas Publishing House.

Syllabus
(2nd Year-Third Semester)
for
B.Voc. (Mechanical Manufacturing)
Industry Partner: Hero MotoCorp
Batch (2021-2024) onwards

*MOOC/ Online Course-IV (Value Education and Professional Ethics)

Subject Code:

Credit	Hours	Marks		
		I	E	To
2	15	30	70	100

Course 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: कर्मसु कौशलम् .
- 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-1 (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 Behaviours versus Ethical

Behaviour: Case Studies (from Yoga-Sutra, Bhagwat Geeta, Panchatantra, Autobiography of Mahatma Gandhi) or any other literatures.

Unit-2 (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-3 (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-4 (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-5 (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)

Recommended Books:

- 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).
- 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).
- Professional Ethics and Human Values Paperback – 2015 by A. Alavudeen (Author), R. Kalil Rahman (Author), M. Jayakumaran (Author), Publisher: Laxmi Publications; First edition (2015).
- 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)
- Living Issues in Philosophy (9th Edition) (1995) By : Titus, Smith and Nolan, Publisher: Oxford University Press, New York.
- Foundation of Ethics and Management By : B P Banerjee, Publisher: Excel Books, 2005.

Recommended Books:

- Case Study: <https://whitneyhess.com/blog/2012/08/21/on-empathy-and-apathy-two-case-studies/> Book: De Gruyter - Speaking of Emotions: Conceptualisation and Expression (edited by Angeliki Athanasiadou, Elzbieta Tabakowska)
- Book: To Kill a Mockingbird - Lee Harper
- Book: Take A Walk In Someone Else's Shoes by Bethany Morlan
- A paper on 'University Students' Value Priorities and Emotional Empathy': file:///C:/Users/Dell/Desktop/University_Students_Value_Priorities_and_Emotionala.pdf
- Research paper on 'Empathy as Added Value in Predicting Donation Behavior': file:///C:/Users/Dell/Desktop/wp_10_692.pdf
- Decety J and Jackson PL. 2004. The functional architecture of human empathy. Behavioral and cognitive neuroscience reviews 3(2):71-100.
- Klimecki OM1, Leiberg S2, Ricard M2, Singer T3. Differential pattern of functional brain plasticity after compassion and empathy training. Soc Cogn Affect Neurosci. 2014 Jun; 9 (6): 873-9.
- A paper on 'The Science of Empathy' - <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5513638/>

- A paper on 'The Psychology of Emotional and Cognitive Empathy' - <https://lesley.edu/article/the-psychology-of-emotional-and-cognitive-empathy>
- Links on the latest research and reviews on articles related to empathy - <https://www.nature.com/subjects/empathy>

Suggested videos/movies (English/Hindi)

- The Boy in the Striped Pyjamas (an English movie based on the novel by the same name by John Boyne)
- Chhapaak (an Indian movie about how a young woman tries to rebuild her life after a man throws acid in her face on a public street in New Delhi in 2005)
- George Lucas Educational Foundation – Edutopia – 3 videos on the importance of empathy - <https://www.edutopia.org/blog/3-videos-importance-empathy>.
- The actor, Mark Ruffalo, and Murray (from Sesame Street) talk about the word "Empathy" - https://www.youtube.com/watch?v=9_1Rt1R4xbM
- <http://theconversation.com/understanding-others-feelings-what-is-empathy-and-why-do-we-need-it-68494>
- <https://www.verywellmind.com/what-is-empathy-2795562>
- "The Present" is a thesis short from the Institute of Animation, Visual Effects and Digital Postproduction at the Filmakademie Baden-Wuerttemberg in Ludwigsburg, Germany. - <https://www.youtube.com/watch?v=96kl8Mp1uOU>

Syllabus
(2nd Year-Fourth Semester)
for
B.Voc. (Mechanical Manufacturing)
Industry Partner: Hero MotoCorp
Batch: (2021-2024) onwards

Applied Physics

Subject Code: PHY-601

Credit	Hours	Marks		
		I	E	To
3	45	15	35	50

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

Applied Physics Lab

Subject Code: PHY-601L

Credit	Hours	Marks		
		I	E	To
01	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 Practicals

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.

Basics of Electrical & Electronics Engineering

Subject Code: EE-501

Credit	Hours	Marks		
		I	E	To
03	45	15	35	50

Objectives:

- To Provide knowledge of Electrical Circuits.
- To Provide knowledge of Electrical Protective Equipment's.
- To Provide knowledge of Semiconductor and Applications.

Learning Outcomes:

- Able to understand the concept of Current, Voltage and Power.
- Able to understand the concept of Transformers and Motor.
- Able to understand the concept of Relay and Circuit Breaker.
- Able to understand the concept of Semiconductor diodes & Bipolar Junction Transistor.

Unit-I

D.C Circuits: Definition of Voltage, Current, Power, Resistance, Inductance and Capacitance with their units, Ohm's law, Kirchhoff's Law, Series -Parallel Circuit, Conversion of Current and Voltage Source.

Unit-II

Three Phase A.C Circuits: Generation of 3 phase E.M.F, Difference between three-phase and single-phase supply, Star connection, Delta Connection and its Conversion.

Unit-III

Electrical Machines: Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Transformer, Induction Motor, Servo & Stepper motors.

Unit-IV

Protective Devices & Safety Precautions: Introduction to PPE (Personal Protective Equipment) & Safety Precautions, Introduction of Relays, Contactors, MCBs, ELCBs, Fuses, Concept of Neutral and Earthing.

Unit-V

Semiconductor Devices & its Applications: Basic idea of semiconductors – P and N type; diodes, Zener diodes and their applications, transistor – PNP and NPN, symbols, identification of terminals of transistor, current flowing in a transistor, its characteristics and uses. Characteristics and applications of a thyristor.

Text Books

- Basic of Electrical and Electronics Engineering by S.k Sahdev, Dhanpatrai Publications,2013.
- Text Book of Electrical Technology by B.L Theraja, S.Chand Publications,2014

Reference Books

- A Course in Electrical Technology by J.B Gupta, Katson Publications,2013
- Electrical Technology by J.S Katre, Techmax Publications, 2016

Basics of Electrical & Electronics Engineering Lab

Subject Code: EE-501L

Credit	Hours	Marks		
		I	E	To
01	30	35	15	50

List of Experiments

1. Introduction of tools, symbols and abbreviations.
2. To verify Kirchhoff's current & voltage law.
3. Construction & Working of DOL starter.
4. Construction & Working of Star-Delta starter.
5. Construction & Working of Distribution Board and Extension Board.
6. To perform open circuit test and short circuit test of a single-phase transformer.
7. Draw V-I characteristics of P-N junction diode.
8. Draw input and output characters of a transistor.
9. Draw reverse break down characteristics of a Zener diode.
10. Construction & Working of Half Wave & Full Wave rectifier on bread board.

Quality Control and Reliability Engineering

Subject Code: IMS-601

Credit	Hours	Marks		
04	60	I	E	To
		30	70	100

Learning Outcomes:

1. Students will be able to know the concept of Statistical process control.
2. Able to know the concept of Acceptance sampling
3. Able to know concept of Reliability engineering.

Unit 1:

Quality Concepts: Quality-Factors influencing quality, quality costs, economics of quality, quality assurance statistical tools used in quality in SQC, Quality planning, Organization for quality. DIN Standard, JIS Standard, C-certification, Bureau of Indian standards, ISO 9000-quality circles KAIZEN-TQM concepts-Quality audit.

Unit 2:

Statistical Process Control: Variation in processes, Factors, Process capability, Analysis of process capability, control charts, variables, Attributes, Establishing and interpreting control charts, X,R, chart for variables, defects, P chart, C-chart and U chart-Con-troll charts for defective quality rating

Unit 3:

Acceptance Sampling: Lot-by-lot sampling, types probability of acceptance in single double, multiple sampling techniques-O.C. curves procedure's Risk and consumers Risk AQL, LTPD, AOQL concepts-standard sampling plans for AQL AND LTPD- uses of standard sampling plans.

Unit 4:

Life Testing-Reliability-Systems Approach: Life testing-objectives-classification-failure characteristics-failure data analysis-mean time to failure-maintainability and availability-reliability-system reliability-series and parallel systems-systems reliability in terms of probability of failure-MTBF-Acceptance sampling based on reliability test OC curves.

Unit 5: Quality and Reliability: Reliability improvement-techniques, use of pareto analysis - Design for reliability, Redundancy, standby redundancy, failsafe systems-optimization in reliability, product design, product analysis, product development product cycle.

References:

1. Betster field D.H. Quality Control-Prentice Hall Pub (1993) (Revised Edn.)
2. Sharma S.C. Inspection Quality Control and Reliability –Khanna Publishers New Delhi (1998)
3. John Bank, The Essence of Total Quality Management, Prentice Hall of India P Ltd New Delhi 1995.
4. Danny Samson, Manufacturing & Operations strategy. Prentice Hall New York (1991)
5. Ganapathy K. Subramaniam B. Narayana V-Quality Circle concepts and implementation – QCFI. Secondrabad 919940.
6. Tapan P. Bagchi ISO9000. Concepts methods and implementation – Wheeler Publisher Allahbad (1994) Automobile Engineering Syllabus 17

Automobile Engineering

Subject Code: ME-603

Credit	Hours	Marks		
		I	E	To
03	45	15	35	50

Course Objectives:

1. To provides basic knowledge about the automobile body, power unit, transmission system, braking system etc.
2. It also provides general tools and technique of maintenance and servicing of the automobile as per the requirement.
3. Introduction to electrical and other auxiliary component and their maintenance.

Overall objective of this course is to impart skills to students to covers the current expectation and requirements of automotive manufacturing industry.

Learning Outcomes: Learner will be able to...

1. Understand the construction, function and working of individual component of a vehicle and the system in which they functions.
2. Understand the need of maintenance service to prevent or remove the defects that may come up in running life of a vehicle.
3. To perform and understand the assembly, dismantling and servicing tools, technique of a vehicle.

Unit-1

Introduction to Automobile: - Introduction to automobiles, their utility and classification. Main components of an automobile and their functions, Various mechanisms and systems in an automobile, Scheduled and preventive maintenance, Servicing of a vehicle, electrical system: lights, fuses, computer and alternator, battery etc, wiring harness etc.

Unit-2

Engine System: Automobile engine, its main components, construction and working. Types of engines – two stroke/ four stroke and their cycle, petrol / diesel fuel, Engine specifications, Introduction to Engine cooling system and lubrication system.

Introduction to Concept of Knock & detonation. Concept of carburettor, Emission system and standards (Bharat IV and Bharat VI).

Unit-3

Transmission & Braking System: Transmission System: Working of single and multi-plate clutches. Introduction to testing clutch unit. Construction, function and working of a gearbox. Introduction to Manual shifting and automatic transmission. Possible Troubles in gear box and rectifications.

Function and principles of braking system, classification of various brakes, working of mechanical, hydraulic, pneumatic, air-assisted hydraulic brake, disc brakes, parking brake, ABS System.

Unit-4

Advancement in Automobile: Methods employed for increasing the efficiency of present automobiles- Supercharging and Turbocharging, regenerative braking etc. Innovation and new trends in automobiles- Electric vehicles, Hybrid Vehicles, environment friendly vehicles and other advancements.

Unit-5

Ignition & Injection System: Types of ignition system, Auto Electronics and electrical, transistorized coil ignition system (TCI), capacitive discharge ignition system (CDI). Ignition system testing, Spark plug testing, ignition timing and setting. Introduction to Injection system in engine.

Recommended Books:

1. Automobile engineering Vol.1 & Vol.2 by Dr. Kripal Singh
2. Automobile Engineering by S.K Gupta
3. Automobile Engineering by K.K Jain and R.B Asthana

Automobile Engineering Lab

Subject Code: ME-603L

Credit	Hours	Marks		
01	30	I	E	To
		35	15	50

Exp.-1. Handling and use of general and special tools used in automobile servicing (two-wheeler).

Exp.-2. Demonstration of dismantling of motorcycle using general and special tools and its assessment.

Exp.-3. Assembly of motorcycle using the required tools and attachment.

Exp.-4. Demonstration of working of 2 stroke and 4 stroke engines.

Exp.-5. Demonstration and Study of electrical systems of two-wheeler (motorcycle).

Exp.-6. Demonstration of dismantling of scooter using general and special tools.

Exp.-7. Assembly of scooter using required tools and attachment.

Exp.-8. Demonstration of electrical systems of scooters.

Exp.-9. Study and analysis of various engine parameters.

Environmental Studies (EVS)

Subject Code: EVS-601

Credit	Hours	Marks		
		I	E	To
04	60	30	70	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.

Computer Aided Design Lab (CAD)

Subject Code: ME-601L

Credit	Hours	Marks		
		I	E	To
04	120	70	30	100

Course objectives: This course introduces students to CAD in general and students will learn theory and practice related to tools & commands used in CAD models for designing.

Learning Outcomes:

- Understand how CAD technology can be leveraged in the design process
- To Design a part or assembly of parts using Computer-Aided Design software. (AUTO CAD/ PRO-E/CATIA/ UNIGRAPHICS)
- Make appropriate selection of CAD functionality to use as tools in the design process.
- Communicate effectively about geometry and intent of design features.

Theory

UNIT-I Introduction: Computer graphics & its terminology, CAD definition, concept & need CAD process, Functional areas of CAD, Coordinate systems

UNIT-II Transformation: Output primitives (points, lines, curves, etc.), 2D & 3D transformation (Translation, Scaling & rotation). Projections: orthographic & Isometric.

UNIT-III Curves: Introduction, Analytic curves-line, circle, ellipse, parabola, hyperbola. Synthetic curves: Hermite cubic spline, bezier curve, B- spline curve

UNIT-IV Surface Modelling: Introduction, Surface representation, Analytic surface, synthetic surfaces-hermite bi cubic surface, bezier surface, b- spline surface

UNIT-V Solid Modelling: Introduction, Geometry & topology, solid representation, boundary representation, sweep representation.

List of Experiments:

1. Starting the software; Setting the paper size, space; setting the limits, units; use of snap and grid commands.
2. Drawing of primitives (Line, arc, circle, ellipse, triangle etc.)
3. Drawing a flange.
4. Drawing a bushing assembly.
5. Dimensioning the drawing and adding text.
6. Setting the layers and application of layers.
7. Isometric and Orthographic projections.
8. Viewing in three dimensions.
9. Removal of hidden lines – Shading and Rendering.
10. Assigning material and calculation of mass properties.

The students must understand and able to use following

- **Basic drawing commands** (Line/ Point/ Circle/ Arc/ Trace/ Text/ Dtext/ Redraw/ Zoom/ Pan/ Ortho/ Coordinates/ Grid/ Snap/ Ellipse/ Polygon)

- **Editing Drawings:** Select/ Erase/ Oops/ Move/ Copy/ Break/ Fillet/ Divide/ Explode/ Undo/ Redo/ Trim/ Extend/ Rotate/ Scale/ Offset/ Mirror/ Stretch/ Chamfer/ Array
- **Inquiry Commands & Intermediate Drawing Commands:** ID/ List/ Status/ Time/ Color/ Area/ Files. Layers/ Change/ Rege/ Fill/ Solid/ Hatch/ Block/ Insert/ WBlock.
- **Dimensioning:** Associative, Base-line, Linear, Angular, Center, Mark, Diameter, Leader, Radius, Setting Dimensioning Variables, Text Fonts and Styles
- **Advanced Drafting Commands:** Spline/ Fit/ Osnap, 3-Dimensioning Drafting, Iso commands, 3D Shapes, User Coordinate System, Elevation, Thickness, Viewpoint, Viewports, 3D Polylines, 3D Face, 3D Surfaces of Revolution,

Able to read the drawings on all views of 3D and 2D Drawings.

Recommended Books:

1. CAD by Sadhoo Singh by Khanna Publisher.
2. CAD by Vikram Sharma

Shri Vishwakarma Skill University

Basics of Mechatronics

Subject Code: MTE-601

Credit	Hours	Marks		
		I	E	To
03	45	15	35	50

Objectives

- Study of various mechatronics elements and their application.
- Study of means of measuring various physical variables.
- Study of different types of sensors and actuators

Learning Outcomes

- Illustrate how different elements are presented and illustrate their working principles.
- Illustrate issues of implementation of different sensors including calibration and error analysis
- Demonstrate different types of actuators and their implementation
- Demonstrate different types of mechatronics elements.
- Combined form of mechanical and electrical components.
- Basics of Automation
- Actuators and sensors.

Unit-I

Introduction: Introduction to Mechatronics –systems – concepts of Mechatronics approach, Need for Mechatronics, Emerging areas of Mechatronics, Classification of Mechatronic.

Unit-II

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

Unit-III

Basic Programmable Logic Controller (PLC) and its Components: Basic structure, Input and output processing, Programming, Timers, counters, Selection of PLC Introduction, Basic commands of PLC

Unit-IV

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

Unit-V

Basic of Design of Mechatronics, Pneumatics & Hydraulics system: Design Process, Stages of Design Process, Traditional & Mechatronics Design concept, Basics of Pneumatics & Hydraulics system

Suggested Readings:

- System design – Devdas Shetty & Richard A.Kolk PWS Publication
- Mechatronics - Electronics control systems in Mechanical Engineering W.Bolton(Pearson)
- Mechatronics HMT (TMH)
- Mechatronics -- Prof.C.R. Venkataramana, Sapna Book House
- Mechatronics -- Electronics in product & process—Bradley, Dawson, Burd and Loader
- Introduction to mechatronics & measuring system.—Alciatore (TMH).

- Mechatronics Principles, concept & Applications—Mahalik (TMH).
- Pneumatic system principle & maintenance – Majumdar

Basics of Mechatronics Lab

Subject Code: MTE-601L

Credit	Hours	Marks		
		I	E	To
03	45	15	35	50

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 Practicals

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).

CNC Machines Programming

Subject Code: ME-602L

Credit	Hours	Marks		
		I	E	To
03	45	15	35	50

Programming by using NC Editor:

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. Finding out coordinates for work and tool
5. Programming by using simulator: Path simulation and solid simulation

List of Experiments

Exp.-1: To study G codes and M codes.

Exp.-2: To study and navigate process of NC/CNC machine tools.

Exp.-3: To familiarize with different coordinate systems.

Exp.-4: To perform setting and off-setting the component.

Exp.-5: To learn and execute programming technique such as interpolation, helical, compensation and their application.

Exp.-6: CNC Part programming, sub programming and execution of an operation on milling machine.

Exp.-7: CNC Part programming, sub programming and execution of an operation on drilling machine.

Exp.-8: CNC Part programming, sub programming and execution of an operation on Lathe Machine.

Exp.-9: CNC Part programming by using Canned Cycles and execution of an operation on VMC machine.

Exp.-10: CNC Part programming by using turning cycles and execution of an operation on HMC machine.

Exp.-11: CNC Part programming for threading operation and execution of an operation on VMC machine.

Exp.-12: CNC Part programming for threading operation and execution of an operation on HMC machine.

Exp.-13: CNC Part programming and execution for different types of pockets.

Exp.-14.: Write and execute a program for CNC Machines for a process of a complex drawing part.

Exp.-15: Understand Automatic tool changer and its relationship with program and putting the tool into ATC.

Syllabus
(3rd Year-Fifth Semester)
for
B.Voc. (Mechanical Manufacturing)
Industry Partner: Hero MotoCorp
Batch: (2021-2024) onwards

Shri Vishwakarma Skill University

*MOOC/ Online Course-VI (Consumer Affairs)

Subject Code:

Credit	Hours	Marks		
		I	E	To
2	15	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-1 (Conceptual Framework)

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.

Unit-2 (The Consumer Protection Law in India)

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.

Unit-3 (Grievance Redressal Mechanism under the Indian Consumer Protection Law)

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.

Unit-4 (Role of Industry Regulators in Consumer Protection)

Banking: RBI and Banking Ombudsman

Insurance: IRDA and Insurance Ombudsman

Telecommunication: TRAI

Food Products: FSSAI

Electricity Supply: Electricity Regulatory Commission

Real Estate Regulatory Authority

Unit-5 (Contemporary Issues in Consumer Affairs)

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.

Recommended Books:

- Khanna, Sri Ram, Savita Hanspal, 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.

Syllabus
(3rd Year-Sixth Semester)
for
B.Voc. (Mechanical Manufacturing)
Industry Partner
Hero MotoCorp
Batch (2021-2024) onwards

Material Science and Heat Treatment

Subject Code: MSE-701

Credit	Hours	Marks		
		I	E	To
03	45	15	35	50

Course Objectives:

The course inculcates students the structure and properties of materials and heat treatment of materials to modify the properties of materials.

Learning Outcomes: The students will be able:

- To learn about basic principles of different engineering materials and applications.
- To understand Crystallography
- To learn about the difference materials
- To learn about the Miscellaneous materials
- To learn about the heat treatment

Unit-I

Introduction- Overview of different engineering materials and applications. Thermal, Chemical, Electrical, Mechanical properties of various materials. Overview semi-conducting material.

Unit-II

Crystallography: Unit Cell, Arrangement of atoms in Simple Cubic Crystals, BCC, FCC and HCP Crystals, Number of atoms per unit Cell, Atomic Packing Factor, Behaviour of material under load and stress-strain. Overview of failure modes, fracture, fatigue and creep.

Unit-III

Compressible Metals and Alloys: Classification of iron and steel, Cast Iron: Different types of Cast Iron, and their usage. Steels: Steels and alloy steel, Classification of plain carbon steels, Properties and usage of different types of Plain Carbon Steels, Effect of various alloys on properties of steel, Uses of alloy steels (high speed steel, stainless steel, spring steel, silicon steel) Non Ferrous Materials, their alloys, properties and uses of White Metals and their alloys.

Unit-IV

Miscellaneous Materials: Classification-thermoplastic and thermo set and their uses, Various Trade names of engg. Plastics. Composites- properties, applications Ceramics-Classification, properties, applications, uses of Asbestos, Glass wool, thermocole, cork, mica, Carbon Fibers, Nano materials, Teflon (PTFE). Overview of tool and die materials.

Unit-V

Heat Treatment: Purpose of heat treatment, various heat treatment processes- hardening, tempering, annealing, normalizing, Case hardening and surface hardening-carburizing, nitriding, flame hardening.

Suggested Readings:

- Introduction to Engineering Materials by B. K. Agrawal, TMH, 2007
- Engineering Materials and Metallurgy, by R Srinivasan, TMH, 2nd Edition
- Engineering Materials & Metallurgy, R. K. Rajput, S. Chand Limited, 2006.

Material Science and Heat Treatment Lab

Subject Code: MSE-701L

Credit	Hours	Marks		
		I	E	To
01	30	35	15	50

List of Experiments:

- To study crystal structures of a given specimen.
- To study crystal imperfections in a given specimen.
- To study Bravais lattices with the help of models.
- To prepare solidification curve for a given specimen.
- To study heat treatment processes (hardening and tempering) of steel specimen.
- To study microstructures of metals/ alloys.
- To study thermo-setting of plastics.
- To study the creep behaviour of a given specimen.
- To study the mechanism of chemical corrosion and its protection.
- To study microstructure of heat-treated steel.
- To study the properties of various types of plastics.
- To study crystal structures and crystals imperfections using ball models

Hydraulics and Pneumatics

Subject Code: ME-605

Credit	Hours	Marks		
		I	E	To
03	45	15	35	50

Course 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. To teach the hydraulic and pneumatic automation and basics of PLC controls.

Learning Outcomes:

- Working principle of various components used for hydraulic & pneumatic systems.
- Identify various components of hydraulic Pumps systems, Hydraulic Actuators and Valve.
- Ability to design pneumatic system for industrial applications.
- Ability to understand industrial applications of hydraulic and pneumatic system.
- Design of hydraulic and pneumatic circuits

Unit-I. Introduction- Need, scope 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.

Unit-II. Hydraulic Elements-Construction, working applications and selection criteria of pumps, Power packs, 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.

Unit-III. Fundamentals of Pneumatics Compressible fluid flow, mass flow rate, compressible fluid- Type, properties and applications.

Unit-IV. Pneumatic Element

Pipes- Type, designations, 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. Installation. Other Elements - Air receivers, filters, pressure regulator, lubricator.

Unit-V. Hydraulic and Pneumatic Circuits Concept, Meaning and ISO symbols, Brief on the designing of hydraulics and pneumatic circuits. applications.

Text Books:

- Fluid Mechanics & Hydraulic Machines by R K Bansal
- Hydraulics and Pneumatics by A.Parr
- Anthony Esposito, "Fluid Power with Applications", PHI / Pearson Education, 2005
- Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.

Reference Books:

- Majumdar, S.R., "Pneumatic Systems – Principles and Maintenance", Tata McGraw Hill, 2007.
- Srinivasan. R, "Hydraulic and Pneumatic Control", IInd Edition, Tata McGraw - Hill Education,2012.

Hydraulics and Pneumatics Lab

Subject Code: ME-605L

Credit	Hours	Marks		
		I	E	To
01	30	35	15	50

Course Objectives:

The students who attend to this course; Can explain the similarities and differences of the electrical, pneumatic and hydraulic systems, can decide which system is better for a specific application, can explain the basic parts of the industrial hydraulic and pneumatic systems and their functions, can design a hydraulic or pneumatic system circuit by using related software and make simulations, can design a hydraulic or pneumatic system and outline PLC control algorithm for a predefined automation process.

List of experiment

1. Design and testing of hydraulic circuits using
 - a) Pressure control
 - b) Flow control
 - c) Direction control.
2. Design of circuit with programmed logic sequence, using an optional PLC in hydraulic Electro Hydraulic Trainer.
3. Design and testing of pneumatic circuits using
 - a) Pressure control
 - b) Flow control
 - c) Direction control
 - d) Circuits with logic controls
 - e) Circuits with timer's
 - f) Circuits with multiple cylinder sequences in pneumatic electro pneumatic trainer.
4. Design of circuits using mechanical feedback systems.
5. Velocity control of single and double acting hydraulic and pneumatic cylinders.
6. Design of Pneumatic system using any commercially available simulation software.
7. Design of Hydraulic system using any commercially available simulation software.

Work Study & Ergonomics

Subject Code: IMS-701

Credit	Hours	Marks		
		I	E	To
04	60	30	70	100

Learning Outcomes:

- Working principle of Work Study and Productivity
- To learn about Work Study
- To learn about Method Study
- To understand Work Measurement
- To learn about the Man and Machine Interaction

Unit-I

Productivity and Work Study: Introduction Definition of Productivity, Productivity of the Individual Organization, Work Study and Productivity Interrelationship of the Various Methods Used to Reduce Ineffective Time.

Unit-II

Human Factors in Work Study: Introduction, Objectives of Work Study, Importance Segments of Work Study, Human Factors Consideration in the Application of Work Study, The Role of Management and Supervisor in Work Study.

Unit-III

Method Study (Motion Study): Introduction, Definition of Method Study, Procedure of Method Study, Develop the Best Method, Install the Best Proposed Method, Maintain the Installed Method Process Analysis, Principles of Motion Economy, Operation Analysis, Therbligs, Work Simplification.

Unit-IV

Work Measurement: Introduction to Work Measurement, Stopwatch Time Study, Essentials for Time Study, Time Study Procedure, Applications of Time Study, Selection of Worker for Time Study, Time Study Equipment, Recording Observation on Time Study Form, Performance Rating, Comparison of Observed and Standard Ratings.

Unit-V

Introduction to Ergonomics: Evolution of Ergonomics, Introduction, Definitions of Ergonomics, The Scope of Ergonomics, Aspects of Ergonomics, Application Areas of Ergonomics, Man and Machine Interaction.

Text Books:

- Work Study and Ergonomics, by Lakhwinder Pal Singh, Cambridge University Press, 2016
- Work Study and Ergonomics, P. C. Tewari, Taylor & Francis Group, 2018

Reference Books:

- Essentials of Work Study (Method Study and Work Measurement), Shyam Bhatawdekar Kalpana Bhatawdekar, and Create space Independent Pub., 2012

Industrial Robotics and Material Handling Systems

Subject Code: RA-602

Credit	Hours	Marks		
		I	E	To
03	45	15	35	50

Objectives:

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

Learning Outcomes:

- Able to design automatic manufacturing cells with robotic control using the principle behind robotic drive system, end effectors, sensor, machine vision robot kinematics and programming.

Unit-I

Introduction: Types of industrial robots, Load handling capacity, general considerations in Robotic material handling, material transfer, machine loading and unloading, CNC machine tool loading, Robot centered cell.

Unit-II

Robots for Inspection: Robotic vision systems, image representation, object recognition and categorization, depth measurement, image data compression, visual inspection, software considerations.

Unit-III

Other Applications: Application of Robots in continuous arc welding, Spot welding, Spray painting, assembly operation, cleaning, robot for underwater applications.

Unit-IV

End Effectors: Gripper design, degrees of freedom. Types of end effectors & their uses.

Unit-V

Material Handling: Concepts of material handling, principles and considerations in material handling systems design, conventional material handling systems - industrial trucks, monorails, rail guided vehicles.

Text Books:

- Richaerd D Klafter, Thomas Achmielewski and Mickael Negin, "Robotic Engineering – An integrated Approach" Prentice Hall India, New Delhi, 2001.
- Mikell P. Groover, "Automation, Production Systems, and Computer Integrated Manufacturing", 2nd Edition, John Wiley & sons, Inc, 2007

Reference Books:

- James A Rehg, "Introduction to Robotics in CIM Systems", Prentice Hall of India, 2002.
- Deb S R, "Robotics Technology and Flexible Automation", Tata McGraw Hill, New Delhi, 1994

Industrial Robotics and Material Handling Lab

Subject Code: RA-602L

Credit	Hours	Marks		
01	30	I	E	To
		35	15	50

List of Experiments:

1. Use of direction control valve and pressure control valves clamping devices for jig and fixture.
2. Study of robotic arm and its configuration.
3. Study the robotic end effectors.
4. Study of different types of hydraulic and pneumatic valves.
5. Study of reciprocating movement of double acting cylinder using pneumatic direction control valves.
6. Study of power steering mechanism using cut piece model.
7. Design and assembly of hydraulic / pneumatic circuit.

Shri Vishwakarma Skill University

Industrial 4.0

Subject Code: CSE-701

Credit	Hours	Marks		
		I	E	To
03	45	15	35	50

Objectives:

- Objective of the course is to introduce 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-I

Introduction of Industry 4.0: 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.

Unit-II

Industry 4.0 Technologies: 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.

Unit-III

Introduction to IoT: Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT.

Unit-IV

IoT & M2M: Machine to Machine, Difference between IoT and M2M, Software define Network.

Unit-V

Introduction of Artificial intelligent: Foundations, scope, problems, and approaches of AI, Intelligent agents: reactive, deliberative, goal-driven, utility-driven, and learning agents.

Text Books:

- Vijay Madiseti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach"
- Walteneus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

Industrial 4.0 Lab

Subject Code: CSE-701

Credit	Hours	Marks		
		I	E	To
01	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
- An 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. To study and analyse components of a real robot and its DH Parameter .

Project

Subject Code: ETP-701L

Credit	Hours	Marks		
		I	E	To
04	120	70	30	100

Objectives:

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

Learning Outcomes: The learner will be able to

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

Content:

- Each student either individually or in a group, will be assigned a 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.
- Project based on Quality circle (dairy Preparation & presentation) on industry related problem

Computer Integrated Manufacturing Systems

Subject Code: ME-702

Credit	Hours	Marks		
		I	E	To
03	45	15	35	50

Objectives:

- To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

Learning Outcomes: The learner will be able to

- Working principle of type of manufacturing system
- To learn about various Tool Monitoring System
- To learn about basic principles of Pneumatics
- To understand Cellular Manufacturing
- To learn about the Integration of robotics in CIM system

Unit-I

Introduction: Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM – Concurrent Engineering-CIM concepts – Computerised elements of CIM system –Types of production – Manufacturing models and Metrics – Mathematical models of Production Performance – Simple problems – Manufacturing Control – Simple Problems – Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production.

Unit-II

Production planning and control and computerised process planning: Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning – Aggregate Production Planning and the Master Production Schedule – Material Requirement planning – Capacity Planning- Control Systems-Shop Floor Control-Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP) – Simple Problems.

Unit-III

Cellular Manufacturing: • Group Technology(GT), Part Families – Parts Classification and coding – Simple Problems in Opitz Part Coding system – Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing – Rank Order Clustering Method – Arranging Machines in a GT cell – Hollier Method – Simple Problems.

Unit-IV

FMS: Types of Flexibility – FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control– Quantitative analysis in FMS – Simple Problems. Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.

Unit-V

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

Suggested Readings:

- CAD/CAM: Computer-Aided Design and Manufacturing, by Groover & CAD/CAM/CIM by P. Radhakrishnan, V. Raju
- Automation, Production Systems, and Computer-Integrated Manufacturing by Mikell P. Groover.
- Groover, M. P., Automation, Production systems and Computer Integrated Manufacturing, Pearson Education Asia (2009).
- Vajpayee, K.S., Principles of Computer Integrated Manufacturing, Prentice Hall (2006).
- Rao, P. N., Tewari, N. K. and Kundra, T. K., Computer Integrated Manufacturing, McGraw Hill (1998).

Reference Books:

- Kant Vajpayee S, "Principles of Computer Integrated Manufacturing", Prentice Hall India, 2003.

Shri Vishwakarma Skill University

Computer Integrated Manufacturing Systems Lab

Subject Code: ME-702L

Credit	Hours	Marks		
1	30	I	E	To
		35	15	50

List of Practicals

1. FMS (Flexible Manufacturing System): Programming of Automatic storage and Retrieval system (AS/RS) and linear shuttle conveyor Interfacing CNC lathe, milling with loading unloading arm and ASRS to be carried out on simple components.(Only Demo/Viva)
2. Robot programming: Using Teach Pendant & Offline programming to perform pick and place, stacking of objects (2 programs). (Only Demo/Viva)
3. Pneumatics and Hydraulics, Electro-Pneumatics: 3 typical experiments on Basics of these topics to be conducted.

AUTO CAD-II/ Solid Works/CATIA

Subject Code: ME-703L

Credit	Hours	Marks		
		I	E	To
04	120	35	15	50

Objective:

Students will be practicing on 2D & 3D Designing software.

Lab Experiments

- Design and drawing of piston, piston pin and piston rings.
- Design and drawing of connecting rod small end and big end, shank design, design of big end cap bolts and drawing of the connecting rod assembly.
- Design and drawing of crankshaft, balancing weight calculations, development of short and long crank arms, front end and rear end details.
- Design and drawing of flywheel, ring gear design. Design and drawing of the inlet and exhaust valves

*To be made as per availability of software in the University.