SCHEME OF EXAMINATION

and

SYLLABUS

for

Bachelors in Vocation (B. Voc.)

in

MECHANICAL (MANUFACTURING)

Offered by

Community college of skill development

J C Bose University of Science & Technology YMCA Sector-6, Mathura Road, Faridabad,

Haryana, India

2025-26

ABOUT THE PROGRAM

The B.Voc. Degree in manufacturing runs with a mission to impart knowledge, technical skills & hands-on training in production, focusing on manufacturing, quality control, CNC technology and machine maintenance. This program is an outcome of industry and student demand. Only Degree program in manufacturing with more than 80% Practical to make you more employable and outshine your career. This program is designed to introduce the students to the elements of engineering and management sciences and production technology consists of elements of operations research, production planning, materials management etc. Students under this program will use application of engineering and management techniques to simplify the production process. The main aim of production technology is to solve problems and challenges arising in the field of production/manufacturing. Vocational training programs have been created with the aim of imparting industry-specific skills in students. These programs are crafted in such a way that the students acquire skills, which will lead them to employment in the respective sector.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO-1: To train students with practical skills and experimental practices related to core and applied areas of Manufacturing Technology to expand their knowledge horizon beyond books and make them industry ready.

PEO-2: To enable students to design and manufacture mechanical equipment which are useful for the industries.

PEO-3: To improve team building, team working and leadership skills of the students with high regard for ethical values and social responsibilities.

PEO- 4: To enable students to communicate effectively and efficiently.

PROGRAMME OUTCOMES (POs)

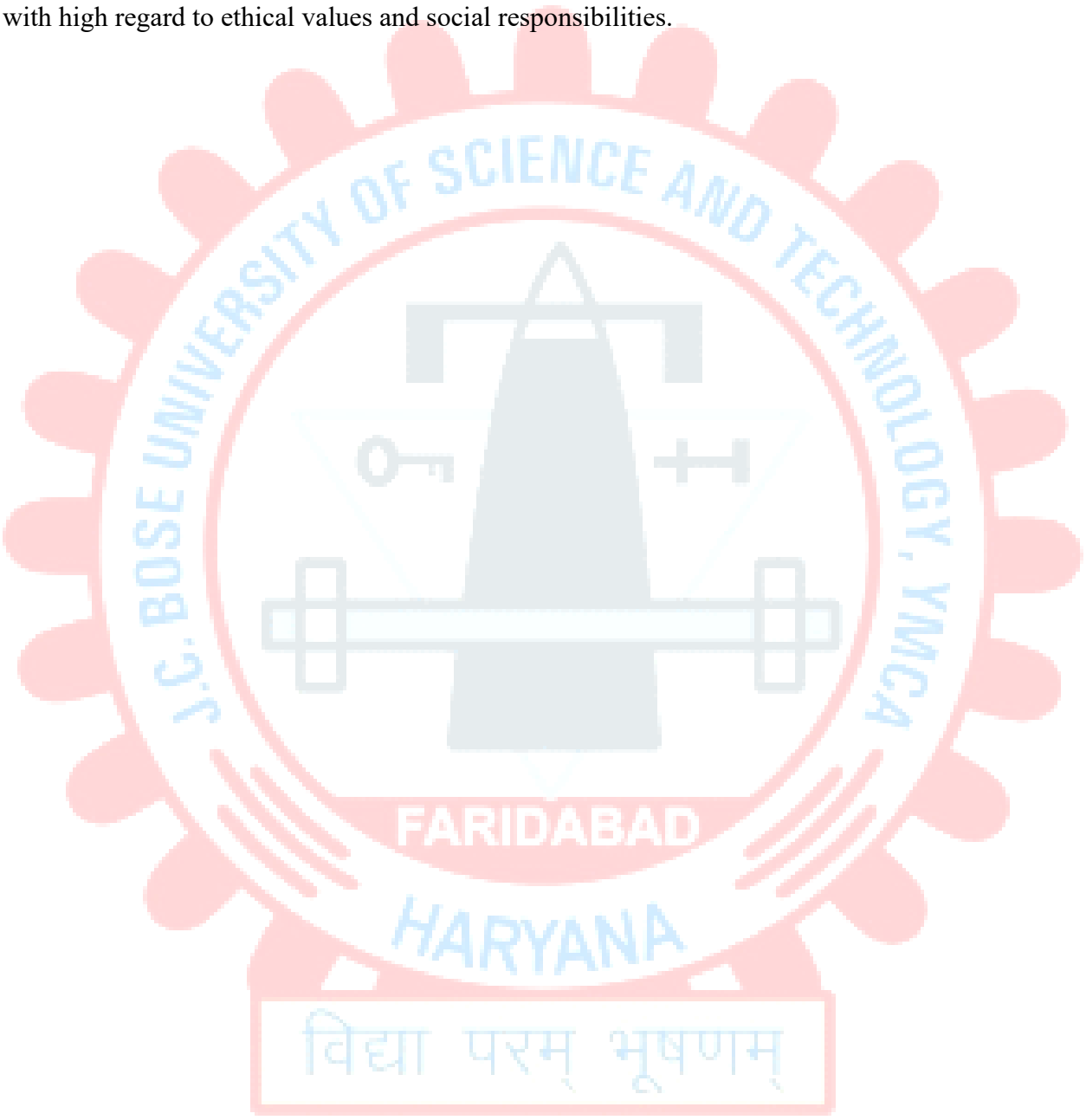
After completion of the program, the student will:

1) Be trained to NSQF level 5.5 in at least one job/profile in the field of automotive manufacturing skills.
2) Be trained for multiple skill sets under the domain of manufacturing.
3) Be able to supervise the various workshop floors for mechanical shop, welding and quality control.
4) Be trained & equipped with knowledge and understanding to start his/her own enterprise in manufacturing.
5) Be able to develop skills in management of customer issues, analysis and evaluation of mechanical, electrical and electronics faults.

6) Be able to supervise the various manufacturing workshop floors for mechanical shops.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

To apply practical skills, vocational training and knowledge of Manufacturing fundamentals to industries. The student will be ready and skilled to take-up a career or to pursue higher studies with high regard to ethical values and social responsibilities.



SCHEME OF EXAMINATION

FIRST SEMESTER

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
ENG-151-V	ENGLISH LITERACY	3-0-0	3	25	75	BSC
MTV-151-V	MATHEMATICS	3-0-0	3	25	75	BSC
AMV-101-V	QUALITY CONTROL & SAFETY	3-1-0	3	25	75	PCC
AMV-103-V	ENGINEERING SCIENCE	3-0-0	3	25	75	PCC
AMV-109-V	ENGINEERING GRAPHICS AND DRAWING	0-0-2	2	60	40	PCC
MFV-101-V	MANUFACTURING PROCESS-I	3-1-0	3	25	75	PCC
MFV-103-V	MANUFACTURING WORKSHOP-I	0-0-6	3	30	70	SDP
Total		**15-2-8**	**20**	**215**	**485**	

SECOND SEMESTER

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
AEC-151-V	BEHAVIORAL SKILLS	3-0-0	3	25	75	BSC
WDD-109-V	TYPOGRAPHY AND COMPUTER APPLICATION	3-1-0	3	25	75	BSC
AMV-102-V	APPLIED SCIENCE	3-0-0	3	25	75	PCC
MFV-102-V	MANUFACTURING PROCESS-II	3-1-0	3	25	75	PCC
MFV-104-V	MANUFACTURING WORKSHOP-II	0-0-10	5	30	70	SDP
VAC-151-V to 153-V	MANDATORY AUDIT COURSE	3-0-0	3	25	75	MAC
Total		**15-2-10**	**20**	**155**	**445**	

THIRD SEMESTER

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
VAC-154-V	EMPLOYABILITY SKILLS	3-0-0	3	25	75	BSC
AMV-201-V	METROLOGY	3-1-0	3	25	75	SDP
AMV-203-V	CAD/CAM	3-1-0	3	25	75	BSC
MFV-201-V	MATERIAL SCIENCE	3-0-0	3	25	75	PCC
MFV-203-V	MACHINING	3-1-0	3	25	75	PCC
MFV-205-V	MANUFACTURING WORKSHOP - III	0-0-10	3	30	70	SDP
AMV-211-V	CAD LAB	0-0-2	2	30	70	SDP
Total		**15-4-10**	**20**	**155**	**445**	

FOURTH SEMESTER

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
MFV-202-V	QUALITY CONTROL TECHNIQUES	3-0-0	3	25	75	PCC
AMV-204-V	INDUSTRIAL MANAGEMENT	3-0-0	3	25	75	PCC
MFV-204-V	MANUFACTURING WORKSHOP - IV	0-0-6	3	30	70	SDP
AMV-206-V	PROJECT	3-0-0	3	25	75	SDP
OEC-101-V to 104-V	OPEN ELECTIVE COURSE	3-0-0	3	25	75	OEC
MFV-206-V MFV-208-V AMV-214-V	PROGRAM ELECTIVE COURSE	3-0-0	3	25	75	PEC
Total		**15-0-10**	**20**	**215**	**485**	

FIFTH SEMESTER

Subject Code	Subject Name	Credits	Marks Weightage		Course Type
			Internal	External	
MF-501	On Job Training (OJT)/ Internship	20	350	150	OJT
	Total	**20**	**350**	**150**	

SIXTH SEMESTER

Subject Code	Subject Name	Credits	Marks Weightage		Course Type
			Internal	External	
MF-601	On Job Training (OJT)/ Internship	20	350	150	OJT
	Total	**20**	**350**	**150**	

LIST OF MANDATORY AUDIT COURSE

Course Code	Course Name
VAC-151-V	HUMAN VALUE AND PROFESSIONAL ETHICS
VAC-152-V	BALANCE DIET AND NUTRITION
VAC-153-V	ENVIRONMENTAL SCIENCE

LIST OF OPEN ELECTIVE COURSE

Course Code	Course Name
OEC-101-V	ENTREPRENEURSHIP
OEC-102-V	TRENDS IN TECHNOLOGY
OEC-103-V	WASTE MANAGEMENT
OEC-104-V	INDUSTRY 4.0

LIST OF PROGRAM ELECTIVE COURSE

Course Code	Course Name
MFV-206-V	RELIABILITY, MAINTENANCE & SAFETY ENGINEERING
MFV-208-V	PLANT LAYOUT & PRODUCT HANDLING
AMV-214-V	AUTOTRONICS

SCHEME OF EXAMINATION

FIRST SEMESTER

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
ENG-151-V	ENGLISH LITERACY	3-0-0	3	25	75	BSC
MTV-151-V	MATHEMATICS	3-0-0	3	25	75	BSC
AMV-101-V	QUALITY CONTROL & SAFETY	3-0-0	3	25	75	PCC
AMV-103-V	ENGINEERING SCIENCE	3-0-0	3	25	75	PCC
AMV-109-V	ENGINEERING GRAPHICS AND DRAWING	0-0-2	2	60	40	PCC
MFV-101-V	MANUFACTURING PROCESS-I	3-0-0	3	25	75	PCC
MFV-103-V	MANUFACTURING WORKSHOP-I	0-0-6	3	30	70	SDP
Total		**15-0-8**	**20**	**215**	**485**	

SUBJECT NAME: ENGLISH LITERACY	
PAPER CODE: ENG-151-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The objective of studying this course is to acquire knowledge on the Basic English grammar starting from speeches to synaptic category going forward with tenses and its types. To comprehend voices, narration and sentence making.

Course Outcomes:

After the successful completion of the course, students will be able:

CO1: To accurately identify and use different parts of speech in sentences.

CO2: To effectively use prepositions, conjunctions, and interjections in their writing and storytelling.

CO3: To construct sentences correctly using present, past, and future tenses.

CO4: To form various types of sentences and identify active and passive voice as well as direct and indirect narration.

Unit-I

Parts of Speech: Noun, Pronoun, Verb, Adverb, Adjective, Vocabulary building.

Unit-II

Literacy Skills: Preposition, Conjunction, Interjection, Story Telling.

Unit-III

FRAGMENT OF TENSES Present tense, Past Tense, Future Tense, Oral Drilling of simple commands and statements, Developing LSR (Listening, Speaking, Reading) skills.

Unit-IV SENTENCE FORMATION

Active and Passive voice, Direct and Indirect Narration, Simple Sentences, Compound Sentences, Complex Sentences, Compound-Complex Sentences, Use of phonetics to aid in identifying speech sounds.

Practical Exercises:

The learners are required to

1. Identify and label the parts of speech in a given paragraph.
2. Write a short story using at least five different prepositions, conjunctions, and interjections.
3. Convert a set of given sentences into present, past, and future tenses.
4. Transform given sentences from active to passive voice, and from direct to indirect speech.

Suggested Readings:

1. Wren and Martin. High School English Grammar and Composition. New Delhi: RRP.
2. Murphy, Raymond. Essential English Grammar. New Delhi: Cambridge.

Note:

1. Only the latest editions of the above books are recommended

SUBJECT NAME: MATHEMATICS	
PAPER CODE: MTV-151-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The objective of studying this course is to Familiarize the prospective graduates with the basics of mathematics, provide knowledge on the application of trigonometry, integration and differentiation and to understand the use of matrices, trigonometry, integration and differentiation to solve formulated mathematical problems

Course Outcomes:

After the successful completion of the course, students will be able:

CO1: To analyse and solve problems related to percentages, interest calculations, and statistical measures, and interpret their results in real-world contexts. To visualise and conceptualized the engineering problems.

CO2: to apply trigonometric identities and functions to solve mathematical problems and real-life applications involving angles and triangles. Use differentiation to evaluate the slop of function.

CO3: To evaluate the properties of matrices and determinants and apply these concepts to solve systems of linear equations.

CO4: To understand and apply the principles of differentiation and integration to solve calculus problems.

Unit-I

Quantitative Aptitude: Percentage, HCF & LCM, Simple interest and Compound interest, Profit & loss, Time, speed & distance, A.P & G.P series, Mean, Median, Mode, Standard deviation.

Unit-II

Trigonometry: Introduction to trigonometric functions: Radian and degree measure, right triangle trigonometry, trigonometric functions of any angle, applications using right triangles; Graphs of sine and cosine functions, transformation of graphs of the sine and cosine functions, Trigonometric Identities, Quadrant Rule, Sum and difference identities for cosine, sine, and tangent, Double-angle identities, half-angle identities, Verifying trigonometric identities, Ratios of Complementary Angles.

Unit-III

Matrices and Determinants: Definition and Properties of Determinants, Definition and Types of Matrices, Transpose of a Matrix, Symmetric, Skew Symmetric Matrices, Orthogonal matrices, Hermitian and Skew Hermitian, Minors and Cofactors, Adjoint and Inverse of a Matrix, Cramer's Rule, Solution of Simultaneous Linear Equations by Inverse Matrix Method.

Unit-IV

Differentiation and Integration: Introduction to Derivatives, Product Rule, Quotient Rule, Chain Rule, Derivatives of Algebraic Function, Derivative of trigonometric functions, Derivative of inverse trigonometric functions, evaluation of simple differentials. Concepts of integration, integration of trigonometric functions, exponential and logarithmic functions, integration by parts, evaluation of simple integrals.

Practical Exercises:
The learners are required to 1. Solve a set of real-life financial problems involving calculations of simple and compound interest, profit and loss, and time-speed-distance scenarios. 2. Verify and prove given trigonometric identities and solve practical problems involving right triangles using trigonometric ratios. 3. Solve a system of linear equations using the inverse matrix method and Cramer's Rule, and explain the steps involved. 4. Differentiate and integrate given functions, applying product, quotient, and chain rules for differentiation, and integration by parts and substitution methods for integration.
Suggested Readings:
1. G.B. Thomas and R.L. Finney, “Calculus and Analytic geometry”, Pearson. 2. N.P. Bali and Manish Goyal, “A textbook of Engineering Mathematics", Laxmi Publications.
Note: Only the latest editions of the above books are recommended.

SUBJECT NAME: QUALITY CONTROL AND SAFETY	
PAPER CODE: AMV-101-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The objective of studying this course to know the importance of safety, health and environment and importance of 5's in the workplace. This course is designed to know the different types of hazards workers face when working in industry and different types of accidents that can arise due to these hazards.

Course Outcomes:

After the successful completion of the course, students will be able:

CO1: To understand the importance of safety, health, and environmental practices in the workplace. Analyse the problems related to statistical quality control.

CO2: To analyze different types of accidents, their causes, and approaches to prevent them. Evaluate the importance of acceptance sampling.

CO3: To apply the principles of 5S (Sort, Set in order, Shine, Standardize, Sustain) to organize and maintain a safe and efficient workplace.

CO4: To evaluate manufacturing output for correct specifications and implement quality control measures.

Unit-I

Importance Of Safety, Health and Environment: Safety, Health and Environment, cleaning of work area, tools, equipment and materials, Importance of safety, objectives of safety management, personal protective equipment like safety gloves, safety glasses, safety shoes and safety helmet, contents of the first aid kit, instructions of equipment manual.

Unit-II

Accidents and Safety In Hazardous Area: Classification of accidents, causes of accidents, accident investigations/reporting, approaches to prevent accidents, Firefighting, Hazards and risks, difference between hazard and risk, Hazard in industrial zones, physical, chemical, environmental, biological, ergonomics and psycho- social hazards, Introduction to OSHMS, OHSAS 18001 and OSHA.

Unit-III

5s In Safety: The basic principles of 5 S in manufacturing and workplace – Cleaning, sorting etc. sorting of materials, tools and equipment's and spare parts, standards, procedures and policies related to 5S, importance of waste disposal, segregation of waste into Hazardous and Non-Hazardous waste, disposal the waste as per SOP, labelling procedures, storage procedures.

Unit-IV

Inspection and Quality Control: How to measure the correct specifications of the output in the terms of thickness, hardness, durability, tightness, finesse etc. relevant manufacturing standards and procedures followed in the company in detail, different types of defects which may arise due to improper manufacturing, Concept of quality control. elements of quality control, quality control groups, objectives of quality control. Statistical quality control, objectives of S.Q.C. Inspection by variables & attributes. Frequency distribution, mean, median & mode, standard deviation, X-R charts, P-Charts, C-Charts and acceptance sampling. (i) I.S.O. 9000 (ii) KAIZEN (iii) Six Sigma (iv) 5S.

Practical Exercises:
The learners are required to 1. Demonstrate the proper cleaning procedures for work areas, tools, equipment, and materials, and identify and use personal protective equipment. 2. Conduct a hazard assessment in a simulated industrial zone, identifying physical, chemical, environmental, biological, and ergonomic hazards, and propose preventive measures. 3. Implement the 5S methodology in a designated area of the workplace, including cleaning, sorting, standardizing, and sustaining practices, and present the results. 4. Analyze manufacturing defects and implement appropriate quality control techniques such as statistical process control charts (X-R, P, C-Charts), ISO 9000 standards, and Six Sigma principles to improve product quality.
Suggested Readings:
1. Industrial Safety and Health Management by C Ray Asfahl, Pearson publications. 2. Industrial Safety Management by N. K. Tarafdar. 3. 3. Industrial Safety (Safety Management) by D S S Ganguly & C S Changeriya.
Note: Only the latest editions of the above books are recommended.

SUBJECT NAME: ENGINEERING SCIENCE	
PAPER CODE: AMV-103-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The main objective of studying this course is to understand the different system of units and their measurement. In this course students will know the different types of laws of motion, basics of thermodynamics, fuels and their classification and pollutants and its types.

Course Outcomes:

After the successful completion of the course, students will be able:

CO1: To understand the need for measurement, different systems of units, and the concept of accuracy and precision in measurements.

CO2: To analyze and apply Newton's laws of motion to solve problems related to equilibrium, friction, and circular motion. Apply the different methodologies for analysis of water and techniques involved in waste water treatment.

CO3: To synthesize knowledge of atomic structure, chemical bonding, and properties of elements and compounds.

CO4: To evaluate the characteristics of different types of fuels, the sources and effects of pollution, and methods for pollution control.

Unit-I

Units and Measurements: Need for measurement: Units of measurement; systems of units; SI units, fundamental and derived units. Length, mass and time measurements; accuracy and precision of measuring instruments; errors in measurement; significant figures. Dimensions of physical quantities, dimensional analysis and its applications.

Unit-II

Laws of Motion: Intuitive concept of force, Inertia, Newton's first law of motion; momentum and Newton's second law of motion; impulse; Newton's third law of motion. Law of conservation of linear momentum and its applications. Equilibrium of concurrent forces, Static and kinetic friction, laws of friction, rolling friction, lubrication. Dynamics of uniform circular motion: Centripetal force, examples of circular motion.

Unit-III

Basic Chemistry: Introduction, atomic structure, periodic classification of element, chemical bonding, acid base and salts, carbon and its compound, metal non-metal and man-made substances.

Unit-IV

Fuel, Pollution & its Control: Definition, characteristics, classification into solid, liquid and gaseous fuel, Petroleum and brief idea of refining into various factions and their characteristics and uses, Calorific value of fuel, Gaseous fuels- preparation, properties, composition and use of producer gas, water and oil gas.

Air Pollution: Types of pollutants, source effects, sink and control of primary pollutants – CO, NO_x, HC, Sox and particulates, effects of pollutants on man and environment – photochemical smog and acid rain. Water Pollution: Classification of pollutants, their sources, wastewater treatment – domestic and industrial. Soil Pollution: Composition of soil, classification and effects of soil pollutants and their

control. Hazardous Wastes: Classification – radioactive, biomedical and chemical, treatment and disposal – physical, chemical and biological processes.

PRACTICAL EXERCISES:

The learners are required to

1. Measure the length, mass, and time using appropriate instruments, analyze the accuracy and precision of measurements, and express the results with the correct number of significant figures.
2. Conduct experiments to demonstrate Newton's laws of motion, measure forces and accelerations, and analyze the relationship between force, mass, and acceleration.
3. Conduct chemical experiments to observe and analyze reactions involving acids, bases, salts, and carbon compounds, and classify substances based on their chemical properties.

Suggested Readings:

1. Thermodynamics by P K Nag
2. Environmental pollution and control engineering: C. S. Rao.
3. Basic Science by S. Chand.

Note: Only the latest editions of the above books are recommended

SUBJECT NAME: ENGINEERING GRAPHICS AND DRAWING	
PAPER CODE: AMV-109-V	
	Total credits: 2
L T P	Theory: 40
0 0 2	Sessional: 60

Course Objectives:

The objective of studying this course is to develop the graphic skill for communication of concept, idea and design of engineering products and to expose them to existing national standard related to technical drawing.

Course Outcomes:

After the successful completion of the course, students will be able:

CO1: To understand the principles and types of projection, including orthographic projection and first/third angle projection, and be able to project points and lines accurately.

CO2: To analyze and project simple solids such as prisms, pyramids, cylinders, and cones onto different planes using rotation and auxiliary plane methods.

CO3: To synthesize knowledge to develop the lateral surfaces of simple solids and solids with cut-outs and holes, including prisms, pyramids, cylinders, and cones.

CO4: To evaluate the principles and techniques of isometric projection, including isometric scale, and be able to create isometric projections of simple and truncated solids.

Unit-I

Projection: Projection: Type of projection, orthographic projection, first and third angle projection. Projection of points and lines: Line inclined to one plane, inclined to both the plane, true length and true inclination.

Unit-II

Projection of Solids: Projection of simple solid like prisms, pyramids, cylinder, cone and truncated solid when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

Unit-III

Development of Surface: Development of lateral surface of simple and the section solid-prisms, pyramid cylinder and cones. Development of lateral surface of solid with cut-outs and holes.

Unit-IV

Isometric and Perspective Projection: Principal of isometric projection – isometric scale – isometric projection of simple solid and truncated solid – prism, pyramid, cylinder, cones.

Practical Exercises:

The learners are required to

1. Practice projecting points and lines onto different planes using orthographic projection techniques, and create drawings showing true length and true inclination of lines.
2. Practice developing the lateral surfaces of simple solids and solids with cut-outs and holes, and create unfolded patterns to represent the flat layout of each surface.
3. Analyze and create isometric projections of simple and truncated solids using isometric scale, and compare the differences between isometric and perspective projections.

Suggested Readings:

1. Bhatt N.D.; Engineering Drawing, Charotar.
2. Gill P.S.; Engineering Drawing, Kataria.

Note: Only the latest editions of the above books are recommended

SUBJECT NAME: MANUFACTURING PROCESS-1	
PAPER CODE: MFV-101-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

To study the various manufacturing processes. To understand the working of various cutting tools. To understand measurement and measuring instruments. To introduce NC and CNC machines.

Course Outcomes:

After the successful completion of the course, students will be able:

CO1: Explain the knowledge of pre- machining activities.
CO2: Identify and describe various types of chips produced during cutting.
CO3: Explain the basic operational principles of machine tools.
CO4: Explain the components and functions of NC and CNC machines.

Unit-I

Pre-Machining Activities: does and don'ts of the manufacturing process, Metal properties/ metallurgy, coolant and lubricants, Selection of proper coolant and lubricant required for machining the required component, use of machine guards, acceptance requirements/ limits of machining e.g. surface finish, specific orientation, gauge inspection etc., introduction to jigs and fixtures, different holding fixtures, gears, stops, Introduction to Measuring devices: micrometers, vernier calipers, gauges, rulers.

Unit-II

Metal Cutting: Introduction to metal cutting, orthogonal and oblique cutting, types of chips, cutting tools, introduction to different types of tools used in the machining process, single point and multi point cutting tools, single point tool geometry, ASA tool signature, material removal rate.

Unit-III

Machining: Different types of machining processes, basic fundamentals of machines and mechanics, introduction and operations of lathe, turning, milling, shaping, boring, broaching, hobbing, facing and shaping, blanking and piercing processes, special purpose machines for operations. grinding, grinding procedure, balancing and dressing of wheels, abrasive, Post machining activities: Impact of presence of burrs, edges, chips on the final product performance, deburring, use of chisels, scrapers to Trim, scrape or deburr objects or parts.

Unit-IV

Introductions to NC and CNC Machines: NC machines, components of NC and CNC machines, difference between NC and CNC, G- codes and M codes, right command in the CNC machine, Introduction to quality, 7 quality tools, company policy.

Practical Exercises:

The learners are required to

1. Compare and contrast NC and CNC machines in terms of functionality.
2. Write and execute basic G-code and M-code programs for CNC machines.
3. Operate a CNC machine using the correct commands.

Suggested Readings:

1. Manufacturing technology by P. N. Rao
2. Production technology- R. K. Jain
3. Manufacturing Science- Amitabha Ghosh & Ashok Kumar Malik, - East- West Press.

Note: Only the latest editions of the above books are recommended.

SUBJECT NAME: MANUFACTURING WORKSHOP-I	
PAPER CODE: MFV-103-V	
	Total credits: 3
L T P	Theory: 70
0 0 6	Sessional: 30

Course Objectives:

Understand the safety precautions of a mechanical workshop. learn functions from different conventional and unconventional machines. To prepare different jobs through different machining processes. Learn more about CNC machines.

Course Outcomes:

After the successful completion of the course, students will be able to:

CO1: Demonstrate the knowledge about understanding of safety measures of mechanical workshops.
CO2: Evaluate the functions of various conventional machine and unconventional machines.
CO3: Interpret knowledge about how to prepare different jobs by different machining operation.

a) To Conduct all pre- machining operations:

A) Measure and mark reference points/ cutting lines on the work pieces, using compasses, calipers, rulers and other measuring tools
B) Understand the does and don'ts of the manufacturing process as defined in SOPs/ Work Instructions
C) Set of machine stops or guides as per the specified lengths indicated through scales or work instructions
D) Set-up, adjust machine tools, fixtures/ jigs and cutting tools in order to perform machining operations
E) Check the centring and facing of the work pieces and check for alignment of the work pieces as per the final product output specifications
F) Gain knowledge on gear changing techniques and minor maintenance as per checklist
G) Check the working of different holding fixtures, gears, stops.
H) Brush or spray lubricating material on work pieces where applicable.
I) Operate hand wheels or valves in order to feed the component and allow cooling and lubricating to the tool.
k) To understand various safety measures, working principle & specifications of various conventional machines (lathe, milling, shaper, grinder etc).
l) To study elements of single point cutting tools and multiple point cutting tools.
m) To prepare a single point brazed tool with carbide tip on a mild steel shank involving milling and brazing operation.
n) To prepare a job involving centering, facing, plain turning and step turning.
o) To prepare a job by machining on a milling/ shaper machine.
p) To prepare a job by surface grinding on surface grinder and perform dressing and balancing of wheels
q) To study and use boring/ broaching/ hobbing / facing/ shaping tools in different applications.
r) To prepare a job by using blanking/ piercing and special purpose machines.
s) To prepare a job on a CNC machine and ensure that the right command is entered in the CNC machine as defined machining parameters.

(B) To conduct all post machining operations

1. Use files, hand grinders, wire brushes, or power tools for performing de burring operations.
2. Use chisels, scrapers, and other hand tools and equipment to Trim, scrape, or de burr objects or parts
3. Clean the hydraulic tank/ Gauge/ Tools/ Fixtures as per the cleaning schedule and the process mentioned in the Work Instruction/ SOP manual
4. Perform minor repairs and adjustments to the machine and notify supervisor/maintenance team when major service/ repair is required
5. Measure the specifications of the finished component and verify conformance as per Control Plan/ Work Instruction
6. Use devices like micrometers, vernier calipers, gauges, rulers and any other inspection equipment for measuring specifications with valid calibration status.
7. Note down the observations of the basic inspection process and identify pieces which comply with the specified standards
8. Organize changing different worn out machine accessories
9. Ensure that the blunt tool is timely and safely replaced by a new tool
10. Replace machine part as per work instructions, using hand tools or notify supervisor/ engineering personnel for taking corrective actions
11. Ensure that the zero offset value is chosen at the time of tool changing process.

(C) To maintain 5S at the work premises

A) Ensure the work area, tools, equipment and materials are clean.
B) Carry out storage of cleaning material and equipment in the correct location and in good condition
C) Ensure self-cleanliness - clean uniform, clean shoes, clean gloves,
D) Follow the daily cleaning standards and schedules to create a clean working environment
E) Carry out sorting of materials, tools and equipments and spare parts
F) Follow proper labeling procedures
G) Follow proper storage procedures
H) Carry out segregation of waste into Hazardous and Non Hazardous waste and dispose the waste as per SOP
I) Follow the floor markings/ area markings used for demarcating the various sections in the plant
J) Follow 5S at the workplace.

Suggested Readings:

1. A course in workshop technology: manufacturing processes by B.S. Raghuwanshi.
2. Textbook of workshop technology by R S Khurmi and J k gupta.

SYLLABUS & SCHEME OF EXAMINATION

SECOND SEMESTER

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
AEC-151-V	BEHAVIORAL SKILLS	3-0-0	3	25	75	BSC
WDD-109-V	TYPOGRAPHY AND COMPUTER APPLICATION	3-0-0	3	25	75	BSC
AMV-102-V	APPLIED SCIENCE	3-0-0	3	25	75	PCC
MFV-102-V	MANUFACTURING PROCESS-II	3-0-0	3	25	75	PCC
MFV-104-V	MANUFACTURING WORKSHOP-II	0-0-10	5	30	70	SDP
VAC-151-V to 153-V	MANDATORY AUDIT COURSE	3-0-0	3	25	75	MAC
Total		**15-0-10**	**20**	**155**	**445**	

LIST OF MANDATORY AUDIT COURSE

Course Code	Name
VAC-151-V	Value and Professional Ethics
VAC-152-V	Diet and Nutrition
VAC-153-V	Environmental Science
VAC-154-V	Shrimad Bhagavad Geeta

SUBJECT NAME: BEHAVIORAL SKILL	
PAPER CODE: AEC-151-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The objective of studying this course is to discuss behavioral skill and their forms and how it is going to help the students. To acquire practical knowledge of writing skills, along with group discussion and interview skills.

Course Outcomes:

After the successful completion of the course, students will be able:

CO1: To understand the meaning, importance, functions, types, and barriers of communication.

CO2: To synthesize knowledge to effectively write different types of letters, reports, mails, and resumes.

CO3: To evaluate the significance of soft skills and demonstrate proficiency in group discussions, translation, and paraphrasing.

CO4: To apply their literacy skills by demonstrating effective speaking, listening, reading, and telephonic communication abilities.

Unit-I

Communication Skills: Meaning of Communication, Importance, Function, Types, Communication barriers and majors to overcome them.

Unit-II

Writing Skills: Letter writing: Formal letter, application letter, covering letter and business letter. Report writing: Academic report, Business report, technical report, News report. Mail writing and resume.

Unit-III

Soft Skills: Definition and significance of soft skills, Group Discussions, basic knowledge of translator and Paraphrasing.

Unit-IV

Speaking and Reading Skills: Importance of Literacy skills (Reading, Writing, Listening, Speaking), telephonic communication skills, Levels of reading skills, process of skimming and scanning.

Practical Exercises:

The learners are required to

1. Write formal letters, application letters, and business letters addressing hypothetical scenarios, and draft resumes and reports based on given prompts or case studies.
2. Participate in group discussions on various topics, practice translation exercises, and paraphrase given texts to convey the same meaning in different words.

Suggested Readings:

1. Mishra. B, Sharma. S Communication Skills for Engineers and Scientists. PHI Learning Pvt. Ltd.
2. Chaturvedi P. D, Chaturvedi M. Business Communication: Concepts, Cases and Applications. Pearson Education India.

Note: Only the latest editions of the above books are recommended.

SUBJECT NAME: TYPOGRAPHY AND COMPUTER APPLICATION	
PAPER CODE: WDD-109-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The objective of studying this course is to understand and learn about the basics of windows, to understand the important MS office programs and to be able to create documents for printing and sharing.

Course Outcomes:

After the successful completion of the course, students will be able:

CO1: To apply their knowledge of basic computer components and Windows interface to navigate, manage files, and customize settings effectively.

CO2: To synthesize their understanding of word processing tools and features to create, format, and manage documents efficiently using MS Word.

CO3: To evaluate and utilize various features and functions of MS Excel to analyze, manipulate, and present complex data effectively.

CO4: To evaluate and utilize presentation software (e.g., MS PowerPoint) and database management software (e.g., MS Access) to create, manipulate, and present data and information effectively.

Unit-I

MS Windows: Basic components of windows, icons, types of icons, taskbar, activating windows, using desktop, title bar, running applications, exploring computer, managing files and folders, copying and moving files and folders. Control panel – display properties, adding and removing software and hardware, setting date and time, screensaver and appearance using windows accessories.

Unit-II

Documentation Using MS Word: Introduction to word processing interface, Toolbars, Menus, Creating & Editing Document, Formatting Document, Finding and replacing text, Format painter, Header and footer, Drop cap, Auto-text, Autocorrect, Spelling and Grammar Tool, Document Dictionary, Page Formatting, Bookmark, Previewing and printing document, Advance Features of MS-Word-Mail Merge, Macros, Tables, File Management, Printing, Styles, linking and embedding object, Template.

Unit-III

Electronic Spreadsheet Using MS Excel : Introduction to MS-Excel, Cell, cell address, Creating & Editing Worksheet, Formatting and Essential Operations, Moving and copying data in excel, Header and footer, Formulas and Functions, Charts, Cell referencing, Page setup, Macros, Advance features of MS-Excel-Pivot table & Pivot Chart, Linking and Consolidation, Database Management using Excel-Sorting, Filtering, Validation, What if analysis with Goal Seek, Conditional formatting, Collaborating with Other Users, analyzing and Presenting Complex data.

Unit-IV

Presentation Using MS Powerpoint: Presentations, Creating, Manipulating & Enhancing Slides, Organizational Charts, Excel Charts, Word Art, layering art Objects, Animations and Sounds, Inserting Animated Pictures or Accessing through Object, Inserting Recorded Sound Effect or In-Built Sound Effect., Introduction to MS Access: creating database creating and manipulating tables, forms, queries, reports, modules, importing and exporting of data.

Practical Exercises:

The learners are required to

1. Demonstrate proficiency in using Windows by completing tasks such as organizing files and folders, customizing display properties, and managing hardware and software through the Control Panel.
2. Create a comprehensive document using MS Word, incorporating advanced features such as mail merge, macros, tables, and templates, and demonstrate proficiency in editing, formatting, and printing.
3. Analyze and manipulate data using MS Excel, including creating and formatting worksheets, applying formulas and functions, generating charts, and performing advanced tasks such as pivot tables, database management, and what-if analysis.
4. Create and deliver a multimedia presentation using MS PowerPoint, incorporating slides, organizational charts, charts from Excel, Word Art, animations, sounds, and other multimedia elements. Also, create and manipulate a database using MS Access, including creating tables, forms, queries, reports, and modules, and importing/exporting data.

Suggested Readings:

1. V. Rajaraman, Computer Fundamentals.
2. Ashok Arora, Fundamentals of Computer Systems.
3. Russell A Stultz, Fundamentals of Computer Systems.

Note: Only the latest editions of the above books are recommended

SUBJECT NAME: APPLIED SCIENCE	
PAPER CODE: AMV-102-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The objectives of this course to learn concepts of Units, Laws of vectors, parallel forces, moment of force, couple, to Learn the fundamentals of properties and behavior of the materials, understand different types of communication systems and to know the fundamentals of advanced communication systems.

Course Outcomes:

After the successful completion of the course, students will be able:

CO1: To understand the significance of mechanics, statics, and dynamics, and be able to analyze force systems using vector representation and resolution techniques.

CO2: To analyze stress, strain, and material properties of solids, and apply Hooke's law and Young's modulus in solving engineering problems.

CO3: To evaluate the mechanisms of heat transfer (conduction, convection, radiation) and electromagnetic waves, and understand their applications.

CO4: To understand the fundamental concepts of thermodynamics, including system, surrounding, boundary, types of processes, and laws of thermodynamics.

Unit-I

Basics of Mechanics and Force System: Significance and relevance of Mechanics, Statics, Dynamics. Space, time, mass, particles, flexible body and rigid body. Scalar and vector quantity, Units of measurement (SI units) - Fundamental units and derived units. Force – unit, representation as a vector and by Bow's notation, characteristics and effects of a force, Principle of transmissibility of force, Force system and its classification. Resolution of a force - Orthogonal components of a force, moment of a force, Varignon's Theorem. Composition of forces – Resultant, analytical method for determination of resultant for concurrent, non-concurrent and parallel coplanar force systems – Law of triangle, parallelogram and polygon of forces.

Unit-II

Properties of Solids: Definitions of deforming force, elasticity and plasticity, examples for elasticity and plasticity, definition of stress and its types with examples and its S.I unit, definition of strain and its types with examples, elastic limit, Hooke's law, stress - strain graph with explanation. Modulus of elasticity and its types, derivation of an expression for Young's modulus of a material. Definition of Compressibility and factor of safety. Simple problems on stress, strain and Young's modulus. Properties of liquids: Definition of thrust and pressure with S.I units. Definition of surface tension and its S.I unit, Viscosity.

Unit-III

Transmission of Heat and Electromagnetic Waves: Definitions of conduction, convection and radiation with examples, definition of thermal conductivity, coefficient of thermal conductivity (K) and its S.I unit. Applications of conduction, convection and radiation.

Electromagnetic wave: Definition, generation of electromagnetic waves and their properties. Electromagnetic spectrum: Definition, classification and its applications. Lasers: Principle and listing the types of Lasers, properties of Laser, applications. Nano-Technology: Definition of Nano-Technology, advantages and dis-advantages of Nanotechnology.

Unit-IV
Thermodynamics: Introduction of thermodynamics, system, surrounding and boundary, types of system, properties of system, state, equilibrium and process, types of thermodynamic processes, laws of thermodynamics- Zeroth, First, second and third law.
Practical Exercises:
1. Analyze and solve problems involving forces and force systems, including determining resultant forces using analytical and graphical methods, and applying Varignon's Theorem to find moments of forces. 2. Perform experiments to measure stress and strain in materials, construct stress-strain graphs, and calculate Young's modulus for different materials using experimental data. 3. Conduct experiments to demonstrate heat transfer mechanisms and measure thermal conductivity, and investigate properties and applications of electromagnetic waves using various devices.
Suggested Readings:
1. D.S. Bedi, Engineering Mechanics, Khanna Publications, New Delhi (2008) 2. Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi. 3. Bansal R K, A textbook of Engineering Mechanics, Laxmi Publications. 4. Ramamrutham, Engineering Mechanics, S. Chand & Co. New Delhi.
Note: Only the latest editions of the above books are recommended

SUBJECT NAME: MANUFACTURING PROCESS-II	
PAPER CODE: MFV-102-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

Study of different manufacturing processes. Understand how a variety of cutting tools work. Understanding of measurement instruments. Introduction of CNC and CNC machines.

Course Outcomes:

After the successful completion of the course, students will be able:

CO1: Understand and apply the selection of proper coolant and lubricant required for machining components

CO2: Analyze different chip formation mechanisms and cutting tool geometries.

CO3: Evaluate different machining processes and their impact on material removal rates

CO4: Create and interpret G-code and M-code commands for CNC machining.

Unit-I

Center Lathe and Milling Machines: Center Lathe: The center lathe and its principle of working, Types of lathes, Lathe specification and size, Features of lathe bed, Headstock and tailstock, Feed mechanism and change-gears. carriage saddle, Cross slide, Compound rest, Tool post, Apron mechanism, lathe accessories, Chucks, Face plate, Angle plate, Driving plate, Lathe doges, mandrills, Steady rest, Lathe attachments, Lathe operations-plane and step turning, Taper turning, Screw cutting, Drilling, Boring, reaming, Knurling, Parting off, Undercutting, Relieving, Types of lathe tools and their uses, Brief description of semi-automatic lathes such as capstan and turret lathes, their advantages and disadvantages over center lathe, types of job done on them. General and periodic maintenance of a center lathe.

Milling Machine: Types of milling machines, constructional features of horizontal milling M/C. general maintenance of the machine, types of milling cutters, milling operations like plane milling, space milling, angular milling form milling, straddle milling, gang milling, Negative rake milling, cutting speed and speed for different tools in up and down milling. Simple, compound and differential indexing, milling of spur gears and racks.

Unit-II

Shaping, Planning & Slotting Machines: Working principles of planer, shaper and Slotter, Differences and similarities among them, types of work done on them, types of tools used, their geometry, General and periodic maintenance of a shaper.

Unit-III

Drilling, Boring and Grinding Machines: Types of tools used in drilling and boring. Classification of drilling and boring machines, principle of working and constructional details of simple and radial drilling M/C and general and periodic maintenance. Operations like facing, counter boring, tapering.

Grinding Machine: Common abrasives, grinding wheel materials, Bonds, Grain and grit of abrasive, Grain structure and shapes of common wheels, various speeds and feeds, Use of coolants, Methods of grinding, Types of grinding machines, precision finishing operations like honing. Broaching machines: Types of work done on broaching machines. Simple types of broaches and their uses, Types of broaching machines

Unit-IV

Jigs and Fixtures: Object of Jigs and Fixture, Difference between jigs and fixtures, Locating and

clamping devices. Types of jigs, Simple examples of milling, turning, grinding, horizontal boring fixtures and broaching fixtures.
Practical Exercises:
The learners are required to 1. Demonstrate the proper selection and application of coolant and lubricant for a given machining task. 2. Measure and compare chip formation and tool wear for orthogonal and oblique cutting operations. 3. Perform turning and milling operations and calculate the material removal rate for each process. 4. Program a CNC machine using G-code and M-code to produce a specified part.
Suggested Readings:
1. Workshop Technology, Vol. I: Hazra & Chaudhry 2. Workshop Technology, Vol. I: BS Raghuwanshi 3. Karyashala Takniki: JK Kapoor.
Note:
1. Only the latest editions of the above books are recommended.

SUBJECT NAME: MANUFACTURING WORKSHOP-II	
PAPER CODE: MFV-104-V	
	Total credits: 3
L T P	Theory: 70
0 0 6	Sessional: 30

Course Objectives:

To introduce about Manufacturing basics, repairing of suspension and steering system, to study the repairing of Manufacturing wheels and tyres & perform vehicle overhauls.

Course Outcomes:

After the successful completion of the course, students will be able to:

CO1: Diagnose and troubleshoot vehicle faults using standard operating procedures and tools.

CO2: Evaluate and service various mechanical aggregates, ensuring compliance with manufacturer specifications.

CO3: Analyze and repair electrical and electronic systems in vehicles, ensuring functionality and safety.

(A) Carry out diagnosis of vehicle for repair requirements

1. To Follow standard operating procedures for using workshop tools and equipment for fault diagnosis or troubleshooting problems in a vehicle.
2. To conduct inspection of the engine and aggregates to diagnose the need for repairs or adjustment in various engine aggregates.
3. To Conduct inspection of mechanical, electrical and electronic systems to diagnose need for repairs, adjustment or part replacement
4. To understand the various precautions to be taken to avoid damage to the vehicle and its components while working on diagnosis or troubleshooting the vehicle for any faults.

(B) Carry out service and major repairs in mechanical aggregates and overhauling of a vehicle.

1. To Understand the auto component manufacturer specifications related to the various components/ aggregates in the vehicle (including major aggregates like engine. gearbox, transmission systems, propeller shaft etc.
2. To Service, repair and overhaul of the steering system.
3. To Service, repair and overhaul of suspension system.
4. To Service, repair and overhaul of tyres.
5. To Service, repair and overhaul of wheels.
6. To Service, repair and overhaul diesel Engines and its fuel system.
7. To Service, repair and overhaul petrol Engines and its fuel system.
8. To Service, repair and overhaul of cooling system and radiator
9. To Service, repair and overhaul of emission and exhaust system.
10. To Service, repair and overhaul of gearbox, drive-train assembly and transmission systems (manual, automatic etc.)
11. To Service, repair and overhaul of brake system.
12. To Service, repair and overhaul of pneumatic brakes.

13. To Service, repair and overhaul of hydraulic brakes.
14. To Service, repair and overhaul of clutch assembly.
15. To Service, repair and overhaul of single plate and multi plate clutches.
16. To Service, repair and overhaul of hydraulic and pneumatic systems and various lubrication systems.

(C) Carry out service and repairs of electrical and electronic faults in a vehicle

A) Repair and overhaul of electronic control unit
B) To Repair and overhaul of electrical wire harness, lighting, ignition, electronic and air-conditioning systems etc.
C) To Repair and overhaul safety systems.
D) Repair and overhaul of hydraulic and pneumatic systems.

Practical Exercises:

The learners are required to

1. Perform a comprehensive inspection and diagnosis of an engine and its aggregates to identify repair needs.
2. Overhaul a vehicle's steering system, adhering to manufacturer specifications.
3. Repair and overhaul an electronic control unit and test its performance post-repair.

SUBJECT NAME: HUMAN VALUE AND PROFESSIONAL ETHICS	
PAPER CODE: VAC-151-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The objective of studying this course is to understand the value system, honesty and integrity, harmony and universal declaration of human rights.

Course Outcomes:

After the successful completion of the course, students will be able:

CO1: To understand the purpose and significance of value education in contemporary society and recognize the importance of balancing outer and inner aspects of life.

CO2: To evaluate key values such as truth, honesty, empathy, and teamwork, and recognize their importance in personal and professional life.

CO3: To synthesize knowledge to understand and promote harmony in family, society, and nature, and recognize the interconnectedness of human beings and the environment.

CO4: To evaluate the interdependence of living and non-living beings, understand human rights issues, and identify strategies to address social evils and promote national integration and peace.

Unit -I

Introduction: Value education-its purpose and significance in the present world, Value system, The role of culture and civilization, Holistic living, Balancing the outer and inner - Body, Mind and Intellectual level- Duties and responsibilities**.**

Unit -II

Salient Values for Life: Truth, commitment, honesty and integrity, forgiveness and love, empathy and ability to sacrifice, care, unity, and inclusiveness, Self-esteem and self- confidence, punctuality - Time, task and resource management, Problem solving and decision-making skills- Interpersonal and Intra personal relationship, Team work, Positive and creative thinking.

Unit -III

Harmony in Family and Society: How to owe responsibilities in family, Understanding Values in Human- Human relations, Role of Trust and Respect, Samman (Respect) for all, Akhand Samaj (A United Society)

Harmony in Nature: Understanding the Harmony in Nature, making sure your contribution is in harmony with nature, Interconnectedness and mutual fulfilment.

Unit -IV

Environment and Ecological Balance: Interdependence of all beings - living and non-living, The binding of man and nature - Environment conservation and enrichment.

Human Rights and social evils: Universal Declaration of Human Rights National Integration - Peace and non-violence - Dr. APJ Kalam's ten points for enlightened citizenship - Social Values and Welfare of the citizen - The role of media in value building - Human Rights violations - Social Evils: Corruption, Cybercrime, Terrorism, Alcoholism, Drug addiction, Dowry, Domestic violence, Untouchability, female infanticide, atrocities against women and how to tackle them.

Practical Exercises:

The learners are required to

1. Engage in reflective exercises to identify personal values, explore cultural influences on values,

and develop strategies for holistic living through activities promoting physical, mental, and intellectual well-being.

2. Analyze real-life scenarios to understand the application of values like commitment, forgiveness, and problem-solving, and participate in group discussions and role-plays to explore different perspectives.
3. Collaborate with family members and community members to organize events promoting trust, respect, and inclusiveness, and engage in environmental conservation activities such as tree planting and waste management.

Suggested Readings:

1. R. R. Gaur, R Sangal, G P Bagaria, A Foundation Course in Human Values and Professional Ethics.
2. Prof. K. V. Subba Raju, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition.
3. Ivan IIIich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA.

Note:

1. Only the latest editions of the above books are recommended

SUBJECT NAME: BALANCED DIET AND NUTRITION	
PAPER CODE: VAC-152-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The objective of studying this course is to understand and apply the concepts of balanced diet and nutritional value, students will be able to identify and apply food principles to food and nutrition systems.

Course Outcomes:

After the successful completion of the course, students will be able to:

CO1: Understand the fundamental concepts of food nutrition, including macronutrients and micronutrients, and plan a balanced diet.

CO2: Demonstrate knowledge of different food groups and their nutritive values, including cereals, pulses, milk, vegetables, fruits, fatty oils, and sugars.

CO3: Analyze the concepts of energy metabolism, calorie requirements, and factors influencing energy expenditure.

CO4: Understand yogic concepts of diet and nutrition, including concepts of mitahara, satvik, rajsik, and tamasik diet, and their role in healthy living.

Unit -I

Concepts and Components of Food Nutrition: Meaning of nutrition, Basic definition regarding nutritional requirements, Nutritional need of human; Concept of food, Acceptance of food, Function of food, Components of food and their classification; Macronutrients – Carbohydrate, Fat, Protein (source, function and effect on the body); Micronutrients – Vitamins, Mineral, Water, roughage (source, function and effect on body); Planning Balanced Diet.

Unit -II

Food Group: Cereals and Millet – Selection, Preparation and Nutritive value; Pulses, Nuts and Oilseeds- Selection, Preparation and Nutritive value; Milk and Milk production - Selection, Preparation and Nutritive value; Vegetable and Fruits - Selection, Preparation and Nutritive value; Fatty oil and Sugar, Jaggery - Selection, Preparation and Nutritive value.

Unit -III

Food and Digestion: Energy – Key concepts, Definition and Components of energy requirements.; Energy – Imbalance concepts of metabolism, anabolism and catabolism; Calorie requirement – BMR, SDA; Physical activity – carbohydrates, lipids and protein metabolism; Factors affecting energy-requirement and expenses; Factors affecting BMR; Factors influencing energy expenditure in physical activity; Methods and requirements for estimating energy expenditure.

Unit -IV

Yogic Concepts of Diet and nutrition: General introduction to diet concepts, concepts of mitahara, Definition and classification, yogic diet according to traditional yoga texts; Concepts of diet according to Gheranda Samhita and Hath Pradeepika; Satvik, Rajsik and Tamasik diet as describe in Bhagwadgeeta; Pathya and Apathya food according to the texts of Yoga; Role of yogic diet in healthy living; Diet according to nature of the body – Vata, Pitta and Kapha.

Practical Exercises:
The learners are required to 1. Analyze the nutritional content of various foods, create a balanced diet plan considering different food groups and their nutritive values. 2. Calculate basal metabolic rate (BMR) and estimate energy expenditure for various physical activities, considering factors like age, gender, weight, and activity level. **3.** Implement yogic dietary principles in daily life, including choosing foods according to one's body type (Vata, Pitta, Kapha) and following guidelines from traditional yoga texts, such as Gheranda Samhita and Bhagavad Gita.
Suggested Readings:
1. Bakhru, H. K., 1991, A Complete Handbook of Nature Cure. 2. Kumar Neeraj, Nagendra, 2014, Mera Aahar Mera Swasthya.
Note:
1. Only the latest editions of the above books are recommended

SUBJECT NAME: ENVIRONMENTAL SCIENCE	
PAPER CODE: VAC-153-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The objective of studying this course is to provide the students a detailed knowledge on the threats and challenges to the environment due to developmental activities,to identify the natural resources and suitable methods for their conservation and sustainable development, to focus on the importance of ecosystem and biodiversity for maintaining ecological balance, and to learn about various attributes of pollution management and waste management practices.

Course Outcomes:

After the successful completion of the course, students will be able to:

CO1: Understand the multidisciplinary nature of environmental studies and recognize the importance of public awareness in addressing environmental issues.

CO2: Analyze the utilization and exploitation of natural resources, including forests, water, minerals, food, energy, and land, and identify sustainable practices for their conservation.

CO3: Comprehend the concepts of ecosystems, biodiversity, and their conservation, and evaluate the significance of biodiversity at global, national, and local levels.

CO4: Analyze social issues related to the environment and evaluate sustainable development strategies, environmental ethics, and the role of legislation in environmental protection.

Unit -I

The Multidisciplinary Nature of Environmental Studies: Definition, scope and importance. Need for public awareness.

Unit -II

Natural Resources Renewable and Non-Renewable Resources: Natural resources and associated problems, Forest resources: Use and overexploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, renewable and non- renewable energy sources, use of alternate energy sources. Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Unit-III

Ecosystems, Biodiversity and Its Conservation: Concept of an ecosystem Structure and Concept of an ecosystem, Structure and function of an ecosystem. Producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystem: a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, and estuaries).

Biodiversity and Its Conservation: Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social,

ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: in-site and ex-situ conservation of biodiversity.

Unit -IV

Social Issues and The Environment: From Unsustainable to Sustainable Development urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case studies, Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies, Wasteland reclamation. Consumerism and waste products, Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act, Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation, public awareness.

Practical Exercises:

The learners are required to

1. Conduct awareness campaigns or workshops in local communities to educate people about environmental problems and the need for conservation.
2. Conduct field visits to areas affected by deforestation, water scarcity, or land degradation, and propose sustainable solutions to mitigate these issues.
3. Conduct biodiversity surveys in different ecosystems (forest, grassland, aquatic), assess their biodiversity indices, and propose conservation strategies for endangered species and habitats.

Suggested Readings:

1. "Perspectives in Environmental Studies" by A. Kaushik and C. P. Kaushik, New age international publishers.
2. "Environmental Studies by Benny Joseph", Tata McGraw Hill Co, New Delhi
3. "Environmental Science Towards a sustainable future" by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
4. "Environmental Engineering and science" by Gilbert M. Masters and Wendell P. Ela 2008 PHI Learning Pvt Ltd.
5. "Fundamentals of Ecology" by Odum, E.P., Barrick, M. and Barret, G.W. Thomson Brooks/Cole Publisher, California, 2005.

Note:

1. Only the latest editions of the above books are recommended

SUBJECT NAME: SHRIMAD BHAGAVAT GEETA	
PAPER CODE: VAC-154-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The objective of studying this course is to provide knowledge, to become a person with a stable mind, pleasing personality and determination and get the spiritual knowledge to get higher success in life.

Course Outcomes:

At the end of the course, the student shall be able to:

CO1: Analyze and apply the teachings of the Shrimad Bhagwat Geeta to approach day-to-day work and duties effectively.

CO2: Demonstrate understanding of basic knowledge as outlined in the Shrimad Bhagwat Geeta.

CO3: Evaluate the personality traits of a role model portrayed in the Shrimad Bhagwat Geeta and analyse their relevance to personal development.

UNIT-I APPROACH TO DAY-TO-DAY WORK AND DUTIES

Shrimad Bhagwat Geeta: Chapter 2-Verses 41, 47,48,
Chapter 3-Verses 13, 21, 27, 35,
Chapter 6-Verses 5,13,17,23, 35,
Chapter 18-Verses 45, 46, 48.

UNIT-II STATEMENTS OF BASIC KNOWLEDGE.

Shrimad Bhagwat Geeta:
Chapter2-Verses 56, 62, 68
Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT-III PERSONALITY OF ROLE MODEL.

Shrimad Bhagwat Geeta:
Chapter2-Verses 17,
Chapter 3-Verses 36,37,42,
Chapter 4-Verses 18, 38,39
Chapter18 – Verses 37,38,63

Practical Exercises:

1. Reflect on personal experiences and challenges, and create action plans based on the principles outlined in the selected verses of the Shrimad Bhagwat Geeta to enhance productivity and efficiency in daily tasks.
2. Engage in discussions and debates exploring the philosophical concepts presented in the verses, and apply them to real-life scenarios to deepen comprehension and critical thinking skills.

Suggested Readings:

1. "Shrimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.

Note:

1. Only the latest editions of the above books are recommended

SYLLABUS & SCHEME OF EXAMINATION

THIRD SEMESTER

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
VAC-154-V	EMPLOYABILITY SKILLS	3-0-0	3	25	75	BSC
AMV-201-V	METROLOGY	3-0-0	3	25	75	SDP
AMV-203-V	CAD/CAM	3-0-0	3	25	75	BSC
MFV-201-V	MATERIAL SCIENCE	3-0-0	3	25	75	PCC
MFV-203-V	MACHINING	3-0-0	3	25	75	PCC
MFV-205-V	MANUFACTURING WORKSHOP - III	0-0-10	3	30	70	SDP
AMV-211-V	CAD LAB	0-0-2	2	30	70	SDP
Total		**15-0-10**	**20**	**155**	**445**	

SUBJECT NAME: EMPLOYABILITY SKILLS	
PAPER CODE: VAC-154-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The objective of studying this course is to encourage the all-round development of students by focusing on behavioral skills and to make the students aware of the importance, the role and the content of behavioral skills through instructions, knowledge acquisition, demonstration and practice.

Course Outcomes:

At the end of the course, the student shall be able to:

CO1: Apply employability skills, including teamwork, leadership, and interview techniques, to enhance professional competence.

CO2: Demonstrate effective presentation skills and personality development techniques to communicate confidently and persuasively.

CO3: Apply effective communication strategies to interact with stakeholders, including customers, industry partners, and colleagues.

CO4: Develop proficiency in written communication through various formats such as letters, reports, and resumes.

Unit-I

Employability Skills: Soft skills– Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development. Teamwork Skills, Leadership Skills, Interview –Types.

Unit -II

Personality Development and Presentation Skills: Types of Personality, Gesture, posture, facial expression, body Language, Personality development programs and techniques, Group Discussion, Presentations Types and making effective presentations.

Unit -III

Communicating with Stakeholders: Communication with customers, dealing with angry customers, call flow, Opening and closing a call, Communication with industry partners/suppliers/dealers/agents, Feedback: Giving and receiving a Feedback.

Unit -IV

Writing Skills: letter Writing, business letter, application letter, covering letter, formal mail, report writing, academic report, business report, technical project report, job application and resume writing.

Practical Exercises:

The learners are required to

1. Role-play scenarios simulating team projects or leadership situations, followed by peer feedback and reflection sessions to improve interpersonal skills.
2. Conduct mock presentations on various topics, focusing on non-verbal communication cues such as gestures and posture.

Suggested Readings:

1. Wren and Martin. High School English Grammar and Composition. New Delhi,RRP.
2. Murphy, Raymond. Essential English Grammar. New Delhi: Cambridge.
3. Malhotra, Prerna and Halder, Deb. Communication Skills: Theory and Practice.

SUBJECT NAME: METROLOGY	
PAPER CODE: AMV-201-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The aim of studying this course for students is to know the basic concepts in various methods of engineering measurement and application, and to understand the importance of measurement and inspection in manufacturing industries. Expose the students to various modern meteorological instruments and the procedure used to operate these instruments.

Course Outcomes:

At the end of the course, the student shall be able to:

CO1: Apply principles of measurement and metrology to select appropriate instruments, analyze measurement errors, and ensure accuracy in industrial processes.

CO2: Demonstrate proficiency in linear and angular measurements using precision instruments and comparators, ensuring compliance with engineering standards.

CO3: Perform measurements of physical properties such as temperature, force, pressure, and surface finish, employing appropriate instruments and techniques.

CO4: Apply geometric dimensioning and tolerancing (GD&T) principles to interpret engineering drawings and measure components' geometric features accurately.

Unit-I

Introduction to Measurement: Aim, Definition, Types, need of inspection, terminology Methods measurements, units of measurements, Selection of instruments, Concept of error (systematic random), sources of error, measurement standards, calibration, statistical concepts of metrology.

Unit-II

Linear and Angular Measurements: Linear instruments, Surface plates (size, accuracy and materi slip gauges, length bars-calibration of slip gauges, dial indicator, micrometer, bevel protector, spirit le sine bar, angle gauges. Comparators, their types, relative merits and limitations, Miscellane measurements, Taper & radius measurements.

Unit-III

Measurement of Properties: Temperature, Force, weight, pressure & flow, Noise, Lux and vibrations, concept of fitting, tightening and torquing in a line and its equipment.

Unit-IV

Linear Tolerance and GD&T: Limits, fits and tolerance: interchangeability, selective assembly, limits, fits and tolerance, limit gauging, design of limit gauges, computer aided tolerance

Measurement of GD&T parameters: measurement of straightness, flatness, squareness, parallelism, roundness, cylindricity, non-contact profiling system

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.

Practical Exercises:

The learners are required to

1. Conduct hands-on sessions using various measurement instruments such as micrometers, dial indicators, and comparators to measure dimensions of precision components, followed by error analysis and calibration procedures.

2. Practice using instruments like micrometers, bevel protractors, and angle gauges to measure linear and angular dimensions accurately, followed by exercises on interpreting measurement results and determining component tolerances. 3. Interpret engineering drawings with GD&T symbols, then use coordinate measuring machines (CMMs) or profile projectors to measure geometric features like straightness, flatness, and roundness, followed by analysis of measurement data and reporting.
Suggested Readings:
1. Thomas, "Engineering Metrology", Butthinson & Co., 1984. 2. Graham T. Smith, "Industrial Metrology", Springer-Verlag London Ltd. 3. Mahajan. M., "A text-Book of Metrology", Dhanpat Rai & Co. (P) Ltd.
Note:
1. Only the latest editions of the above books are recommended

SUBJECT NAME: MATERIAL SCIENCE	
PAPER CODE: MFV-201-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

To study the materials structure and their deformation. To understand ferrous metals. To understand non-metallic materials. To introduce heat treatment.

Course Outcomes:

At the end of the course, the student shall be able to:

CO1: Analyze the relationship between the structure of metals and their mechanical properties
CO2: Evaluate the mechanical properties and applications of various ferrous alloys
CO3: Compare the properties and applications of various non-metallic materials in engineering
CO4: Apply heat treatment processes to manipulate the microstructure and properties of metals.

Unit-I

Structure Of Metals and Their Deformation: Structure of metals and its relation to their physical, mechanical and technological properties, Elementary idea of arrangement of atoms in metals, molecular structures, crystal structures and crystal imperfections, Deformation of metals, effects of cold and hot working operations over them. Recovery recrystallization and grain growth, solid solutions, alloys and intermetallic compounds, effect of grain size on properties of metals.

Unit-II

Metals-Ferrous Metals: (a) Classification of iron and steel. (b) Cast iron types as per I.S. - White, malleable, Grey (c) Steels: Classification of steels according to carbon content and according to use as per I.S. Mechanical properties of various steels and their uses. Availability of steel in market, its forms and specifications (d) Alloy Steel: Effect of alloying various elements, viz Cr, Hi, Co, V, W, Mo, Si, and Mn, on mechanical properties of steel, Common alloy steels, viz, Ni-steel, Ni-Cr-steel, Tungsten steel, Cobalt steel, Stainless Steel, Tool steel- High Carbon Steel, High Speed steel, Tungsten Carbide, Silicon manganese steel, Spring Steel, Heat Resisting alloy Steels etc.

Unit-III

Non-Metallic Materials

(a) Plastic and Other Synthetic Materials: Plastics-Important Sources-Natural and Synthetic, Classification, thermo-set and thermoplastic, Various trade names, Important Properties and engineering use of plastics. Market forms of Plastics

(b) Paints, Enamels, Varnishes and Lacquers: Paints and Enamels-types, its purpose, essential ingredients and their role, characteristics of a good paints and enamel, trade names of some important types of products. Varnishes-types purpose of varnish, essential ingredients and their role, characteristics, preparation, trade names storage of varnish, Lacquer- characteristics, preparation and uses.

(c)Heat Insulating Materials: Classification of Heat Insulating material, properties and uses of China clay, Cork, Slag wool, Glass Wool, Thermocole, Puff, Properties and uses of asbestos as filler material. Hardware: General specification, uses and methods of storage of G.I. and C.I. steel Copper, A.C. pressure conduits, R.C.C. spun, P.V.C. Pipes and their uses. General sheets specification (I.S.) and uses, Method of storage of G.I. sheets, M.S. sheets, General specification of pipe fitting

Unit-IV

Heat Treatment of Metals: Elementary concept, purpose, Iron-carbon equilibrium diagram. T.T.T.

and `S' curve in steels and its significance, Hardening, Tempering, Annealing, Normalising and case hardening.
Practical Exercises:
1. The learners are required to 2. Conduct metallographic analysis to correlate microstructure with mechanical properties under different deformation conditions. 3. Perform tensile testing on different types of ferrous metals and analyze the results to determine their suitability for specific applications. 4. Conduct experiments to determine the thermal conductivity and insulation properties of different heat insulating materials. **5.** Apply heat treatment processes to manipulate the microstructure and properties of metals.
Suggested Readings:
1. Manufacturing technology by P. N. Rao 2. Production technology- R. K. Jain 3. Manufacturing Science- Amitabha Ghosh & Ashok Kumar Malik, - East- West Press.
Note:
1. Only the latest editions of the above books are recommended.

SUBJECT NAME: MACHINING	
PAPER CODE: MFV-203-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The main objective of this course is to study the various machines, machine tools and the operation performed on them. By gaining the basic knowledge about the various machine tools we can study about the students and get familiar with different parts.

Course Outcomes:

At the end of the course, the student shall be able to:

CO1: Demonstrate the setup and operation of a center lathe to perform tasks such as facing, turning, and drilling on a workpiece.

CO2: Analyze the working principles and maintenance requirements of shaping, planning, and slotting machines.

CO3: Evaluate the various operations and parameters involved in milling, grinding, and broaching processes.

CO4: Compare and contrast the principles and applications of jigs, fixtures, and automation in machining.

Unit-I

Center Lathe: The center lathe and its principle of working, Types of lathes, Lathe specification and size, Features of lathe bed, Headstock and tailstock, Feed mechanism and change-gears. carriage saddle, Cross slide, Compound rest, Tool post, Apron mechanism, lathe accessories, Chucks, Face plate, Angle plate, Driving plate, Lathe doges, mandrills, Steady rest, Lathe attachments. Lathe operations-plane and step turning, Taper turning, Screw cutting, Drilling, Boring, reaming, Knurling, parting off, undercutting, Relieving, Types of lathe tools and their uses, Brief description of semi-automatic lathes such as capstan and turret lathes, their advantages and disadvantages over center lathe, types of job done on them, General and periodic maintenance of a center lathe.

Unit-II

Shaping, Planning and Slotting Machines: Working principles of planer, shaper and Slotter, Differences and similarities among them, quick return mechanism applied to the machines, types of work done on them, types of tools used, their geometry. General and periodic maintenance of a shaper

Drilling and Boring Machines: Types of tools used in drilling and boring, Classification of drilling and boring machines, principle of working and constructional details of simple and radial drilling M/C and general and periodic maintenance. Operations like facing, counter boring, tapering.

Unit-III

Milling Machines, Grinding Machines and Broaching Machines: Types of milling machines, constructional features of horizontal milling M/C. general maintenance of the machine, types of milling cutters, milling operations like plane milling, space milling, angular milling form milling, straddle milling, gang milling, Negative rake milling, cutting speed and speed for different tools in up and down milling. Simple, compound and differential indexing, milling of spur gears and racks.

Common abrasives, grinding wheel materials, Bonds, Grain and grit of abrasive, Grain structure and shapes of common wheels, various speeds and feeds, Use of coolants, Methods of grinding. Types of grinding machines, precision finishing operations like honing

Types of work done on broaching machine, Simple types of broaches and their uses, Types of broaching

machines
Unit-IV
Jigs And Fixtures and Automation of Machine Tools: Difference between jigs and fixtures, Principle of location. Principle of clamping, Locating and clamping devices, Types of jigs & fixtures, Introduction to CNC lathe (Computer Numerical Control Lathe) and FMS (Flexible Manufacturing System) Introduction only.
Practical Exercises:
The learners are required to 1. Apply knowledge of lathe components and operations to perform basic turning tasks. 2. Disassemble and inspect the components of a shaping machine, identifying parts and understanding their functions, followed by reassembly and testing. **3.** Design and fabricate a simple fixture for a specific machining operation, considering principles of location and clamping, then use it to machine a workpiece accurately.
Suggested Readings:
1. Manufacturing technology by P. N. Rao 2. Production technology- R. K. Jain 3. Manufacturing Science- Amitabha Ghosh & Ashok Kumar Malik, - East- West Press. 4. Workshop Technology Vol I & II –Hazra & Chaudhary, Asian Book Comp., New Delhi.
Note:
1. Only the latest editions of the above books are recommended.

SUBJECT NAME: CAD/CAM	
PAPER CODE: AMV-203-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The aim of studying this course is to study about Introduction CIM and CAD & Analysis. Computer aided Manufacturing CAM and Part Programming NC part programming.

Course Outcomes:

At the end of the course, the student shall be able to:

CO1: Evaluate the concepts and benefits of Computer Integrated Manufacturing (CIM) and Computer-Aided Design (CAD), analyzing their evolution and integrated functionalities.

CO2: nalyze the functions and benefits of Computer-Aided Manufacturing (CAM), understanding part families, coding structures, and Computer-Aided Process Planning (CAPP) systems.

CO3: Assess the components and working principles of CNC machines, including turning centers and machining centers, and understand the principles of part programming for CNC machining.

CO4: Demonstrate the heat treatment processes of hardening, tempering, annealing, normalizing, and case hardening on metal samples and analyze the resulting microstructures and properties.

Unit-I

Introduction Cim and Cad & Analysis: Introduction of CIM– concept of CIM - evolution of CIM – CIM wheel –Benefits – integrated CAD/CAM. CAD: Introduction– CAD definition – Shigley's design process – CAD activities – benefits of CAD. Types of CAD systems, CAD software packages, 2D & 3D transformations, Geometric modelling: Techniques: Wire frame modelling – surface modelling – solid modelling.

Unit -II

Computer Aided Manufacturing Cam: Definition, functions, benefits. Group technology – Part families - Parts classification and coding - coding structure – Optimize system, MICLASS system and CODE System - process planning – CAPP – Types of CAPP: Variant type, Generative type – advantages of CAPP – production planning and control – computer integrated production management system – Master Production Schedule (MPS) – Capacity planning – Materials Requirement Planning (MRP) – Manufacturing Resources Planning (MRP-II)

Unit -III

CNC Machine and Its Part Programming: CNC Machines: Numerical control – definition – components of NC systems – development of NC – DNC – Adaptive control systems – working principle of a CNC system – Features of CNC machines - advantage of CNC machines – difference between NC and CNC – Construction and working principle of turning centre – Construction and working principle of machining centers – machine axes conventions turning centre and machining centre – design considerations of NC machine tools.

Part Programming NC part programming – methods – manual programming – conversational programming – APT programming - Format: sequential and word address formats - sequence number – coordinate system – types of motion control: point-to-point, paraxial and contouring – Datum points: machine zero, work zero, tool zero NC dimensioning – reference points – tool material – tool inserts - tool offsets and compensation - NC dimensioning – preparatory functions and G codes, miscellaneous functions and M codes – interpolation: linear interpolation and circular interpolation.

Unit -IV

FMS, Integrated Material Handling and Robot: Types of manufacturing - introduction to FMS – FMS components – FMS layouts – Types of FMS: flexible manufacturing cell – flexible turning cell – flexible transfer line – flexible machining systems – benefits of FMS - introduction to intelligent manufacturing system – virtual machining. Computer Integrated material handling – AGV: working principle – types, benefits – Automatic Storage and Retrieval Systems (ASRS).
ROBOT – definition – robot configurations – basic robot motion – robot programming method – robotic sensors - industrial applications: characteristics, material transfer, machine loading, welding, spray coating, assembly and inspection.

Practical Exercises:

The learners are required to

1. Design a simple mechanical component using CAD software, demonstrating proficiency in 2D and 3D transformations and geometric modeling techniques.
2. Develop a part program for a CNC machine, considering motion control types, coordinate systems, tooling, and NC dimensioning, utilizing both manual and conversational programming methods.
3. Design a layout for a flexible manufacturing cell, incorporating AGVs for material handling and programming a robot for specific tasks such as material transfer or assembly.

Suggested Readings:

1. Ibrahim Zeid CAD/CAM - Theory and practice Tata McGraw Hill Publishers.
2. Salomon, D. Transformations and projections in computer graphics Springer.
3. Rao, P.N., CAD / CAM Principles and Applications, McGraw Hill Publishers, New Delhi.
4. M.P. Groover, Automation, production systems and Computer-integrated Manufacturing, Eastern Economy Edition.

Note:

1. Only the latest editions of the above books are recommended

SUBJECT NAME: MANUFACTURING WORKSHOP-III	
PAPER CODE: MFV-205-V	
	Total credits: 3
L T P	Theory: 70
0 0 6	Sessional: 30

Course Objectives:

The main objective of this course is to familiarize the students with different type of mechanical and optical measurement tool. The knowledge of this tool help student in quality inspection and dimension measurement.

Course Outcomes:

After the successful completion of the course, students will be able to:

CO1: Analyze and apply different methods for measuring angles with precision
CO2: Evaluate and implement alignment measurement techniques using autocollimators and roller sets
CO3: Assess cutting tool performance by measuring cutting forces using dynamometers.
CO4: Analyze surface roughness measurements using Tally Surf or mechanical comparators.

METROLOGY LAB

1. Measurements using Micrometer, vernier caliper.
2. Measurement of angle using Sine Centre / Sine bar / bevel protractor.
3. Measurement of alignment using Autocollimator / Roller set
4. Measurement of cutting tool forces using a) Lathe tool Dynamometer b) Drill tool Dynamometer.
5. Measurement of Screw threads Parameters using two wire or Three-wire methods.
6. Measurements of Surface roughness, Using Tally Surf/Mechanical Comparator
7. Measurement of gear tooth profile using gear tooth vernier /Gear tooth micrometer
8. Calibration of Micrometer using slip gauges
9. Measurement using Optical Flat.

Suggested Readings:

1. The Metrology handbook by jay L. Bucher, ASQ, Quality Measurement Division.
2. Handbook of optical metrology by Toru Yoshizawa, CRC Press publication.

Note:

1. 1. Only the latest editions of the above books are recommended

SYLLABUS & SCHEME OF EXAMINATION

FOURTH SEMESTER

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
MFV-202-V	QUALITY CONTROL TECHNIQUES	3-0-0	3	25	75	PCC
AMV-204-V	INDUSTRIAL MANAGEMENT	3-0-0	3	25	75	PCC
MFV-204-V	MANUFACTURING WORKSHOP - IV	0-0-6	3	30	70	SDP
AMV-206-V	PROJECT	3-0-0	3	25	75	SDP
OEC-101-V to 104-V	OPEN ELECTIVE COURSE	3-0-0	3	25	75	OEC
MFV-206-V MFV-208-V AMV-214-V	PROGRAM ELECTIVE COURSE	3-0-0	3	25	75	PEC
Total		**15-0-10**	**20**	**215**	**485**	

LIST OF OPEN ELECTIVE COURSE

COURSE CODE	COURSE NAME
OEC-101-V	ENTREPRENEURSHIP
OEC-102-V	INDUSTRY 4.0
OEC-103-V	TRENDS IN TECHNOLOGY
OEC-104-V	WASTE MANAGEMENT

LIST OF PROGRAM ELECTIVE COURSE

Course Code	Course Name
MFV-206-V	RELIABILITY, MAINTENANCE & SAFETY ENGINEERING
MFV-208-V	PLANT LAYOUT & PRODUCT HANDLING
AMV-214-V	AUTOTRONICS

SUBJECT NAME: QUALITY CONTROL TECHNIQUES	
PAPER CODE: MFV-202-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

To introduce quality control techniques. Through the QC tools. Which will lead to developing understanding of Trends in Quality Engineering & Management.

Course Outcomes:

After the successful completion of the course, students will be able to:

CO1: Understand the principles and fundamentals of quality control techniques.

CO2: Analyze and categorize defects in manufactured products, identifying root causes and suggesting corrective actions.

CO3: Evaluate and apply various quality management tools and standards in organizational processes.

CO4: Evaluate and compare contemporary quality management approaches like Six Sigma and their applicability in different sectors.

Unit-I

Basics of quality, its control techniques.

Unit-II

(Quality Engineering and Management Tools, Techniques & Standards: 7 QC tools, 7 New Quality Management Tools, 5S Technique, Kaizen, Poka-Yoke, Quality Circle, Cost of Quality Technique. Introduction to Quality Management Standards-ISO: 9000, ISO:14000, QS:9000 (Concept, Scope, Implementation Requirements & Barriers, and Benefits), Introduction to National and International Quality Awards (Malcolm Baldrige National Quality Award-MBNQA, The Deming Prize Rajiv Gandhi National Quality Award).

Unit-III

Basic Philosophy, Approach, Implementation Requirements & Barriers. Designing for Quality: Introduction to Concurrent Engineering, Quality Function Deployment (QFD) and Failure Mode and Effect Analysis (FMEA)-Concept, Methodology and Application

Unit-IV

Contemporary Trends in Quality Engineering & Management: Six Sigma-Basic Concept, Principle, Methodology, Implementation, Scope, Advantages and Limitation of all as applicable. Quality in Service Sectors: Characteristics of Service Sectors, Quality Dimensions in Service Sectors, Measuring Quality in Different Service Sectors.

Practical Exercise

The learners are required to

1. Implement the 5S technique in a manufacturing or service environment, documenting improvements in workplace organization and efficiency.
2. Conduct a QFD analysis for a product or service, prioritizing customer requirements and translating them into design features.
3. Implement a Six Sigma project in a service sector organization, measuring process performance and identifying areas for improvement to achieve quality goals.

Suggested Readings:
1. Quality Control & Application by B. L. Hanson & P. M. Ghare, Prentice Hall of India. 2. Quality Management by Kanishka Bedi. 3. Statistical Quality Control by M. Mahajan, Dhanpat Rai & Co. (P) Ltd.
Note:
1. Only the latest editions of the above books are recommended.

SUBJECT NAME: INDUSTRIAL MANAGEMENT	
PAPER CODE: AMV-204-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The main objective of this course is to understand how to manage the material in industry, different costs associated with the production and labour, industrial and tax laws.

Course Outcomes:

At the end of the course, the student shall be able to:

CO1: Understand the principles of industrial management and the sources of capital for industrial ventures.

CO2: Differentiate between private sector and public sector enterprises, and comprehend the organizational structures and functions within industries.

CO3: Grasp the concepts of wages, incentives, and material management in industry, along with elements of cost and indirect expenses.

CO4: Familiarize with the evolution of labour and industrial laws, and understand the roles of technicians and supervisors in industry.

UNIT-I

Introduction: Growth of industry, the management of men, materials and machines, the art of management, Sources of capital- industrial individual enterprise, private partnership and private Ltd. Co., Joint Stock Co. shares, debentures, financial agencies and their role in promoting industries. Break even analysis.

UNIT-II

Private Sector and Public Sector: Public sector enterprise, merits and demerits of public sector industry and private sector industry, Line, staff and functional organizations, reasons for the choice of various types of organization, functions of different departments, viz. stores, purchase and sales departments relationship between individual departments.

UNIT-III

Wages & Incentives and Material Management: Definition of wages, real wage and nominal wage, systems of wage payment, incentives, financial and non - financial incentives, Essentials of a good wage plan, essentials of a good incentive scheme. Introduction to elements of cost & indirect expenses, Material cost, labour cost, fixed and variable overheads, components of cost, selling price, Factory expenses, administrative expenses, selling & distribution expenses, depreciation, obsolescence, interest on capital, Idleness, Repair and maintenance.

Material Management: Introduction, Scope of Material Management selective control techniques-ABC analysis, Material handling, inventory control, Essential steps in inventory control, quality standards

UNIT-IV

Labour, Industrial and Tax Laws: Evolution of industrial law, factory act, workmen compensation act, payment of wages act, employee's state insurance act, Industrial dispute act. Role of technician in industry: Position of technician in various engineering departments, Role of a supervisor in industry, Foremanship, duties and qualities of a good foreman.

Practical Exercises:
The learners are required to 1. Analyze case studies of different industrial ventures to identify the sources of capital utilized and evaluate their effectiveness in achieving business objectives. 2. Conduct a comparative study of a private sector and a public sector enterprise, examining their organizational structures, decision-making processes, and operational efficiencies. 3. Design a wage plan and incentive scheme for a hypothetical industrial scenario, considering factors such as productivity, employee motivation, and cost-effectiveness. 4. Role-play scenarios based on industrial laws and regulations, allowing students to understand their practical implications in resolving workplace disputes and ensuring compliance.
Suggested Readings:
1. Industrial Management, S.C. Sharma, Khanna Publishing House.
Note:
1. Only the latest editions of the above books are recommended

SUBJECT NAME: CAD LAB	
PAPER CODE: AMV-211-V	
	Total credits: 2
L T P	Theory: 60
0 0 2	Sessional: 40

Course Objectives:

The main objective of this course is to familiarize the students with AUTO-CAD software so students can learn the draw sketch in more efficient manner and also do drafting of give part.

Course Outcomes:

After the successful completion of the course, students will be able to:

CO1: Understand the fundamental concepts and principles of Computer-Aided Design (CAD) software.
CO2: Apply commands and tools within CAD software to create and modify drawings effectively.
CO3: Demonstrate proficiency in viewing drawings, manipulating coordinates, and navigating within CAD software.

Unit-I

Introduction of AutoCAD: Setting up a drawing starting from scratch, using and creating a template file, screen layout, pull-down menus, screen icons, dialogue boxes.

Unit-II

Drawing Command: Lines, Ray, Construction Line, Multiline and polyline, rectangles, arc, circle, and ellipse, polygon, spline, Co-ordinate input method (directive, absolute, relative and polar), starting a new drawing/opening an existing drawing, hatching command text (multi-line & single line), formatting text styles, view commands & drawing setting.
Modify Command: Hatching, Text (Multiline & Single line), Formatting text styles, copy, move, rotate, Pattern, explode, mirror.

Unit-III

Isometric Command
3D Command: Box, wedge, extrude, subtract, union, solid edit,
Surface Design: Planner, thicken, surf network, surf fillet, surf offset, surf patch.
Export

Unit-IV

2D & 3D Project: Standard parts like chains and belt, standard shaft parts, spring, Mouse, Hair dryer, alloy wheel, fan blade, sheet metal project, single cylinder engine assembly and drafting.

Suggested Readings:

1. A handbook on AutoCAD tool practice by Azar Wahab, SSR Krishna.

Note:

1. 1. Only the latest editions of the above books are recommended

SUBJECT NAME: MANUFACTURING WORKSHOP-IV	
PAPER CODE: MFV-204-V	
	Total credits: 3
L T P	Theory: 70
0 0 6	Sessional: 30

Course Objectives:

To understand the safety measures of a mechanical workshop. To learn the functions of various conventional machines and unconventional machines. To prepare different jobs by different machining operations. To learn about CNC machines.

Course Outcomes:

After the successful completion of the course, students will be able to:

CO1: Analyze manufacturing process SOPs and work instructions to understand best practices and procedures.

CO2: Demonstrate proficiency in setting up and adjusting machine tools, fixtures, and cutting tools.

CO3: Evaluate workpiece cantering, facing, and alignment as per final product specifications.

CO4: Measure and mark cutting lines on workpieces using compasses, callipers, rulers, and other measuring tools, ensuring precision and alignment.

(A) Carry out diagnosis of vehicle for repair requirements

1. Measure and mark reference points/ cutting lines on the work pieces, using compasses, callipers, rulers and other measuring tools
2. Understand the does and don'ts of the manufacturing process as defined in SOPs/ Work Instructions
3. Set of machine stops or guides as per the specified lengths indicated through scales or work instructions
4. Set-up, adjust machine tools, fixtures/ jigs and cutting tools in order to perform machining operations
5. Check the cantering and facing of the work pieces and check for alignment of the work pieces as per the final product output specifications
6. Gain knowledge on gear changing techniques and minor maintenance as per checklist
7. Check the working of different holding fixtures, gears, stops.
8. Brush or spray lubricating material on work pieces where applicable
9. Operate hand wheels or valves in order to feed the component and allow cooling and lubricating to the tool.
10. To perform exercise on centre lathe such as facing, plain turning, step turning, chamfering and thread cutting operations.
11. To perform reaming, parting off and knurling operation by using lathe.
12. To perform the drilling and boring operations by using a lathe machine.
13. To perform shaping operation of a given mild steel rod.
14. To prepare a job by machining on a milling machine.
15. To Prepare a 'V' block on a rectangular block on a shaping machine.

16. To grind the single point cutting tool with the given nomenclature and measure angles using the tool maker's microscope.
17. To perform exercises on a shaping machine to obtain flat surfaces and key ways.
18. To prepare a job by using planar, shaper and slotting machine.
19. To perform the operations such as drilling, counter boring and tapping using a drilling machine.
20. To make a slot on the given work piece.
21. To prepare a job by surface grinding on surface grinder and performing dressing and balancing of wheels.
22. To study and use broaching machines in different applications.
23. To study a progressive tool and perform blanking and piercing.
24. To make rod/pipe bending using Hydraulic press (or) to perform Bending Operation.
25. Use files, hand grinders, wire brushes, or power tools for performing deburring operations.
26. Use chisels, scrapers, and other hand tools and equipment to Trim, scrape, or deburr objects or parts
27. Clean the hydraulic tank/ Gauge/ Tools/ Fixtures as per the cleaning schedule and the process mentioned in the Work Instruction/ SOP manual
28. Perform minor repairs and adjustments to the machine and notify supervisor/maintenance team when major service/ repair is required
29. Measure the specifications of the finished component and verify conformance as per Control Plan/ Work Instruction
30. Use devices like micrometres, vernier callipers, gauges, rulers and any other inspection equipment for measuring specifications with valid calibration status.
31. Note down the observations of the basic inspection process and identify pieces which comply with the specified standards
32. Organize changing different worn-out machine accessories
33. Ensure that the blunt tool is timely and safely replaced by a new tool
34. Replace machine part as per work instructions, using hand tools or notify supervisor/ engineering personnel for taking corrective actions

Reference books

1. A course in workshop technology: manufacturing processes by B.S. Raghuwanshi.
2. Textbook of workshop technology by R S Khurmi and J k gupta.
3. Workshop Technology Vol I & II –Hazra & Chaudhary, Asian Book Comp., New Delhi.

SUBJECT NAME: PROJECT	
PAPER CODE: AMV-206-V	
	Total credits: 3
L T P	Theory: 60
0 0 3	Sessional: 40

Course Objectives:

The aim of this course is to apply the subject knowledge to make a project related to your field.

PROJECT

The student individually works on a specific topic approved by a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programmer. The topic may be experimental or analytical. At the end of the semester, a detailed report on the work done should be submitted which contains a clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

SUBJECT NAME: ENTREPRENEURSHIP	
PAPER CODE: OEC-101-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The objective of studying this course is that the students acquire necessary knowledge and skills required for organizing and carrying out entrepreneurial activities, to develop the ability of analyzing and understanding business situations in which entrepreneurs act and to master the knowledge necessary to plan entrepreneurial activities.

Course Outcomes:

At the end of the course, the student shall be able to:

CO1: Analyze the essential characteristics of successful entrepreneurs and differentiate between various types of entrepreneurs based on their traits and motivations.

CO2: Apply leadership skills and emotional intelligence in entrepreneurial contexts to foster team collaboration and problem-solving.

CO3: Assess the societal impact of entrepreneurship and analyze the ethical responsibilities of entrepreneurs towards society.

CO4: Understand the regulatory and legal framework governing entrepreneurship, including intellectual property rights and government support mechanisms for start-ups.

Unit-I

Entrepreneurship and Entrepreneur: Entrepreneurship: Concept and process, Entrepreneur vs manager, Essential Characteristics of a good Entrepreneur, Types of entrepreneurs, Types of Entrepreneurial firms, Need and Importance of Entrepreneurship, Entrepreneurial Mindset.

Unit-II

Key Skills for Successful Entrepreneurship: Leadership: leadership styles, Lead by example, Team Spirit, Emotional Intelligence, Problem Solving by Critical Thinking: Applying critical thinking, Reason Model of Critical Thinking. Problem solving by Creative thinking, Importance and benefits of Creative thinking,

Unit-III

Serving the Society: Roles of Entrepreneurs in society, Selfless Entrepreneurship, Factors affecting entrepreneurial business, Business Networking and its advantages, entrepreneurial work ethics, Success Story of Mumbai Dabbawalla and Steve Jobs (Discuss more Success failure stories of famous entrepreneurs)

Unit-IV

Regulatory And Legal Issues in Entrepreneurship: Introduction to start-up's, Role of District Industries Centre in setting up industry, Function of NSIC, SISI, NISIET, NRDC, SSIC. Business Loans for start-ups and MSMEs by Indian Government, Legal Issues: Intellectual Property Rights, patents, trademarks, copyrights, trade secrets.

Practical Exercises:

The learners are required to

1. Conduct personality assessments and case studies to identify and evaluate the key characteristics of successful entrepreneurs, followed by a group discussion on the importance of these traits in entrepreneurial ventures.
2. Conduct a group debate or seminar on the role of entrepreneurs in addressing social issues and

promoting sustainable development, using case studies of successful entrepreneurs who have made significant contributions to society.

3. Engage in role-playing exercises to simulate real-life entrepreneurial scenarios, where students take turns practicing different leadership styles and emotional intelligence techniques to address team challenges and conflicts effectively.

Suggested Readings:

1. Khanka S.S., "Entrepreneurship Development" S. Chand
2. C.V. Bakshi, Entrepreneurship Development, Excel Publications.
3. Drucker, Peter. "Innovation and Entrepreneurship" Heinemann, London.
4. Arora M., Natarajan K. and Gordan E., Entrepreneurship Development, 1st ed; Himalaya Publishing House Pvt Ltd, 2009.

Note:

1. Only the latest editions of the above books are recommended

SUBJECT NAME: TRENDS IN TECHNOLOGY	
PAPER CODE: OEC-103-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The objective of studying this course is to make aware of the changes in technologies, applications and Systems around us.

Course Outcomes:

At the end of the course, the student shall be able to:

CO1: Evaluate the different types of e-commerce models and their respective advantages and disadvantages.

CO2: Demonstrate proficiency in using basic internet tools such as email, search engines, and social networking sites.

CO3: Analyze the security measures and electronic payment systems employed in e-banking transactions.

CO4: Evaluate the implementation challenges and strategies associated with e-governance, e-agriculture, and e-learning initiatives.

Unit-I

E-Commerce: Introduction: E-commerce as Business need-commerce, Types, Advantages, Disadvantages, e-Commerce Architecture; Internet Payment Systems, Characteristics, 4C Payment Methods, SET Protocol for Credit Card Payment, E-Cash, E-Check, Overview of Smart Card.

Unit-II

E-Mail and Internet: Introduction, E-mail Account & Its Functions, Search Engine, Surfing Webpages, Basics of Social Networking Site.

Unit-III

E-Banking Transactions: Inter Banking, Intra Banking, Electronic Payments, (Payment – Gateway Example), Securities in E-banking (SSL, Digital Signatures – Examples), Services Provided: ATM, Smart Card ECS (Electronic Clearing System), e.g., Telephone, Electricity Bills.

Unit-IV

E – Governance, E – Agriculture, E-Learning: E –Governance Models: (G2B, G2C, C2G, G2G), Challenges to E – Governance, Strategies and tactics for implementation of E – Governance, Types of Agriculture information (Soil, Water, Seeds, Market rate) & Technique dissemination, Future trade marketing, Corp Management, Query redressal System, (Information Kiosk, IVR, etc.), Case Study. Models WBT, CBT, Virtual Campus, LMS & LCMS, Video Conferencing, Chatting Bulletin, Building Online Community, Asynchronous / Synchronous Learning, Case Study.

Practical Exercises:

The learners are required to

1. Conduct a comparative analysis of various e-commerce platforms (e.g., B2B, B2C, C2C) using case studies of successful and unsuccessful e-commerce ventures, and present findings in a group discussion.
2. Assign tasks requiring students to create and manage email accounts, perform web searches to gather information on specific topics, and engage in discussions on social networking platforms to explore the functionalities and potential risks associated with online communication.
3. Simulate online banking transactions using different electronic payment methods (e.g., credit card,

e-check) and explore the security protocols (e.g., SSL, digital signatures) involved in securing online transactions, followed by a discussion on the importance of trust and security in e-commerce.
Suggested Readings:
1. Internet (Use of Search Engines Google & yahoo etc.). 2. E–Commerce: C. V. S. Murty. 3. Fire Wall and Internet Security: William Cheswick, Stevens, Aviel, Rubin. 4. The Essential Guide to Knowledge management: Amrit Tiwana. 5. The GIS Book: George B. Karte.
Note:
1. Only the latest editions of the above books are recommended

SUBJECT NAME: WASTE MANAGEMENT	
PAPER CODE: OEC-104-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The objective of this course is to introduce about Sources of solid and hazardous wastes, to study about Waste exchange and storage and collection of municipal solid wastes.

Course Outcomes:

At the end of the course, the student shall be able to:

CO1: Evaluate the regulatory framework and its application in solid and hazardous waste management.

CO2: Analyze the composition and characteristics of solid wastes to develop effective waste management strategies.

CO3: Evaluate waste collection, storage, and transportation systems for efficiency and effectiveness.

CO4: Assess waste processing technologies and disposal options for sustainable waste management.

Unit-I

Sources, Classification and Regulatory Framework: Types and Sources of solid and hazardous wastes - Need for solid and hazardous waste management – Elements of integrated waste management and roles of stakeholders - Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, lead acid batteries, electronic wastes, plastics and fly ash – Financing waste management.

Unit -II

Waste Characterization and Source Reduction: Waste generation rates and variation - Composition, physical, chemical and biological properties of solid wastes – Hazardous Characteristics – TCLP tests – waste sampling and characterization plan - Source reduction of wastes –Waste exchange - Extended producer responsibility - Recycling and reuse Practical: Composition of MSW, Determination of Physical and Chemical Properties of MSW.

Unit -III

Storage, Collection and Transport of Wastes: Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations Optimizing waste allocation– compatibility, storage, labeling and handling of hazardous wastes – hazardous waste manifests and transport.

Unit -IV

Waste Processing Technologies and Waste Disposal: Objectives of waste processing – material separation and processing technologies – biological & chemical conversion technologies – methods and controls of Composting - thermal conversion technologies, energy recovery – incineration – solidification & stabilization of hazardous wastes- treatment of biomedical wastes.

Waste disposal options – Disposal in landfills - Landfill Classification, types and methods – site selection - design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – Rehabilitation of open dumps – landfill remediation.

Practical Exercises:

The learners are required to

1. Analyze and interpret Indian legislation related to waste management, identify key provisions and

requirements, and develop a compliance checklist for waste management practices.

2. Conduct a waste characterization study, collect samples of municipal solid waste (MSW), perform physical and chemical analyses, and interpret the results to understand waste composition and properties.
3. Assess different waste collection methods in a local community, conduct a field study to observe waste handling practices, and propose improvements for optimizing waste collection and transportation processes.

Suggested Readings:

1. George Techobanoglous et al, ‖Integrated Solid Waste Management‖, McGraw - Hill, 2014.
2. Manual on Municipal Solid waste Management, CPHEEO, Ministry of Urban Development, Govt. Of. India, New Delhi, 2000.
3. Tchobanoglous Theisen Ellasen; Solid Waste Engineering Principles and Management, McGraw - Hill 1997.

Note:

1. Only the latest editions of the above books are recommended

SUBJECT NAME: RELIABILITY, MAINTENANCE & SAFETY ENGINEERING	
PAPER CODE:MFV-206-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The main objective to study this course is to understand the basics of Reliability and reliability functions. To understand maintainability and safety engineering.

Course Outcomes:

At the end of the course, the student shall be able to:

CO1: Understand the fundamental concepts of reliability and its key metrics such as MTTF, MTBF, and hazard rate.

CO2: Evaluate the constant failure rate model and its implications on system reliability

CO3: Apply design principles for reliability, including reliability specifications, measurements, and effectiveness.

CO4: Analyze maintainability aspects such as downtime and repair time distribution, as well as fundamentals of safety engineering.

Unit-I

Reliability: Reliability: Definition, reliability function, Mean failure rate, mean time to failure (MTTF), mean time between failures (MTBF), hazard rate curve. Bathtub curve, Conditional Reliability

Unit-II

Constant Failure Rate Model: Constant Failure rate model: Exponential Reliability function, Failure Modes, CFR model, memory lessness, System reliability: Series, parallel, mixed & complex configuration; Reliability improvement.

Unit-III

Design For Reliability: Design for reliability: Reliability specifications and system Measurements, System Effectiveness, redundancy, Classification of Redundancy. Introduction of failure mode and effect analysis (FMEA).

Unit-IV

Maintainability and Safety Engineering: Maintainability Analysis of Downtime, repair time distribution, stochastic point processes.

Safety engineering: Fundamentals of industrial safety, Safety policy and safety terminology, Different types of safety systems and equipment, Safety targets, standards, objectives.

Practical Exercises:

The learners are required to

1. Determine the reliability of a system using the exponential reliability function, considering failure modes and applying the constant failure rate model to different configurations.
2. Design a system with redundancy to meet specified reliability targets, utilizing reliability specifications and conducting failure mode and effect analysis.

Suggested Readings:

1. Reliability Engineering, S.C. Sharma, Khanna Publishing House.

Note:

1. Only the latest editions of the above books are recommended.

SUBJECT NAME: PLANT LAYOUT & PRODUCT HANDLING	
PAPER CODE: MFV-208-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

To learn the Objective of Facility Design. To study Computerized handling of layout algorithms. To study Product handling.

Course Outcomes:

CO1: Demonstrate the knowledge about the objective of facility design.
CO2: Demonstrate the knowledge about layout planning.
CO3: Demonstrate the acquire knowledge about application of pneumatic and hydraulic system in transportation.
CO4: Demonstrate the knowledge about fundamentals of product handling.

Unit-I

Objective of Facility Design: Types of layout problems, the layout function, organization of layout. Analysis and Design of Material Flow: Systems approach to flow cycle, process charts, flow process charts, Quantitative analysis of material flow; optimal material flow configuration. Space and Area Allocation for Production and Physical Plant Services.

Unit-II

Computerized Handling of Layout: Computerized handling of layout algorithms; Algorithms for computerized Layout Planning, Construction and Development type of computerized Layout Planning Techniques i.e. CRAFT, ALDEP, CORELAP etc.

Unit-III

Product Handling: Product handling; Design of system configurations conforming to various kinds of product features and layout characteristics; Design concepts of common handling and transfer equipment; Different types of conveyors, elevators, forklifts;
Design concept of warehouse facilities commensurate with adopted kind of handling and transfer devices; Automated Handling of materials, Automated Transfer lines, AGVS, Use of Robots in Product handling, automated packaging devices.

Unit-IV

Application of Pneumatic and Hydraulic: Application of pneumatic and hydraulic system in transportation and handling of products, Design of integrated plant layout for product handling systems.

Practical exercise:

The learners are required to
1. Create a simple flow process chart for a given manufacturing process.
2. Design a basic conveyor system for handling products in a manufacturing plant.

Suggested Readings:

1. Plant Layout & Material Handling, G. K. Agarwal, Jain Brothers (New Delhi).
2. Plant Layout & Material Handling, S. C Sharma, Khanna Publication.

Note:

1. Only the latest editions of the above books are recommended.

SUBJECT NAME: AUTOTRONICS	
PAPER CODE: AMV-214-V	
	Total credits: 3
L T P	Theory: 75
3 0 0	Sessional: 25

Course Objectives:

The objective of studying this course to get the knowledge of electronics, automotive sensors and actuators.

Course Outcomes:

At the end of the course, the student shall be able to:

CO1: Analyze the current trends and advancements in automotive electronic systems.
CO2: Evaluate the types and functionalities of automotive sensors and actuators.
CO3: Demonstrate understanding of automotive electronic systems and their components.
CO4: Apply data acquisition techniques for automotive applications.

Unit-I

Fundamentals of Automotive Electronic System: Fundamentals of Automotive Electronic System: Current Trends in Automotive Electronic Engine Management System, Electro-magnetic Interference Suppression, Electromagnetic Compatibility, Electronic Dashboard Instruments, onboard Diagnostic system, security and warning systems.

Unit-II

Automotive Sensors and Actuators: Automotive Sensors & Actuators Types of sensors, actuators, Crankshaft position, camshaft position, manifold absolute pressure, Airflow rate sensor, Throttle position sensor, Inlet air temperature sensor, oxygen sensor, vehicle speed sensor, Wheel speed sensor, sensors for feedback control, engine control actuators, Solenoid actuators, motorized actuators.

Unit-III

Automotive Electronic Systems: Automotive Electronic Systems Electronic Ignition systems, electronic injection systems, Anti-Lock brake system circuit, Traction control, electronic control of automobile transmission, Active suspension, EPS.

Unit-IV

Applications Data Acquisitions: Applications Data Acquisitions- Temperature Control – Stepper Motor Control-Automotive Applications Engine Control, Suspension System Control, Driver Information Systems), Development of A High Speed, High Precision Learning Control System for the Engine Control. Programmable Logic Controls, Relay Logic, Control, Motion Control.

The learners are required to

1. Explore various electronic engine management systems used in modern vehicles, including their components, functionalities, and integration with other vehicle systems.
2. Conduct hands-on experiments with different automotive sensors and actuators, such as crankshaft position sensors, throttle position sensors, and motorized actuators, to understand their operation and applications.
3. Disassemble and analyze electronic ignition systems, electronic injection systems, and other electronic control systems in vehicles to understand their circuitry, components, and functionality.

Suggested Readings:
1. Ramesh Goankar S., “Microprocessor Architecture Programming and Applications”, Willey Eastern Ltd. 2. William B. Riddens, “Understanding Automotive Electronics”, 5thEdition, Butter Worth Heinemann
Note:
1. Only the latest editions of the above books are recommended

FIFTH SEMESTER

Subject Code	Subject Name	Credits	Marks Weightage		Course Type
			Internal	External	
MF - 501	On Job Training (OJT)/ Internship evaluation including report and presentation	20	350	150	OJT
	Total	**20**	**350**	**150**	

Students will go into industries for **On Job Training**. Students will be evaluated based **upon On Job Training (OJT)/Internship** including report and presentation.

SIXTH SEMESTER

Subject Code	Subject Name	Credits	Marks Weightage		Course Type
			Internal	External	
MF- 601	On Job Training (OJT)/ Internship evaluation including report and presentation	20	350	150	OJT
	Total	**20**	**350**	**150**	

Students will go into industries for **On Job Training**. Students will be evaluated based **upon On Job Training (OJT)/Internship** including report and presentation.

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