

**CURRICULUM FOR**

**DIPLOMA IN**

**AUTOMOBILE ENGINEERING**

**SEMESTER I, II, III, IV, V, VI,**

**VII & VIII**

# Directorate of Technical Education, Goa State

## PROGRAMME STRUCTURE

### SET I

#### Semester - I

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
GN102	Engg. Maths - I	4	2	-	6	75	25			100
GN103	Applied Physics-I	4		2	6	75	25	-	50	150
GN106	Basic Engg.Skills	-	-	6	6	-	-	50	100	150
GN105	Comp. Fund & App.	-	-	4	4	-	-	50	50	100
GN203	Environmental Studies	3			3	75	25	-	-	100
Total		11	2	12	25	225	75	100	200	600

#### Semester - II

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
GN202	Applied Physics-II	4	-	2	6	75	25	-	50	150
GN201	Engg. Maths II	4	2	-	6	75	25	-	-	100
GN104	Applied Chemistry	3		2	5	75	25	-	50	150
GN101	Communication skills	-	-	2	2	-	-	50	50	100
GN205	Engg. Materials	4	-		4	75	25	-	-	100
GN204	Engg. Drawing	2	-	4	6	-		50	50	100
Total		17	2	10	29	300	100	100	200	700

## SEMESTER I

### GN 102 ENGINEERING MATHEMATICS- I

#### 1. RATIONALE

There are variable and constant concepts in the engineering phenomena and problems, which need to be understood, analyze and predict their behaviour. For instance, motion and acceleration of an object under applied known force, effect of temperature and pressure under constant volume, etc. All these situations require modeling of constants and variables into a relationship known as formula (formulating) and solving problems of engineering by substituting the values of constants and variables. Thus mathematics is used to understand, analyse and find solutions. There are some standard principles and formulae, which should be understood by students and apply as per needs of situations in real life.

#### 2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
GN-102	L	T	P	C	TH	TM	TW	PR/OR	100
Engineering Mathematics	4	2	-	6	75	25	-	-	

Minimum passing % : Theory 40%

#### Legends:

**L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:

**PR/OR** - End Semester Practical / Oral Examinations; **TW**- Term Work

#### 3. DETAILED COURSE CONTENTS

##### Unit 0 Fundamentals of algebraic mathematical operations

- Use of scientific calculator
- Recall of algebraic operations & formulae
- Solving of simultaneous equations with two variables

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<b>Unit 1</b>	<b>Co-ordinate Geometry/ Analytic Geometry;</b>
Purposes/Applications of Co-ordinate Geometry. Coordinate systems. <i>Straight Line</i> -Distance between two points. Internal & external division of a line. Area of triangle. Slope of line. Angle between two lines. Various forms of equation of line-parallel to axis, point-slope form, slope intercept form, two point form, intercepts form & normal form. General equation of line. Distance of a point from a line. - Equations of circle, Equations of tangent & normal to circle.	
<b>Unit 2</b>	<b>Trigonometry</b>
Purposes/Applications of Trigonometry. Radian. Radian & degree. Area of sector & length of an arc. Trigonometric ratios of any angle & Trigonometric identities. Trigonometric ratio of allied angles, compound angles, & Multiple angles( only 2A ). Sum & product formulae. Sine, Cosine rules. Solution of triangles	
<b>Unit 3</b>	<b>Limits &amp; Functions</b>
Functions- constants, variables. Kinds of functions ( question not to be asked ). Concepts of limits- algebraic, trigonometric, logarithmic & exponential functions (No question on method of substitution and Inverse Trigonometric function)	
<b>Unit 4</b>	<b>Differential Calculus</b>
Purposes/Applications of Differential Calculus. Definition of Derivative. Derivatives of standard functions-applications. Derivative of sum, difference, product & quotient of a function. Derivative of composite, implicit & parametric functions with reference to - algebraic, logarithmic, trigonometric, inverse circular functions, exponential functions & logarithmic differentiations. Introduction to Second order derivatives.	
<b>Unit 5</b>	<b>Application of derivatives</b>
Geometrical meaning of derivatives. Equation of tangent & normal to curves. Derivatives as rate, motion, related rates. Maxima & minima.	

### 4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

Unit No.	Topic	Teaching Hours/ Semester	Marks
1	Co-ordinate Geometry	14	20
2	Trigonometry	17	16
3	Limits & Functions	8	12
4	Differential Calculus	15	20
5	Application of derivatives	10	07
		<b>64</b>	<b>75</b>



**5. SUGGESTED LEARNING RESOURCES**

<b>S.No.</b>	<b>Author</b>	<b>Title of Books</b>	<b>Publication &amp; Year</b>
1.	Deshpande S.P.,	Mathematics for Polytechnics	Griha Prakashan, Pune, 1996 or latest
2.	Grewal B.S;	Engineering Mathematics	Khanna Pub., New Delhi 1995 or latest
3.	Prasad, I.B.;	Engineering Mathematics	Khanna Pub., New Delhi 1997 or latest
4.	TTTI, Bhopal	Mathematics for Polytechnics Vol. – I & Vol. – II	TTTI, Bhopal  Latest
5.	Wartiker P.N.,	Applied Mathematics	Griha Prakashan Pune, 1996 or latest

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**GN 103 APPLIED PHYSICS-I**

**1. RATIONALE:**

Being the basis of all engineering branches, the students must acquire knowledge of basic principles; laws and facts of Physics. This knowledge will improve their ability to apply it in solving engineering problems and overall growth of their disciplines.

**2. TEACHING AND EXAMINATION SCHEME:**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
GN-103 Applied Physics I	L	T	P	C	TH	TM	TW	PR/OR	150
	4	-	2	6	75	25	50	-	

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

**Legends:**

**L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:

**PR/OR** - End Semester Practical / Oral Examinations; **TW**- Term Work

**3. DETAILED COURSE CONTENTS**

**Unit 1 UNITS & DIMENSIONS**

Fundamental and Derived Physical Quantities and their SI units. Dimensions and Dimensional formula, Principle of Homogeneity, use of Dimensional Analysis for checking the correctness of an equation. Definition of least count of Vernier Caliper, Micrometer Screw Gauge.

**Unit 2 KINEMATICS**

Vectors and Scalars-Definition, Difference between vectors and scalars, types of vectors with example.  
Definition - Displacements and distance, Velocity and speed, uniform and average velocity, Uniform acceleration and retardation, problems based on kinematic equations for uniform acceleration.  $V=u+at$ ,  $S=ut + \frac{1}{2}at^2$ ,  $v^2 = u^2 + 2as$ . Velocity- time diagram, Motion under gravity.

**Unit 3 PROPERTIES OF MATTER**

Definition of Elasticity, Stress, Strain and Elastic limit. Hooke's Law. Definition of Young's modulus, Bulk modulus, Rigidity modulus. Determination of Young's modulus by Searle's method. Behaviour of wire under continuously increasing stress. Definition of Yield Point, Breaking Stress, and Factor Of Safety. Adhesive and Cohesive forces. Angle of contact. Concept and definition of Surface Tension, Surface Tension by Capillary rise method. Application of Surface Tension. Definition and explanation of Viscosity. Statement of Newton's law of viscosity, Terminal Velocity (no derivation) Stokes Law. Determination of Viscosity by Stokes method. Streamlined and Turbulent flow. Definition of Critical Velocity, Reynolds Number.

**Unit 4 HEAT**

Definition of specific heat and units of specific heat. Modes of transfer of heat transfer, Conduction, Convection and Radiation. Law of thermal conductivity. Definition of co-efficient of thermal conductivity. Determination of coefficient of thermal conductivity of a good conductor  
Statement of Charles's law, Boyle's law and Gay Lussac's law. Derivation of general gas equation.

**Unit 5 ELECTROSTATICS**

Coulomb's Law of Electrostatics, Electric Field, Intensity of Electric Field, Electric Potential and its unit, Potential difference between two points (no derivation), Potential of a sphere, Potential of Earth, Definition and units of Capacitance, Principle of Capacitor, Capacitors in series, Capacitors in Parallel.

**Unit 6 MAGNETISM**

Magnetic Effect of Electric current (Oersted's Experiment) Magnetic Field, Intensity of Magnetic Field. Coulomb's Law of Magnetism, Magnetic lines of Force, Magnetic Induction, Expression for Magnetic Induction at the centre of a Circular coil carrying current ( no derivation), Force acting on straight conductor placed in Magnetic Field ( no derivation).

**Unit 7 (A) LAWS OF FORCES & FRICTION ( MECHANICAL AND ALLIED GROUPS)**

Triangle law of forces, parallelogram law of forces (expression only), graphical & analytical representation of force, resolution of forces, resolving force into rectangular components. Definition & concept of friction, types of friction, Force of friction, Laws of static friction, Coefficient of friction, angle of friction (expression only), angle of repose( only qualitative aspects)

**OR**

**UNIT 7(B) : SEMICONDUCTORS (ELECTRONICS AND ALLIED GROUPS)**

Energy Band structure of electronic material( conductor , semiconductor and insulator)  
Definition of semiconductors, types of impurities added to the semiconductors, intrinsic and extrinsic semiconductors.  
Types of semiconductors P- type and N- type, Structure of P- type and N- type, Extrinsic semiconductor using pure Si and Ge semiconductors.  
Types of carriers; N- type and P- type  
Process of recombination of carriers.  
Formation of P-N junction and depletion region.

#### 4.SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (THEORY)

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Units and Dimensions	5	5
2	Kinematics	9	12
3	Properties of Matter	13	14
4	Heat & Gas Laws	9	10
5	Electrostatics	12	12
6	Magnetism	8	10
7A	Laws of Forces & Friction	8	12
	<b>OR</b>		
7B	Semiconductors	8	12
	<b>Total</b>	<b>64</b>	<b>75</b>

**7A-Mechanical and allied branches**

**7BFor Electronics and allied branches**

#### 5. SUGGESTED LIST OF EXPERIMENTS

Sr. No.	LIST OF EXPERIMENTS
1	Use of Vernier Caliper
2	Use of Micrometer Screw gauge
3	Determination of Surface tension by capillary rise method using Travelling Microscope.
4	Determination of coefficient of viscosity by stroke's method.
5	Determination of acceleration due to gravity ('g') by simple pendulum.
6	Determination of Young's modulus by Searle's method.
7	Determination of Coefficient of thermal conductivity by Searle's method.
8A	Find resultant force using parallelogram of forces
8B	Draw and interpret band structure of Insulator, Semiconductor and conductor, Band structure of P-type & N-type extrinsic semiconductor, Drawing PN junction.

**6. SUGGESTED LEARNING RESOURCES**

<b>Sr.No.</b>	<b>Author</b>	<b>Title</b>	<b>Publication and Year</b>
1.	Halliday D and Resnick	Physics Part-I & II	Latest
2.	Das S.K., Sisodiya M.L., Neher P.K., Kachhawa C.M.,	Physics Part-I & II for 10+2 Students	Latest
3.	B.G. Dhande	Applied physics for polytechnics	Latest
4.	Bhandarkar	Applied Physics for polytechnics	Latest
5.	Saxena HC & Singh Prabhakaer	Applied Physics Vol. I & II	Latest
6.	Rao, B.V.N.	Modern Physics	Latest
7.	R.K.Guar and S.L. Gupta.	Engineering Physics	Latest
8.	B.L. Thereja.	Engineering Technology	Latest
9.	Modern Publishers.	ABC of Physics	Latest
10.	V.K Mehta	Elements of electronic engineering	Latest
11	R S Khurmi	Applied Mechanics	Latest

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**GN-105 - COMPUTER FUNDAMENTALS & APPLICATIONS**

**1. RATIONALE**

The course on Computer Fundamentals & Applications will enable the students to understand the basic concepts related to computer fundamentals, Data Representation & Number Systems, Computer Languages, operating system, Computer Software and Internet Technology and will be able to apply the same in different areas of electronics engineering. Laboratory practice will help in developing the requisite skills.

**2. TEACHING AND EXAMINATION SCHEME**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
GN-105	L	T	P	C	TH	TM	TW	PR/OR	100
Computer Fundamentals & Applications	-	-	4	4	-	-	50	50	

Minimum passing % : Theory 40%

**Legends:**

**L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks;  
**PR/OR** - End Semester Practical / Oral Examinations; **TW**- Term Work

**3. DETAILED COURSE CONTENTS**

**UNIT 1 Computer Fundamentals**

1.Introduction to Computer

2. History, Evaluation, Classification and Generations of computers

3.Organisation of the Computer System

4. Hardware

Input device, Memory or Storage Devices, Processing Unit, Output device, Scanner  
Printers.

5. Communication technology and evolution of communication mediums

6. Software

System software

Application Software

Shareware

Freeware

Open Source

7. Concept of Computer Viruses

Definition

Types

Preventive Measures

**UNIT 2 Operating System**

1. Introduction to operating system

Definition Functions , Types, Examples, Comparisons of Various Operating Systems

2. Windows Operating System-

GUI(Graphical user Interface), desktop, Start Menu, Task Bar, Status Bar, Scroll Bar, Title Bar, Toolbar, Menu Bar. File Organization: Creating, Saving, Deleting, Renaming, Cutting, Pasting, copying, moving, Searching Files and Folders. Applications: My Computer, Recycle Bin, Windows Explorer, Control Panel.

**UNIT 3 Application Software**

**1. MS Word**

- Introduction
  - Starting MS Word
  - Creating, saving and opening a document
  - Editing commands-Cut, Copy, Paste, Paste Special
  - Text Formatting, Bullets and Numbering, Borders and shading etc.
  - Tabs, Style, Views
  - Insert Table, Picture, OLE Objects, etc.
  - Checking Spelling and Grammar, Thesaurus
  - Page Layout & Printing
  - Mail Merge.

**2. MS Excel**

- Create, Save and open a worksheet
- Entering data – text, numbers and formulae in a worksheet, Hyperlink
- Navigating within a Worksheet and also between different Worksheets of a Workbook
- Inserting and deleting cells, rows and columns in a worksheet
- Select, copy, paste and delete cell data within the worksheet
- Using various formulae and inbuilt functions like Trigonometric, Statistical, Logical, Data Sorting
- Update worksheets using special tools like spell check and auto correct.
- Setup the page and margins of worksheets for printing
- Enhance worksheets using charts & graphs

### 3. MS Power Point

- Introduction and starting the program
- Starting a presentation
- Adding new slide
- Saving and Opening presentation
- Text formatting options
- Copy, Move and delete slides and text
- Applying designs
- Using Animations
- Slide Transitions, Hyperlink
- Insert clip art
- Viewing the presentation

### UNIT 4 The Internet

#### Networks, Advantages of networking, Types of networks.

- History and Functions of the Internet
- Working with Internet
- Web Browsers, World Wide Web, Uniform Resources Locator and Domain, Names, Issues related to web security.
- Uses of Internet
- Search for information, Email, Chatting, Instant messenger services, News Group, Teleconferencing, Video-Conferencing, E-Commerce and M-Commerce.

#### Email

- Manage an E-mail Account  
E-mail Address, Configure E-mail Account, log to an E-mail, Receive E-mail, Sending mails, sending files an attachments and Address Book
- Downloading Files

### 4. SUGGESTED LIST OF EXPERIMENTS

S. No.	Unit No.	List of Experiments
1	1	Identify Input and output devices
2	1	Calculate capacity of different storage device
3	2	Identify OS and different application software s loaded on that OS
4	3	Load Windows operating system. Configure and load relevant device drivers



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5	4	<p>Practice on Windows 95/98/2000 ;</p> <ul style="list-style-type: none"> <li>o Starting Windows, Exploring the desktop, Arranging windows, My Computer, The start button, Creating Shortcuts, Practice on moving and sizing of windows</li> <li>o Study of file organization: creating, copying, moving, renaming and deleting</li> <li>o Practice on Windows Accessories- Notepad, Word Pad and Paint</li> <li>o Editing document &amp; formatting text, Previewing and printing document/Image file</li> <li>o Practice on Windows Explorer</li> <li>o Recycle bin</li> <li>o Shutting down windows</li> </ul>
6	4	<p>Practice on MS-Word ;</p> <ul style="list-style-type: none"> <li>o Create and format document</li> <li>o Edit and Modify text- changing font size type and style</li> <li>o AutoText, AutoComplete, AutoCorrect, grammar and spellchecker, Find and replace of text</li> <li>o Open save and print a document</li> <li>o Insert, modify table</li> <li>o Insert graphics</li> <li>o Mail merge</li> </ul>
7	5	<p>Practice on Microsoft Excel</p> <ul style="list-style-type: none"> <li>o Create, save &amp; format worksheet</li> <li>o Open and save worksheet file</li> <li>o Edit &amp; modify data</li> <li>o Use formula and functions</li> <li>o Split windows and freeze pans</li> <li>o Data sort and security features</li> <li>o Create, edit, modify and print worksheet.</li> <li>o Create and edit charts</li> </ul>
8	5	<p>Practice on PowerPoint</p> <ul style="list-style-type: none"> <li>o Create, edit, insert, move, slides</li> <li>o Open and save presentation</li> <li>o Insert picture, audio slide layout, action button</li> <li>o Apply custom animation</li> <li>o Present slide show</li> </ul>
9	6	<p>Practice on:</p> <ul style="list-style-type: none"> <li>o Identification of type of Account.</li> <li>o Connecting to internet</li> <li>o Dial up access</li> <li>o Web browsing</li> <li>o Searching websites</li> <li>o Information searching</li> <li>o Email services</li> <li>o Creating email accounts &amp; Receiving and sending mails</li> </ul>

**5. SUGGESTED LEARNING RESOURCES**

<b>S.No.</b>	<b>Author</b>	<b>Title of Books</b>	<b>Publication &amp; Year</b>
1	Norton Peter	Introduction to Computers (special Indian edition)	Tata McGraw Hills New Delhi, 6 <sup>th</sup> Edition, 2005  ISBN: 0070593744
2	Kahate Atul	Information Technology	Tata McGraw Hills New Delhi,  ISBN-13:9780070593718
3	Williams Stalling	Using Information technology: A Practical Introduction to Computers and Communication	Tata McGraw Hills New Delhi,
4	Curtin	Information Technology: The Breaking Wave (book only)	Tata McGraw Hills New Delhi,  ISBN:0074635581
5	Ravichandran, D	Introduction to Computers and Communication	Tata McGraw Hills New Delhi,  ISBN: 0070435650
7	Douglas E.	The Internet Book	Prentice Hall of India, New Delhi, 3 <sup>rd</sup> Edition,  ISBN: 812032286X
8	Basanbhara S.K.	Computer Today	Nita Mehta Publications, 2003  ISBN: 8186340742

## GN 106 BASIC ENGINEERING SKILLS

### 1. Rationale:

A technician is expected to work on the shop floor. It therefore becomes essential for him to have a through exposure to safety aspects, fire fighting, first aid as he is the guide for the skilled and unskilled personnel working under him. From technical knowledge and skills point of view he is also expected to have knowledge on proper ways of using various hand tools, measuring devices etc. in addition to other engineering skills.

The course on Basic Engineering skills is aimed at providing him the knowledge and skills in all those areas through shop instructions, demonstrations and skill development exercises. This course is also aimed at providing the student the exposure to engineering equipment which will help him to assimilate the teaching which takes place at higher semesters.

### 2. Teaching And Examination Scheme

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
(GN106) Basic Engineering Skills	L	T	P	C	TH	TM	PR/O R	TW	150
	0	0	6	6	-	-	50	100	

Legends: L-Lectures; P-Practical; C-Credits; TH-End Semester Theory; TM-Test Marks;

PR/OR-End Semester Practica/Oral Examinations TW- Term Work

### 3. Detailed Course Contents

#### **Unit 1: General Safety, Housekeeping, Fire Fighting & First Aid**

Introduction to General Safety aspects of engineering workshop, meaning and importance of housekeeping, possible fire hazards, fire triangle, types of fire extinguishers – selection and use, basic knowledge of first aid with specific inputs on cuts, burns, electric shocks, artificial respiration, handling emergencies.

#### **Unit 2: Fitting Workshop Practice**

Introduction to the trade, Introduction to various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools, Types of files and filing methods. Drill bits and drilling Processes, using portable and pillar drilling machine. Operations performed in fitting shop such as measuring, marking, chipping, filing, grinding, sawing, drilling tapping and deing. Use of spirit level and plumb bob.

#### **Unit 3: Carpentry Workshop Practice**

Introduction to the trade, types of wood and its characteristics, forms of wood, defects in timber and its identification, wood working hand tools, wood working processes. Different types of joints and their usage. Introduction to wood working machines- lathe , circular saw, band saw, wood planner, universal wood working machine.

#### **Unit 4: Electrical Workshop Practice**

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Brief introduction to power distribution, different hand tools used in electrical trade, different measuring instruments. Making of cable joints. Measurement of current, voltage, frequency and Power Consumption. Connecting and starting of Induction Motor. Changing of Direction of rotation of induction motor. Introduction to commonly used electrical Fittings (Domestic & Industrial). Reading of simple electrical drawings.

### Unit 5: Basic Electronics Workshop Practice

Introduction to basic electronic components, Introduction to use of Multimeter in measuring voltage, current, resistance, capacitance. Checking of connectivity. Introduction to soldering process. Soldering Irons- Types and wattage. Reading of basic electronic circuits.

**Note: during first 20 minutes of the practical session, Instructor shall provide theoretical knowledge as prescribed in the curriculum. (Shop Talk)**

Unit No.	Topic	Hours/ Semester
1.	General Safety, Housekeeping, Fire Fighting & First Aid	06
2.	Fitting Workshop Practice	36
3.	Carpentry Workshop Practice	18
4.	Electrical Workshop Practice	18
5.	Basic Electronics Workshop Practice	18
	<i>Total</i>	<b>96</b>

**GN203 ENVIRONMENTAL STUDIES**

**1. RATIONALE**

Due to various developmental activities carried out by man, our environment is continuously being abused and getting degraded. The air we breathe, water we drink, food we eat, land we live on, all are getting spoiled day by day. The purity of our environment is of prime importance for survival of human race on the earth. Man should not go for developmental activities at the cost of environment. This subject has been introduced in the Diploma Programme to bring about awareness towards the environmental purity amongst the students.

**2. TEACHING AND EXAMINATION SCHEME**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN203  Environmental Studies	L	T	P	C	TH	TM	TW	PR/O R	100
	3	-	-	3	75	25	-	-	

**Minimum passing %: Theory 40%**

**Duration of Theory Paper: 3 Hrs.**

**3. DETAILED COURSE CONTENT**

**Unit 1 Multidisciplinary Nature Of Environmental Studies.**

Definition, scope and importance. Need for public awareness.

**Unit 2 Natural Resources**

Renewable and nonrenewable 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, droughts, conflicts over water, dams- benefits and problems.
- Mineral resources: Use and exploitation, environmental effects of extracting and using 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 source, land degradation, man induced land slides, soil erosion and desertification.

Role of an individual in conservation natural resources. Equitable use of resources for sustainable life styles.

### **Unit 3 Ecosystems.**

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 following ecosystems: (a) Forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) Aquatic ecosystems (Ponds, streams, lakes, rivers, oceans, and estuaries).

### **Unit 4. Biodiversity And Its Conservation.**

Introduction – 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 wild life, man-wild life conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

### **Unit 5. Environmental Pollution.**

Definition. Causes, effects and control measures of: Air pollution, water pollution, soil pollution, marine pollution, noise pollution, Thermal pollution, Nuclear hazards. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of individual in prevention of pollution. Pollution case studies. Disaster management: flood, earthquakes, cyclone and landslides.

### **Unit 6. Social Issues And The Environment.**

From unsustainable to sustainable development. Urban problems related to energy. Water conservation rainwater harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns; case studies. Environmental ethics: Issues and possible solutions. Climatic change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust; case studies. Wasteland reclamation. Consumerism and waste products. Environmental 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.

**Unit 7. Human Population And The Environment.**

Population growth, variation amongst nations. Population explosion – Family welfare programme. Environment and human health. Human rights. Value education. HIV / AIDS. Women and child welfare. Role of Information technology in environment and human health. Case studies.

**Unit 8. Field Work.**

Visit local area to document environment assets – river / forest / grassland / hill / mountain. Visit to a local polluted site – urban / rural / industrial / agricultural. Study of common plants, insects, birds. Study of simple ecosystems – ponds, river, hill slopes, etc. (field work equal to 6 lecture hours).

**4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )**

Unit No.	Topic	Teaching Hours	Marks
1)	Multidisciplinary Nature Of Environmental Studies.	01	03
2)	Natural Resources.	10	12
3)	Ecosystems.	06	08
4)	Biodiversity And Its Conservation.	06	09
5)	Environmental Pollution.	08	12
6)	Social Issues And The Environment.	07	12
7)	Human Population And The Environment.	04	09
8)	Field Work.	06	10
		48	75

### 5. MANDATORY ACTIVITIES

In addition to the class room instruction, visits should be arranged in any 2 of the following areas:

1. Visit to NIO or Science Centre.
2. Visit to Selaulim/ Anjunem Dam.
3. Visit to study ecosystem (Pond, Stream, River, and Forest).
4. Visit to show Hill cuttings, mining areas.
5. Visit to show Rain water harvesting project / Vermicomposting plant / Watershed management project. ( Krishi Vigyan Kendra – Old Goa)
6. Visit to water treatment/ waste water treatment plant.

### 6. SUGGESTED VIDEOS

In addition to the class room instruction, video films on environment may be shown.

### 7. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	Erach Bharucha	Textbook of Environmental Studies for Undergraduate courses	University Press
2	P. Meenakshi	Elements of Environmental Science and Engineering	Prentice Hall of India (PHI)
3	S. Deswal & A. Deswal	A Basic Course in Environmental Studies.	Dhanpat Rai & Co.
4	Pandya and Camy	Environmental Engineering	Tata McGraw Hill
5	Asthana D.K. and Asthana Meera	Environmental Problems and Solutions.	S. Chand & Co
6	Centre for Environmental education	Video Film	Thaltej Tekra, Ahme
7	Dr. S.K. Dhameja	Environmental Studies	



## **SEMESTER II**

### **GN 101 COMMUNICATION SKILLS**

#### **1. RATIONALE**

This course deals with Student's proficiency in English by developing their skills in reading, writing and speaking. They will be able to appreciate the usage of grammar. Acquiring proficiency in English is absolutely essential for effective communication while serving on the job. It also deals with applications of the concepts and principles learnt. Using visuals in written communication and body language in oral communication highly enhances the effectiveness of the communication process. These and some other important aspects are discussed in this course. The practice-feedback-practice cycle is of utmost important for developing the communication competencies/skills.

#### **2. TEACHING AND EXAMINATION SCHEME**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN-101	L	T	P	C	TH	TM	TW	PR/OR	100
Communication Skills		-	2	2	-	-	50	50	

Minimum passing % : Practical 40%

**Legends:**

**L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:

**PR/OR** - End Semester Practical / Oral Examinations; **TW**- Term Work

#### **3. DETAILED COURSE CONTENTS**

##### **Unit 1 - Fundamental of Communication skills**

Definition, components (message, sender, receiver, transmission medium and protocol), types (verbal & non-verbal, technological & non-technological, etc), importance of communication skills, effective communication skills (phatic stage, personal stage and intimate stage), barriers in effective communications (verbal, non-verbal), barriers while speaking, other barriers (individual's viewpoints, emotional block, etc.) methods of and hint to increase communication skills, body language.

### **Unit 2 – Presentation Skills**

Methods and styles of presentations (seminars, speeches, etc), the plan, objectives, audience, structure (sequential, hierarchical, question oriented pyramid, meaty sandwich), tips for good beginning and end, aids to presentation (visual, verbal), delivery style (eyes, voice, expression, appearances, stance, etc), techniques for a good speech (repeat, draw (signs, pictures), jokes, etc).

### **Unit 3 - Technical Reports, Letter Writing, CVs**

Functions of Reports (information, initiate action, recommend new procedures, recording, coordinating project), techniques (basic format, steps, appendices), types of reports (emphasis on progress reports, industrial visit reports, inspection reports, accident reports, survey report, report on seminars, workshop, technical gathering, etc).

Types of letters, format function, qualities of a good letter, examples of job applications, leave applications, complaints, purchase orders, enquiries replies etc.

Brief mention of importance of etiquette in email communication, importance of careful proofing the documents sent.

Curriculum Vitae – definition, sample, tips for a good CV, covering letter

### **Unit 4 - Soft Skills**

Importance of values, attitude and etiquettes in communication, ethics and manners, courtesy, honesty and reliability; personal integrity, flexibility – adaptability, team skills – cooperation; ability to follow regulations; willingness to be accountable; Ability to relate to co workers in a close environment, non verbal communication, leadership skills – self directed, ability to direct and guide others, self-supervising; ability to relate to co workers in a close environment; positive attitude; positive work ethic, written communication Skills- basic spelling and grammar; reading and comprehension, personal hygiene and energy, interpersonal skills – communication skills with public, fellow employees, supervisors, and customers, motivation – willingness to learn; caring about seeing the company succeed; understanding what the world is all about; commitment to continues training and learning; critical thinking skills, grooming – good personal appearance.

### **Unit 5 - Language Workshop**

The Reading, Listening, Writing, Speaking Skills will be tested

#### **1. Reading Skills:**

Articles from the newspapers, magazines, journals etc. will be given to the students to read aloud thus checking their pronunciation, clarity and their style of reading.

#### **2. Listening Skills:**

Passages, Topics, Stories, Speeches of eminent people will be read or played. The students have to listen and their listening skills will be tested.

#### **3. Writing Skills:**

- Students to write on any given topic
- Students to compose their own stories
- Students will be given a particulars situation i.e. accident, college gathering etc. and asked to write a report

#### **4. Speaking Skills:**

- Students to speak on any given topic

## Directorate of Technical Education, Goa State

b) Narrate a story written by them.

Group discussions in the classroom. This could include debates, discussion on current issues, role-playing.

### 4. List of Experiments :

- Oral presentation about technical products for five minutes.
- Seminar Presentation/Report writing and presentation on identified topics from science and technical subjects for short duration.
- Group discussion on science and technical topics.
- Organise mock interviews.
- Organise debates.
- Extempore speech for three minutes on a topic.
- Observe a process and reproduce orally in own words for three to five minutes.
- Arrange video recording of presentations for self-feedback.

### 5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Year of Publication
1	Wren and Martin	Practical English Grammar	1992
2	John Sinclair (ed.),	Collins Cobuild English Grammar	William Collins & Sons Cp., London 1990
3	Krishna & Mohan,	Effective English Communication	Tata McGraw Hill, New Delhi 2000
4	Randolf, Quirk & Sidney Greenbaum	University Grammar of English	1993
5	Tiwari, N.P. et al ,	Communication Skills for Technical Students – Book	Somaiya Publications, 1995
6	Tiwari, N.P. et al,	A Communicative Grammar of English	Somaiya Publications, 1989

**GN 104 APPLIED CHEMISTRY**

**1. RATIONALE**

Applied Chemistry is multi-disciplinary science having wide applications in all the branches of engineering and technology. In simple terms, it is the science of chemical phenomena in various engineering situations. An understanding of the basic concepts of applied chemistry is essential not only for all chemists but also for engineers. Therefore it forms an indispensable base for them. The emphasis is given more on applications of principles of chemistry to engineering situations rather than fundamental principles only. It also develops in the students the habit of scientific enquiry, ability to investigate the cause and effect relationship, ability to interpret and analyze the results under given conditions.

**2. TEACHING AND EXAMINATION SCHEME:**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
GN-104 Applied Chemistry	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	2	5	75	25	50	-	

Minimum passing % : Theory 40%

**Legends:**

**L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks;  
**PR/OR** - End Semester Practical / Oral Examinations; **TW**- Term Work

**3. DETAILED COURSE CONTENTS**

**Unit 1 Atomic Structure and Chemical Bonding**

Fundamental particles and their characteristics, Energy levels - definition, designation of energy levels, Bohr- Bury's laws for distribution of electrons in shells (1<sup>st</sup> three laws only), concept and shape of orbitals (s and p only), Quantum numbers-designation, definition, values, Aufbau and Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, orbital electronic configuration of elements with atomic number 1 to 20, Lewis and Langmuir concept of stable configuration. Concept of electrovalent, covalent and co-ordinate bond, Formation, properties and examples of electrovalent compounds (NaCl, MgO, CaCl<sub>2</sub>) covalent compounds (Cl<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>, CO<sub>2</sub>) and coordinate compounds (O<sub>3</sub>, SO<sub>2</sub>).

### **Unit 2 Electrochemistry**

Arrhenius theory of electrolytic dissociation., Degree of Ionisation- definition, factors affecting degree of ionisation , Nature of solute and solvent, concentration of solution, and temperature, Strong and weak electrolytes - definition and examples, Concept of the terms involved in electrolysis –conductor, insulator, electrolyte, non-electrolyte, electrolysis, electrodes, electrolytic cell, cathode, anode and current density, electrochemical series- concept and significance. Mechanism of electrolysis, Ionisation, primary reactions at the cathode, activity series of cations, primary reactions at the anode, activity series of anions, electrolysis of i. Fused NaCl using carbon electrodes, ii. aqueous NaCl using platinum electrodes iii. aqueous CuSO<sub>4</sub> using platinum electrodes iv. aqueous CuSO<sub>4</sub>, using copper electrodes);

### **UNIT 3 Water and its treatment**

Hard and soft water, types of hardness and its causes, disadvantages of hardness of water (i) for industrial use - dyeing, textile, sugar, paper, bakeries, (ii) in boilers for steam generation with special reference to sludge and scale formation ( no chemical equations), zeolite and ion exchange process for water softening, desalination by electro dialysis and reverse osmosis, concept of pH

### **Unit 4 Corrosion and Its Control**

Definition, Atmospheric corrosion (direct chemical corrosion) - definition, Oxidation corrosion, the nature of the oxide film, stable, unstable and volatile, mechanism of oxidation corrosion, corrosion due to other gases. Immersed corrosion (electrochemical corrosion) - definition, factors necessary for electrochemical corrosion , Galvanic cell corrosion, concentration cell corrosion- metal ion concentration and differential aeration. Mechanism of electrochemical corrosion- Hydrogen evolution mechanism, Oxygen absorption mechanism, Protection of metals from corrosion; galvanising, tinning, metal spraying , proper designing , using pure metals, using metal alloys, Cathodic protection- sacrificial anode and impressed current .Modifying the environment- De-aeration, De-activation, De-Humidification and alkaline neutralization.

### **Unit 5 Lubricants**

Definition, functions of Lubricants, Types of Lubrication, Fluid Film, Boundary, Extreme Pressure, Classification of Lubricant - solid, semi- solid, liquid synthetic oils. Characteristics of Lubricants, Definition and Its significance -Viscosity. Viscosity Index, Flash and Fire Point, Oiliness, Pour Point, Volatility, Acidity, Emulsification and Saponification Value. Selection of Lubricants for Delicate Instruments, High Pressure and Low Speed Machines, Extreme Pressure and Low Speed Machines, Mechanisms of Lubrications.

**4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (Theory)**

Unit No.	Name of the unit	Hours	Marks
1	Atomic Structure and Chemical bonding	10	15
2	Electrochemistry	08	13
3	Water and its treatment	09	15
4	Corrosion and its control	16	25
5	Lubricants	05	07
	Total	48	75

**5. SUGGESTED LIST OF EXPERIMENTS**

Sr. No.	Unit No.	List of Experiments
1.		Double titration of acid and base using phenolphthalein
2.		Double titration of acid and base using methyl orange
3.		Redox titration of potassium permanganate, ferrous sulphate and oxalic acid.
4.		Determination of degree of hardness of water by EDTA method
5.		Determination chloride content of water by Mohr's method
6.		Determination of total alkalinity of water sample
7.		Titration of strong acid and strong base using pH meter
8.		Determination of conductivity of water
9.		Titration of strong acid and strong base using conductometer
10.		Corrosion susceptibility of aluminium to acid or base.

**6. SUGGESTED LIST OF ACTIVITIES**

S.No.	Title
1.	Quiz on Electronic configuration of atoms.
2.	Demonstration of process of electrolysis
3.	Demonstration of purification of water by domestic/economical method.
4.	Identification and application of lubricants in different equipment/glasswares used in different laboratories
5.	Visit to some metallurgical industries for demonstration of different processes of metallurgy.
6.	Preparation of chart of different alloys of steel and their uses
7.	Seminar on different aspects of fuel, properties and usages
8.	Use of pH paper for testing different samples of water, blood etc.
9.	Demonstration and use of different samples of paints, varnishes, drying oils, pigments, thinners, dryers, fillers, plasticizers and anti-skinning agents.

### 7. SUGGESTED LEARNING RESOURCES

Sl. No.	Author	Title	Publication and Year
1.	M.M. Uppal	A text book of Engineering Chemistry,	Khanna Publishers
2	V.P. Mehta	A textbook of Engineering Chemistry,	Jain Bros. Delhi
3	S.N. Narkhede	A Textbook of Engineering Chemistry	Nirali Prakashan
4	R.A. Banawat, S.K. Mahajan, S.K.Mehta	Textbook of Applied Chemistry	India Book House
	V.S. Godbole	Applied Chemistry	
5	R.S. Sharma	Textbook of Engineering Chemistry	Khanna Publishers
	P.C. Jain and M. Jain	Engineering Chemistry	
6	J.C. Kuriacose and J. Rajaram	Chemistry in Engineering	Tata McGraw Hill Publishing Co.Ltd., New Delhi
7	Dr.S. Rabindra and Prof.B.K. Mishra	Engineering Chemistry:	Kumar and Kumar Publishers (P) Ltd., Bangalore -40
8	S.S.Kumar	A Text book of Applied Chemistry-I	Tata McGraw Hill, Delhi
9	Sharma	A Text book of Applied Chemistry -I	Technical Bureau of India, Jalandhar
10	S.S.Dhara	A Textbook of Engineering chemistry	S.Chand & Company, New Delhi
11	Dr. G.H. Hugar	Progressive Applied Chemistry – I & II	Eagle Prakashan, Jalandhar

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**GN201 ENGINEERING MATHEMATICS- II**

**1. RATIONALE :**

Mathematics is the backbone of all areas of engineering and technology and hence technician / engineers need to study relevant theories and principles of mathematics to enable them to understand and grasp the concept of advance courses of the curriculum. With above in mind, the necessary content for the engineering mathematics is derived to understand advance use of mathematics in solving engineering problems.

**2. TEACHING AND EXAMINATION SCHEME :**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
GN-201 Engineering Mathematics-II	L	T	P	C	TH	TM	TW	PR/OR	100
	4	2	-	6	75	25	-	-	

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

**Legends:**

**L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks;  
**PR/OR** - End Semester Practical / Oral Examinations; **TW**- Term Work

**3. DETAILED COURSE CONTENT :**

<b>Unit 1 Determinants</b> Determinants of the second order and third order, solutions of equations in two or three variables using Cramer's Rule
<b>Unit 2 Binomial Theorem</b> - Binomial Theorem for a rational index, general term of binomial expansion, middle term (s).
<b>Unit 3 Mensuration</b> - Volume and surface area of - Prism, pyramid, frustrum of a sphere, frustrum of pyramid, frustrum of cone, Area and volume by Simpsons Rule
<b>Unit 4 Matrices</b> Definition and Notations, Elements of Matrix, Types of matrices, Special matrices - Square, Diagonal, Row, Column, Scalar Unit, Zero or null, upper and lower triangular matrices, Symmetric, Skew symmetric matrices . Addition, Subtraction and multiplication of matrices, Inverse of matrix using Adjoint method only Application of matrices in solving simultaneous equations in 2 or 3 variable.
<b>Unit 5 Integral Calculus</b>  Definition, fundamental properties. Methods of Integration - Integration by substitution, Integration by parts, Integration by partial fractions.. Definition of Definite Integral Properties of definite integrals, Application of integration, area under a plane curve, volume of revolution.(simple sums only)



**Unit 6 Differential Equations**

Definition, order and degree of a differential equation, solutions of differential equations of first order and first degree-variable separable type only. Second order differential equation of type  $\frac{d^2y}{dx^2} = f(x)$  only, Application of differential equation in engineering problems

**Unit 7 Statistics (Mechanical and Allied Engg. Branches)**

Measures of central tendency for grouped and ungrouped data - Mean, Median and Mode. Measures of dispersion for grouped and ungrouped data - range, mean deviation, standard deviation, variance and co-efficient of variation

**OR**

**Unit 7 Complex Numbers. ( Electronics engg and Allied branches)**

Definitions, Argand diagrams, polar form of a complex number, Addition, Subtraction, Multiplication & Division of a complex number. Exponential and circular function, De-Moivre's theorem, roots of a complex number- Cube roots of unity, n th roots of unity, hyperbolic functions

**4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY):**

Unit No.	Topic	Teaching Hours/ Semester	Marks
1.	Determinants	5	7
2.	Binomial Theorem	7	10
3.	Mensuration	7	10
4.	Matrices	11	08
5.	Integral Calculus	17	20
6.	Differential equations	08	10
7.	Statistics	09	10 \$
<b>OR</b>			
7	Complex Numbers	09	10 #
	Total :	64	75

**\$- for Mechanical and allied branches**

**# - For Electronics and allied branches**

**5. SUGGESTED LEARNING RESOURCES :**

S.No.	Author	Title of Books	Publication & Year
1.	Deshpande S.P,	Mathematics for Polytechnics	Griha Prakashan, Pune, 1996 or latest
2.	Grewa, I B.S;	Engineering Mathematics	Khanna Pub., New Delhi 1995 or latest
3.	Prasad, I.B.;	Engineering Mathematics	Khanna Pub., New Delhi 1997 or latest
4.	Wartiker P.N.,	Applied Mathematics	Griha Prakashan Pune, 1996 or latest

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**GN 202 APPLIED PHYSICS-II**

**1. RATIONALE:**

Physics is one of the basic building blocks for engineering sciences. Therefore, the students need to describe and explain the basic principles, laws & facts of physics. These skills will enhance their ability to apply it in solving engineering problems related to their respective branches of engineering

**2. TEACHING AND EXAMINATION SCHEME:**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit s	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
GN-202 Applied Physics-II	L	T	P	C	TH	TM	TW	PR/OR	150
	4	-	2	6	75	25	50	-	

Minimum passing % : Theory 40% and Practical 40%

Duration of Theory Paper: 3 Hrs.

**Legends:**

**L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks;

**PR/OR** - End Semester Practical / Oral Examinations; **TW**- Term Work

**3. DETAILED COURSE CONTENTS**

**Unit 1 FORCE, WORK, POWER, AND ENERGY**

Definition of Force and its units. Types of Forces with example- Direct, Remote action e.g. Gravitational Force, Magnetic Force, Electric Force. Effect of Forces on body-External, Internal.

Work-definition and units, Graphical Representation of workdone, Energy definition and units.

Types of Mechanical Energies- K.E. & P.E. Law of Conservation of Energy, Total Energy, Power-definition and units, Power (Force X Velocity)

**Unit 2 CURRENT ELECTRICITY**

Ohms law, General equation of Ohms law, Factors affecting resistance, specific resistance and units. Effect of temperature on resistance, Law of resistance in series and parallel. Internal resistance and EMF of the cell. Potential drop along a uniform wire. Principle of potentiometer. Comparison of EMF of a given cell by single cell method. Comparison of EMF of a given cell by sum and difference method. Use of meter bridge to determine the unknown resistance.

Definition of Electric power and energy in d.c. circuit. Concept of Kilowatt hour, calculation of energy bills.

**Unit 3 ELECTROMAGNETISM**

Electromagnetic Induction, Faraday's Laws of Electromagnetic Induction, Lenz's Law, Self Induction & Mutual Induction.

**Unit 4 LOGIC GATES**

Introduction to Binary Number System, Concept of '0' and '1' in Binary System. Binary equivalent of Decimal numbers from 0 to 10  
Logic Gates: 1. 'NOT' Gate , 2. 'OR' Gate 3. 'AND' Gate. NAND , NOR GATE Their Logic Representation & Truth Table

**Unit 5 SOUND**

Definition and examples of Free and Forced Vibrations, Resonance. Determination of velocity of sound using Resonance Tube.  
Definition of Beats (No derivation), Beat frequency & application of Beats, Definition of Echo, Reverberation & Reverberation time, Sabine's Formula, Acoustical Planning of an Auditorium. Factors affecting Reverberation Time, Ultrasonic waves, Piezo Electric Effect, Applications of Ultrasonic waves.

**Unit 6 CIRCULAR MOTION AND GRAVITATION**

Definition of Uniform Circular Motion, Angular Displacement, Angular Velocity, Relation between Linear and Angular velocity, Definition and concept of Centripetal and Centrifugal Force.(No derivation), Expression for velocity of a vehicle moving on a curved Horizontal Road, Expression for Angle of Banking & Super Elevation of Road. Newton's Law of Gravitation, Force of Gravity. Acceleration due to Gravity, Expression for Acceleration due to gravity.

**Unit 7(A) FUNDAMENTAL CONCEPTS OF SIMPLE MACHINES  
(MECHANICAL AND ALLIED GROUPS)**

Definition of efforts, velocity ratio, mechanical advantage & efficiency of machine and their relationship. Laws of machines, examples of simple machine, definition of ideal machine, systems of pulleys (First & Second). Determination of velocity ratio ,Mechanical Advantage & Efficiency.

OR

**Unit 7 (B) RECTIFIERS  
(ELECTRONICS AND ALLIED GROUPS)**

V-I characteristics of P-N junction. Diode as a rectifier. Half wave rectifiers, working, input and output waveforms, percentage regulation,  $\left( \frac{V_{NL} - V_{FL}}{V_{FL}} \right) \times 100$   
Full wave rectifier with centre tap transformer, working, input and output waveforms, percentage regulation  
Bridge rectifier, working, input and output waveforms, percentage regulation

**4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS(THEORY)**

Unit No.	Unit	Teaching Hours / Semester	Marks
1	FORCE, WORK, POWER & ENERGY	10	12
2	CURRENT ELECTRICITY	16	16
3	ELECTROMAGNETISM	6	8
4	LOGIC GATES & AWARENESS TO NANO SCIENCE	4	6
5	SOUND	8	9
6	CIRCULAR MOTION & GRAVITATION	10	12
7A	FUNDAMENTAL CONCEPTS OF SIMPLE MACHINES	10	12
	OR		
7B	RECTIFIERS	10	12
	Total	64	75

**7A- for Mechanical and allied branches**

**7B- For Electronics and allied branches**

**5. LIST OF EXPERIMENTS**

1. Determination of Specific resistance of a material wire by Voltmeter and Ammeter.
2. Determination of Internal resistance of a given cell by using Potentiometer.
3. Calibration of Voltmeter by using Potentiometer.
4. Comparison of E.M.F. of two given cells by single cell method using potentiometer.
5. Determination of specific resistance by meter bridge.
6. Verify the law of resistances in series by meter bridge.
7. Verify the laws of resistances in parallel by meter bridge.
8. Determination of velocity of sound by Resonance tube.

**6. SUGGESTED LEARNING RESOURCES**

S.No.	Author	Title	Publication and Year
1.	Halliday D and Resnickr	Physics Part-I & II	Latest
2.	Das S.K., Sisodiya M.L., Neher P.K., Kachhawa C.M.,	Physics Part-I & II for 10+2 Students	Latest
3.	B.G. Dhande	Applied physics for polytechnics	Latest
4.	Bhandarkar	Applied Physics for polytechnics	Latest
5.	Saxena HC & Singh Prabhakaer	Applied Physics Vol. I & II	Latest
6.	Rao, B.V.N.	Modern Physics	Latest
7.	R.K.Guar and S.L. Gupta.	Engineering Physics	
8.	B.L. Thereja.	Engineering Technology	
9.	Modern Publishers.	ABC of Physics	
10.	V.K Mehta	Elements of Electronic Engineering	

**GN 204 ENGINEERING DRAWING**

**1. RATIONALE:**

Drawing is a graphical language of engineering field. Engineering technician irrespective of his field of operation in an industry is expected to possess a thorough understanding of drawing, which includes clear spatial visualization of objects and the proficiency in reading and interpreting a wide variety of engineering drawings. It is the skill, which translates an engineering idea into lines and dimensions on a piece of paper. Besides this he is also expected to possess a certain degree of drafting skill- depending upon his job functions-in his day-to-day activities. This course of Engineering Drawing for Diploma courses is aimed at developing basic knowledge and skills of engineering drawing and use of computer in the field of Engineering Drawing.

**2. TEACHING AND EXAMINATION SCHEME:**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
GN-204	L	T	P	C	TH	TM	TW	PR/OR	100
Engineering Drawing	2	-	4	6	-	-	50	50	

Minimum passing % : Theory 40% and Practical 40%

Duration of Theory Paper: 3 Hrs.

**Legends:**

*L*-Lecture; *T* - Tutorial; *P* - Practical; *C*- Credit; *TH*- End Semester Theory; *TM* – Test Marks:

*PR/OR* - End Semester Practical / Oral Examinations; *TW*- Term Work

**3. DETAILED COURSE CONTENT**

**Unit 1 Introduction**

- Importance of Engineering drawing as a means of communication.
- Introduction to drawing equipment, instruments and their uses.
- Planning of drawing sheet as per I.S. 696 - 1972.
- Indian standard practices of laying out and folding of drawing
- Different types of lines used in engineering drawing.
- Importance of scale in Engineering Drawings.
- Lettering

**Unit 2     Dimensioning techniques and standard conventions**

- Methods of dimensioning, Dimensioning terms and notation (use of I.S. code 696 and 2709), General rules for dimensioning, Dimensioning of cylinder, holes, arcs of circle, narrow space, angles, counter sunk hole, screw thread, taper etc.
- Conventional representation of various materials.

**Unit 3     Engineering Curves & Shapes**

- Construction of an Equilateral and Isosceles triangle, Square, Rhombus, Regular pentagon & Regular hexagon given distance across the corners/ flats and given length of a side using general method of construction
- Types of Engineering curves
- Construction of Engineering curves like
  - Ellipse- by focus & directrix method and arcs of circles method
  - Parabola- by focus & directrix method and rectangle or oblong method
  - Hyperbola- by transverse axis & Focus and directrix method
  - Cycloid- by generating circle rolling on a straight line
  - Involute of a triangle, circle & pentagon
  - Draw normal & tangents to the above curves from given point on the curve
- Practice problems of drawing various engineering curves

**Unit 4     Orthographic projection**

- Definitions of various terms associated with orthographic projections.
- Planes of projections.
- Concept of Quadrants.
- First and third angle method of projection.
- Projection of points
- Projection of lines
  - (i) Parallel to both Principal planes
  - (ii) Parallel to one and Perpendicular to other Principal plane.
  - (iii) Inclined to one plane and parallel to other plane.
- Projection of Triangle, Square, Rhombus, regular Pentagon when inclined to one principal plane & perpendicular to other plane.
- Introduction to the following solids  
Cylinder, cone, cube.  
  
Right regular solids such as
  - (i) Prism: Triangular & Square
  - (ii) Pyramid: Square & Pentagonal.
    - Projections of above mentioned solids when axis is inclined to one principal plane & Parallel to other principal plane.
    - Conversion of simple pictorial views into orthographic views.

- Practice problems on projection of points, lines and planes.
- *Problems where one end of the line is in one quadrant & other end in other quadrant and traces are to be excluded.*
- *Problems where apparent projection of plane are given, true shape & slope angle are to be drawn are excluded.*

### **Unit 5 Section of solids**

- Concept of sectioning planes
- Auxiliary planes and true shape of section.
- Drawing projections and section of solids like square prism, square pyramid, pentagonal pyramid, cylinder and cone with sectioning plane inclined to one principal plane and Perpendicular to the other principal plane (Axis of solid perpendicular to one principal plane and parallel to the other)

### **Unit 6 Development of lateral surfaces**

- Concept and importance of surface development in the engineering field.  
Methods of development of surfaces-Radial & Parallel line method.  
Development of surfaces for the following right regular solids-
- Cylinder
- Prism
- Cone
- Pyramids
- Development of solids standing on its base & cut by a plane inclined to either VP/HP and perpendicular to the other is also included.
- *Practice problems on above with top & bottom of the solid is excluded*

### **Unit 7 Isometric Views**

- Limitations of orthographic projections.
- Procedure for preparing isometric projections.
- Difference between Isometric projection & Isometric view.
- Isometric view of geometrical solids and simple machine parts.
- Conversion of orthographic views into isometric views.
- Construction of Isometric view for any real object. Conversion of orthographic views of simple components into isometric views.

**4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS**

Unit No.	Unit	Teaching Hours / Semester
1	Introduction	1
2	Dimensioning techniques & standard conventions	1
3	Engineering Curves & Shapes	4
3	Orthographic projections	13
4	Section of solids	3
5	Development of surfaces	4
6	Isometric projections	2
-	Revision	4
	<b>Total</b>	<b>32</b>



## 5. SUGGESTED LIST OF ACTIVITIES

Following shall be the list of sheets to be prepared as Engineering drawing lab work

Sheet No.	TITLE	Contents	Hours
1.	TYPES OF LINES, LETTERING, DIMENSIONING.	All types of lines, Single stroke vertical capital letters, Methods of Dimensioning-Aligned & unidirectional System, Conventional representation of materials.	4
2.	GEOMETRICAL CONSTRUCTIONS	Construction of Equilateral and Isosceles triangle, Square, Rhombus, Regular pentagon & hexagon	4
3.	ENGINEERING CURVES	Construction of ellipse, parabola, hyperbola by given methods. Involute, cycloid. Draw normal and Tangent to curves.	8
4.	PROJECTION OF POINTS & LINES	Drawing projection of points in all 4 quadrants.  Drawing of projections of lines in following positions  (i) Parallel to both Principal planes  (ii) Parallel to one and Perpendicular to other Principal plane.  (iii) Inclined to one plane and parallel to other plane.	6
5	PROJECTION OF PLANES	Drawing the projection of Triangle square, Rhombus, regular Pentagon when inclined to one principal plane & perpendicular to other plane.	6
6	PROJECTIONS OF SOLIDS	Drawing projection of following solids Cylinder, cone, cube.  Right regular solids such as Prism: Triangular & Square, Pyramid: Square & Pentagonal, when axis is inclined to one principal plane & parallel to other principal plane.	8
7	ORTHOGRAPHIC PROJECTIONS	Simple problems on conversion of pictorial into orthographic views. (atleast 2 problems each in 1 <sup>st</sup> angle and 3 <sup>rd</sup> angle)	4
8	SECTIONS OF SOLIDS	Drawing projections and section of solids like square prism, square pyramid, pentagonal pyramid, cylinder and cone with sectioning plane inclined to one principal plane and Perpendicular to the other principal plane (Axis of solid perpendicular to one principal plane and parallel to the other)	8

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9.	DEVELOPMENT OF LATERAL SURFACES	Draw the Development of surfaces for the following right regular solids-  Cylinder, Cone, Prism & pyramids (square, triangular, pentagonal).	8
10	ISOMETRIC VIEWS	Conversion of orthographic views of simple components into isometric views.	8

### 6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title	Publisher
1.	BIS, India	IS. 696. (Latest revision).	BIS, India
2.	N.D. Bhatt	Engineering Drawing	Charoter Publisher, Anand
3.	R. K. Dhawan	Engineering Drawing & Machine Drawing	Kumar
4.	R.B. Gupta	Engineering Drawing	Satya Prakashan, Delhi
5.	P.S. Gill	Geometrical Drawing	Ketson & Sons
6.	P.S. Gill	Machine Drawing	Ketson & Sons
8.	TTTI, Bhopal	Work Book in Mechanical Drafting	TTTI, Bhopal
9.	T. Jeyapoovan	Engineering Drawing & Graphics Using AutoCAD 2000	Vikas Publishing House Pvt. Ltd, New Delhi.
10	N.D. Bhatt	Machine Drawing	Charoter Publisher, Anand

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**GN 205 ENGINEERING MATERIALS**

**1. RATIONALE:-**

Adequate knowledge of different types of engineering materials, their properties & applications are very essential for the engineers. This course content is designed to provide basic insight knowledge regarding engineering material and their applications which will be useful for the students to learn subjects of higher semesters. The range of materials available for engineering applications is quite vast, hence only the basic groups of ferrous non-ferrous, non-ferrous & other engineering materials with their general properties and uses have been stressed upon.

**2. TEACHING AND EXAMINATION SCHEME:**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credi ts	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
G-205	L	T	P	C	TH	TM	TW	PR/OR	100
Engineering Materials	4	-	-	4	75	25	-	-	

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

**Legends:**

**L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:

**PR/OR** - End Semester Practical / Oral Examinations; **TW**- Term Work

**3. COURSE CONTENTS**

**Unit 1 Introduction to Engineering Materials**

Classification of Materials

- Metal, Non-metal
- Ferrous Metal & Non-ferrous Metals.

Differences between Metals & non-metals.

Properties of Materials.

- Physical properties – Melting point, freezing point, boiling point, Density, Linear co-efficient of expansion, Thermal conductivity, Electrical resistivity.
- Mechanical properties – Strength, Elasticity, Plasticity ductility,

Malleability, Toughness, Brittleness, Hardness, fatigue, creep.

- Electrical properties – Resistivity, conductivity, Temperature coeff. of resistance, dielectric strength, Thermo electricity, super conductivity.
- Magnetic properties – permeability, coercive force, magnetic stresses.
- Chemical properties - Corrosion resistance, chemical composition, acidity, alkalinity.

## **Unit 2 Ferrous & Non-Ferrous Metals & its Alloys**

### ➤ **Ferrous alloys.**

- Low carbon steel, medium carbon steel, High carbon steel, their carbon percentage, properties & uses.
- Cast iron – Grey cast iron, white cast iron, spheroidal grey cast iron, their properties & uses.
- Alloy steels.
  - Constituents of alloy steels such as phosphorous sulphur, Silicon, Manganese and their effect on properties of materials.
  - Stainless steel, chromium – Nickel steel, Nickel-chromium-molybdenum steel, Nitriding steel, Manganese steel, its properties & uses.
- Tool steel – composition, HSS, High carbon steel, properties & uses.

### ➤ **Non-ferrous Metals & alloys**

- Aluminium – Properties & uses.
- Aluminium alloys – constituents of alloy & their effect on properties of metal
- Properties & uses of Duralumin, Y-alloy, Al-si alloy, Al-Zn-Mg alloys.
- Copper – Properties & uses.
- Copper alloys – Constituents of alloy & their effect on properties of metal.
- Properties & uses of Copper – Zinc alloys such as Muntz metal, manganese bronze, copper-Tin alloys such as Bronze, copper aluminium alloys such as aluminium bronzes.
- Properties & uses of lead & its alloys.

## **Unit 3 Non – Metallic materials**

- Refractory
- Desirable properties.
- Difference between acid, basic & neutral refractories.
- Properties & uses of Fire clay refractory, silica refractory.
  - Plastic
- Classification table only.
- Properties & uses of Thermosetting & Thermoplastic.
  - Natural & Synthetic abrasive materials.
- Introduction, Properties & uses.
  - Rubber
- Properties & uses of natural, neoprene, synthetic & butyl rubber.

- Vulcanization process.
  - Glass
- Properties & uses of soda glass, Borosilicate glass, fibre glass.
- Glass wool – composition, properties & uses.
  - Introduction to composite materials. Classification diagram only.

**Unit 4 Conductor, Semi Conductor, Insulating and Magnetic Materials.**

- Classification of Materials as conductor, Semiconductor and Insulating materials.
- Conductor Materials.
  - High conductivity materials
    - Copper, Aluminium, Carbon, Silver, Lead, Brass, Bronz, Tungsten & Gold.
    - Their properties as conducting materials and applications.
  - High resistivity materials
    - hichrome, constantan, manganin
    - Their applications
- Insulating materials
  - Introduction
  - Characteristics of Good Insulating materials
  - Solid Insulating materials
    - Wood, paper, rubber, mica, glass fibre, porcelain, varnish, PVC, Resins.
  - Their characteristics as insulating materials and applications.
  - Liquid insulating materials
  - Mineral oil, its properties as insulating material and applications.
  - Gaseous insulating materials like air, Nitrogen, Sulphur hexafluoride & their applications.
- Semiconductor Materials.
  - Silicon & Germanium. Their specifications as semiconductor material and uses
- Magnetic Materials.  
Classification as:
  - \* Dia Magnetic
  - \* Para Magnetic
  - \* Ferromagnetic
  - \* Non magnetic

List of these materials and their applications.

**Unit 5 Construction Materials**

- Building Stones : Classification of rocks, Characteristics of good building stones, common building stones & their uses.
- Cement: Chemical composition of port land cement, outline of manufacturing process, types of cements, uses.
- Bricks: Bricks – Constituents, properties, classification, special bricks – refractory and flyash bricks; uses.
- Other materials:
  - Lime – Sources. Properties, uses.
  - Clay – Different building products from clay like tiles, pipes etc.
  - Timber – Common varieties of timber, uses wood products, veneer, plywood, etc.
  - Sand – Sources: rivers, crushed aggregates, characteristics uses.

#### 4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

Unit No.	Topic	Teaching Hours/ Semester	Marks
1	Introduction to Engineering Materials	04	09
2	Ferrous & Non-Ferrous Metals & its Alloys	16	18
3	Non – Metallic materials	12	12
4	Conductor, Semi Conductor, Insulating and Magnetic Materials.	16	18
5	Construction Materials	16	18
		64	75

## SEMESTER III

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	TW	PR	
CS301	Engg.Mechanics	3	1	2	6	75	25	50	-	150
ME301	Machine Drawing	2	-	4	6	75	25	50	-	150
ME302	Manufacturing Process I	3	-	4	7	75	25	50	-	150
ME303	Thermal Engineering	3	1		4	75	25	-	-	100
CS305	Computer Aided Drafting	-	-	4	4	-	-	50	50	100
CS302	Elements of Electrical & Electronics Engg.	3	-	2	5	75	25	25		125
Total		14	2	16	32	375	125	225	50	775

**(CS301) ENGINEERING MECHANICS**

**1. RATIONALE.**

The focus of the course is to study rigid bodies, subjected to motion or equilibrium with the particular emphasis of engineering applications. This course plays a key role in engineering and is a pre- requisite for all design applications. Basic understanding of the concepts and principles involved in mechanics is essential. The concepts in Applied Mechanics form the base of all engineering disciplines. Applications of principles to engineering situations is emphasized in this course. Considering the level of student, concepts are difficult; hence classroom demonstration should be used to explain concepts and principles.

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CS301	L	T	P	C	TH	TM	PR /OR	TW	150
Manufacturing Processes-I	3	1	2	6	75	25	-	50	

Minimum passing % : Theory 40% and Practical 40%    Duration of Theory Paper: 3Hrs

**2. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE.**

The course content should be taught and implemented with the aim to appreciate and apply the Principles and Laws of Engineering Mechanics in basic Engineering Design concepts.

**3. DETAILED COURSE CONTENT**

<b>CH1. FORCE</b>	<b>09 Mrks</b>	<b>05hr</b>
Definition & units of Force, Types of Forces, its Characteristics, Effect of Forces, System of Forces, Resolution & Composition of Forces (Resolving along X & Y Axis only). Relationship between Resultant & Equilibrant Force. Application of Resolution to find Resultant of coplanar concurrent Force System, and Finding missing force when resultant is given.		



**CH2. MOMENTS**

**09Mrks**

**04hrs**

Definition and units, Sign conventions (Take clockwise +ve, Anticlockwise -ve)

Definition & units of couple (clockwise +ve, Anticlockwise -ve)

Characteristics of couple, Varignon's Theorem,

Application of above to find Resultant in magnitude, direction and line of action in Coplanar Non- concurrent and parallel Force system.

**CH.3 EQUILIBRIUM**

**18Mrks**

**12hrs**

Concepts of Equilibrium, Conditions of Equilibrium for Two forces, Three forces, concurrent & non concurrent force system, Lami's Theorem and its application..

Concepts and drawing of Free Body Diagram involving not more than three bodies.

Definition of Beam, types of beams, types of Supports and types of loading.

Application of Equilibrium to beams ( Beams with two supports at the ends, Beams with overhangs) with Concentrated loading, UDL, Partially UDL Loading only.

Applications of Equilibrium to determine the forces in the member of the perfect simple support and cantilever truss using method of Joints. Graphical method/ Maxwell diagram for determination of forces in the member of truss.

**CH.4 FRICTION**

**09Mrks**

**06hrs**

Definition, Coulombs Law of static friction, coefficient of friction, Angle of friction, Cone of friction, Angle of Repose

Application of Friction with a block on horizontal and inclined Plane , Ladder friction.

**CH.5 KINETICS**  
**09hrs**

**12Mrks**

D'Alemberts Principle and its Application

Simple problems related to Motion of Lift, Two connected bodies with a single string, suspended on horizontal and inclined planes.

**CH.6 MOMENTUM, IMPACT, AND IMPULSE**  
**04Hrs**

**06Mrks**

Definition and units of Momentum and Impulse

Definition of impulsive force

Law of Conservation of Momentum.

Simple problems related to Momentum and Impulse, impulsive force, Law of Conservation of Momentum

**CH.7 WORK, POWER & ENERGY**

**12Mrks**

**08Hrs**

Definition and units of Work, Power and Energy.

Forms of Energy – Kinetic and Potential Energy.

Principle of Conservation of Energy

Simple numerical problems to calculate Work, Power, Energy & conservation of Energy.

**Total = 75 Mrks**

**48 Hrs**

**Engineering Mechanics (Practicals)**

**Experiments:- (Minimum 06 experiments)**

1. To Verify Polygonal Law of forces.
2. To Prove Lami's Theorem.
3. To find Co-efficient of Friction.(Any Two Surfaces)
4. To Determine Reactions in Beam Apparatus.
5. Four experiments on Lifting Machine to find M.A, V.R , Efficiency, and to obtain Law of Machine

**Graphical Analysis:** - 3 sheets (Half Imperial)

- a) Determination of Resultant of Coplanar Concurrent Forces.
- b) Determination of Resultant of Coplanar, Non-concurrent Forces and Parallel.
- c) Analysis of Trusses (Simply supported and Cantilever) using Maxwell diagram.

**Reference Books :-**

- 1. Fundamental of Applied Mechanics – Dadhe, Jamdar, Walavaikar
- 2. Applied Mechanics – R.S. Khurmi
- 3. Engineering Mechanics – A.R. Basu
- 4. Applied Mechanics Vol-I – R.C. Patel & B.M. Patel

**ME 301 MACHINE DRAWING**

**1. RATIONALE:**

By this time the student has gained basic knowledge of engineering drawing. Hence in this course stress, looking to the professional needs of the technicians, more emphasis has been given on the use of I.S. code of practice and reading and interpretation of manufacturing drawings. The topics on multi-view representation, dimensioning and tolerance and sectional views of machine parts are included to build foundation for production drawing. The topic of pipe drafting will help the students to understand the importance and functions of piping system in Industry. Computer Graphics is a modern concept in Mechanical Drafting and knowledge of the same is required now a days. Detailed assembly drawing, Geometric & dimensional tolerancing are considered essential for the technician's level.

**2. TEACHING AND EXAMINATION SCHEME:**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
ME 301	L	T	P	C	TH	TM	PR /OR	TW	150
Machine Drawing	2	-	4	6	75	25	-	50	

Minimum passing % : Theory 40% and Practical 40%

Duration of Theory Paper: **4 Hrs.**

**3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE:**

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency ***Draw & interpret assembly and detailed drawings of given machine parts/components as per standards.***

**4. DETAILED COURSE CONTENT**

<p>Unit 1 Conventional Representation</p> <p>Conventional representation of different materials, conventional representation for ball bearings, roller bearings, springs, bolts and nuts, screws, studs, spoked wheels. Different types of sections.</p>
<p><b>Unit 2 Free hand sketches of following Machine parts</b></p> <p>Hexagonal headed bolt, washer, nut, Assembled and individual,</p> <p>Keys: sunk key, Feather key, woodruff key,</p> <p>Gib and cotter Joint</p> <p>Muff coupling, flexible coupling,</p> <p>V-belt pulley, flat belt pulley with arms.</p>
<p><b>Unit 3 Assembly drawing</b></p> <p>Knuckle joint, Protected type flange coupling, Foot step bearing, Feed check valve (NRV), Piston and connecting rod of I.C. engine</p>
<p>Unit 4 Detailed Drawings</p> <p>Socket and spigot joint, Universal coupling, Plummer block, Stop Valve</p>

### Unit 5 Pipe fittings and pipe joints

Different pipe fittings like Coupling, cap, Tee, elbows, cross, lateral, reducer, valves, union, plug.

Single line and double line Representation of the pipe fittings.

Pipe joints: Socket joint, socket and spigot joint, union joint, expansion joint.

### Unit 6 Welds and welded joints

Different Types of welded joints : Lap joint, butt joint, Tee joint, corner joint, fillet weld.

Conventional/Sectional representation of fillet, butt, single and double U, V, J and Bevel weld, seam weld, spot weld.

Representation of weld details on drawing: site weld, weld all round, weld on arrow side, on other side, intermittent weld, weld length, weld size, concave finish, flush finish, weld size.

### Unit 7 Elements of production drawing

Geometrical Tolerances: Types, terminology, representation of geometrical tolerances on drawings.

Dimensional Tolerances: Terminology, selection of dimensional tolerances, representation of dimensional tolerances on drawings. Surface Roughness: Terminology, representation of surface roughness on drawings.

**5. SUGGESTED DISTRIBUTION OF MARKS & HOURS**

Unit No.	Unit	Teaching Hours/ Semester	Marks Distribution for End Semester Exam
			Total
1	Conventional Representation	3	9
2	Free hand sketches of following Machine parts	5	9
3	Assembly drawing	6	15
4	Detailed Drawings	6	15
5	Pipe fittings and pipe joints	4	8
6	Welds and welded joints	4	9
7	Elements of production drawing	4	10
	<b>Total</b>	<b>32</b>	<b>75</b>

- Only critical dimensions are to be remembered by students and other dimensions can be used approximately as per proportion.

**6. SUGGESTED LIST OF ACTIVITIES**

Following shall be the list of sheets to be prepared as machine drawing lab work

<b>S.No.</b>	<b>Title</b>
1	One sheet on conventional representation and Free hand sketches (Unit 1 and Unit 2)
2	One sheet on Assembly drawing ( Unit 3)
3	One sheet on Detailed drawings ( Unit 3)
4	One sheet on Pipe fittings , pipe joints and welded joints (Unit 5 and Unit 6)
5	One sheet on production drawing(Unit 7)

**7. SUGGESTED LEARNING RESOURCES**

<b>S.No.</b>	<b>Title</b>	<b>Author and Publisher</b>
1.	Elements of Machine Drawing	N.D.Bhatt. Anand Charotkar
2.	Machine Drawing	R.K.Dhawan, S. Chand
3	Machine Drawing	P. S Gill
4	Machine Drawing	Mali, Chaudhari, Vrinda Publications
5	Machine Drawing	K. R Gopalkrishna, Subhas Publication
6	Machine Drawing	Venugopal



**ME302 – MANUFACTURING PROCESSES-I**

**1. RATIONALE**

As a technician the knowledge and practical skills in different manufacturing processes are essential and hence enough weightage is given in this course towards skills development. Further the technician should be able to handle machine, equipment, tools and accessories in the recommended manner and also follow safety precautions. The contents of this course are oriented towards the above.

**2. TEACHING AND EXAMINATION SCHEME**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
ME 302	L	T	P	C	TH	TM	PR /OR	TW	150
Manufacturing Processes-I	3	-	4	7	75	25	-	50	

Minimum passing % : Theory 40% and Practical 40%

Duration of Theory Paper: 3 Hrs.

**3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE**

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency ***Prepare the job as per given specification by selecting and applying appropriate manufacturing processes following safe working procedures.***

**4. DETAILED COURSE CONTENT**

<b>Unit 1</b>	<b>Foundry</b>
<b><i>Pattern Making</i></b>	
Introduction, Materials used for pattern making, Types of patterns, Pattern allowances, Introduction to cores, core boxes, core materials, Core prints, and core making.	

***Moulding***

Introduction, Moulding tools and equipment, Ingredients of moulding sand, Types of moulding sands, Sand additives, Properties of moulding sand, Types of moulds, Steps involved in making a mould, Moulding processes: Bench molding, floor molding and machine molding

***Gating and Riser System***

Elements of gating system: Functions of the following: pouring basin, sprue, runner, gates, risers.

***Melting Practice***

Construction and working of Cupola furnace.

***Casting Methods***

Introduction to permanent mould casting, Working principle and advantages of Centrifuging, Hot chamber and cold chamber pressure die casting.

***Casting Defects***

Different types of casting defects, their causes and remedies.

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**Unit 2      Welding**

***Introduction***

Principle of welding, Classification of welding processes, Advantages and limitations of Welding.

***Manual Metal Arc Welding***

Principle of operation of arc welding, Arc welding machines and equipment, A.C. and D.C. arc welding, Effect of polarity

***Gas welding and cutting***

Principle of operation of gas welding, Types of gas welding flames and their applications,

Oxy acetylene gas welding equipment: oxy acetylene gas welding torch, Filler rods and Fluxes. Introduction to gas cutting

**Other welding processes**

Working principle and applications of the following welding processes

Resistance welding: spot welding, seam welding, submerged arc welding(SAW), Metal inert gas (MIG) welding, Tungsten Inert Gas welding (TIG)

***Weld Defects - Causes and Remedies***

Various weld defects like under cutting, overlap, improper penetration, improper fusion, slag inclusion, porosity, blow holes, cracks, spatter loss- Causes and Remedies.

**Unit 3 Metal Forming Processes**

***Press working***

Basic working principle of mechanical and hydraulic press.

Sheet metal working: Trimming, punching, notching, blanking, embossing, stamping, and deep drawing.

***Forging***

Open die forging, closed die forging, press forging.

**Unit 4 Metal Cutting**

Introduction to metal cutting : Types of cutting tools, tool geometry, significance of rake angles, Tool signature, Cutting tool materials , Orthogonal and oblique cutting, Types of chips and Cutting fluids, Cutting parameters : Cutting speed, feed and depth of cut and their effect.

**Unit 5 Lathe**

Introduction, Description and function of various parts of a lathe, specification of a lathe, Lathe accessories:- Centers, dogs, chucks, collets, face plate, angle plate, mandrel, steady rest, taper turning attachment, tool post grinder.

**Unit 6 Drilling**

Introduction, classification of drilling machines and their description, nomenclature of a drill, Types of drills, Taps and reamers.

Various operations performed on drilling machine - drilling, spot facing, reaming, and boring, counter boring, countersinking, tapping.

**5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )**

Unit No.	Topic	Teaching Hours	Total Marks
1	Foundry	10	15
2	Welding	10	15
3	Metal Forming Processes	06	10
4	Metal cutting	08	10
5	Lathe	08	15
6	Drilling	06	10
		48	75

**6. SUGGESTED LIST OF EXPERIMENTS**

The experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency – ***Prepare the job as per given specification by selecting and applying appropriate manufacturing processes following safe working procedures. Workshop Instructors should explain various safety measures to be followed by the students during the practical sessions.***

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S. No.	Unit No.	Experiment	Hours
1	1	To prepare a single piece pattern: one job	06
2	1	To prepare a spilt pattern : one job	06
3	1	To prepare a mould cavity using Single piece pattern : one job	06
4	1	To prepare a mould cavity using split pattern : one job	06
5	2	To prepare welding job in flat and horizontal position by arc welding process.  (Selection of welding current, type and diameter of Electrode to be expalined)	12
6	3	To prepare a hexagonal prism from a M.S Round bar and thereafter into a flat chisel.	06
7	3	To prepare a round hook from round M.S. bar	06
8	5	To prepare a job on a lathe machine as per given dimensions involving following operations: facing, plain turning, step turning, taper turning, knurling, drilling, chamfering, grooving, parting etc.	16
<b>Total</b>			64

**7. SUGGESTED LEARNING RESOURCES**

<b>S.No.</b>	<b>Author</b>	<b>Title of Books</b>	<b>Publication &amp; Year</b>
1	S.K.Hajra Chaudhary & A.K. Hajra Chaudhary	Elements of Workshop Technology Vol. I & II	Media Promoters & Publishers Pvt Ltd. Mumbai
2	P. N Rao	Manufacturing Technology ( Foundry, Forming and welding)	Tata McGraw Hill Publishers,New Delhi, Fifth edition 1992
3	O.P Khanna and M. Lal	A Text book of Production Technology Vol. I & II	Dhanpat Rai Publications New Delhi Revised edition 1999
4	R K Jain	Production Technology	Khanna Publishers, New Delhi

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**ME 303 THERMAL ENGINEERING**

**1. RATIONALE**

Mechanical engineering diploma holders have to work with various power producing; power absorbing and heat transfer devices. In order to understand the principles, construction & working of these devices, it is essential to understand the concept of energy, work, heat & conversion between them. Hence it is important to study the course of Thermodynamics. It includes the study of various sources of energy, basic laws & concept of thermodynamics, gas laws, properties of steam & generation. Heat transfer forms the basis for different power engineering application.

Boilers find application in different process industries. Steam turbines and condensers are the major component of any steam power plant. Mechanical engineer should understand working and application of these devices.

**2. TEACHING AND EXAMINATION SCHEME**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
ME 303	L	T	P	C	TH	TM	PR /OR	TW	100
Thermal Engineering	3	1		4	75	25	-	-	

Minimum passing % : Theory 40% and Practical 40%

Duration of Theory Paper: 3 Hrs.

**3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE**

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency – ***Apply concepts and laws of thermodynamics to manage various processes and equipment/instruments used in the area of Thermal Engineering.***

#### 4. DETAILED COURSE CONTENT

<p><i>Unit 1 Basics of Thermodynamics (No Numericals)</i></p> <p>Types of systems, properties of systems, Extensive and Intensive properties, and their units (S.I). Work and Energy- Thermodynamic definition of work, heat, difference between heat and work, definitions of Potential Energy, Kinetic Energy, Internal Energy and concepts of enthalpy and entropy</p>
<p><b>Unit 2 Laws of Thermodynamics</b></p> <p>Laws of Thermodynamics – Zeroth's Law, First Law of Thermodynamics, principle of energy conservation( simple numericals), irreversibility, Second Law of Thermodynamics, Kelvin – Plank &amp; Clausius statements.Applications to heat engine, refrigerator and heat pump(simple numerical)</p>
<p><b>Unit 3 Ideal Gas</b></p> <p>Concept of Ideal gas, Charles law, Boyle's law, Gay-Lussac's law, Avogadro's law, equation of state for Perfect gas,</p> <p>Characteristic gas equation (no derivation), universal gas constant.</p> <p>Ideal gas processes: - Isobaric, Isochoric, Isothermal, Adiabatic, Polytropic with representation of the processes on P-V and T-S diagram (only simple numeric problems)</p>
<p><b>Unit 4 Properties of steam and Vapor Processes</b></p> <p>Enthalpy &amp; Entropy of water and steam, Generation of steam at constant pressure with representation on various charts such as T-H, T-S, H-S,. Properties of steam and use of steam table, Quality of steam, Types of steam Calorimeters ( No Numericals), Enthalpy-entropy chart (Mollier diagram), Vapour cycles, Carnot cycle, Rankine cycle, Calculation of work done and efficiency of Rankine cycle using Mollier Chart.</p>
<p><b>Unit 5 Steam Boilers</b></p> <p>Steam Boilers: - Classification of boilers. Principle &amp; working of Cornish, Cochran, Babcock - Wilcox and Lancashire boilers</p> <p>Construction and working of high pressure Boilers - La Mont, Loeffler and Benson Boiler.. Boiler draughts- natural and mechanical.Boiler mountings &amp; accessories. Introduction to Indian Boiler Regulations (IBR) (for information only)</p>



**Unit 6 Steam Turbines (No Numericals)**

Steam nozzle – Types of nozzles and applications, concept of Mach number, critical Pressure.

Steam turbine - Classification of turbines, Construction and working of Impulse and Reaction turbine.

Compounding of turbines, nozzle control governing, Concepts of Reheating & Regenerative feed heating.

**Unit 7 Steam Condenser (No Numericals)**

Steam condenser - Dalton's law of partial pressure, function and classification of condensers, construction and working of surface condensers.

Sources of air leakage, concept of condenser efficiency, vacuum efficiency.

Cooling Towers- Forced draught, natural draught and induced draught type.

**5. SUGGESED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

Unit No.	Topic	Teaching Hours/ Semester	Theory Marks Distribution for End Semester Exam <i>(Duration – 3 Hours)</i>
6.	Basics of Thermodynamics	04	06
7.	Laws of Thermodynamics	04	09
8.	Ideal Gas	10	15
9.	Properties of steam and Vapour Processes	08	12
10.	Steam Boilers	10	15
11.	Steam Turbine	06	09
12.	Steam Condenser	06	09
	<i>Total</i>	<b>48</b>	<b>75</b>

**Legends:** R = Remembrance; U = Understanding; A = Application and above levels

**6. SUGGESTED LEARNING RESOURCES**

<b>S.No.</b>	<b>Author</b>	<b>Title of Books</b>	<b>Publication &amp; Year</b>
1	Patel and Karamchandani	Elements of heat engines Vol.I and II	
2	Pandya & Shah	Thermal Engineering	Charotar publishing house,Anand
3	R.S. Khurmi	Thermal Engineering	
4	K.R. Gopalkrishnan	Elements of Mechanical Engg.	

**(CS 302) ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING**

**1. RATIONALE:**

A Mechanical Engineering Diploma holder in his job in industry has to interact with many electrical machines and electronics based controls in operation of various machine tools and machine control systems. Therefore a basic knowledge about electrical and electronics engineering relevant to his job requirement of operation and maintenance in industry is mandatory to perform his job efficiently.

**2. TEACHING AND EXAMINATION SCHEME:**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credi t	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
ELEMENTS ELECTRICALAND ELECTRONICS ENGINEERING.	L	T	P	C	TH	TM	TW	PR/OR	125
	3	-	2	5	75	25	25	-	

Minimum passing % :Theory 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

**3. Unit- I–AC Fundamentals**

**(2hrs) (3marks)**

Sinusoidal AC voltage waveform.

Definition of terms related to AC wave-- average value, RMS value.

Definition of power factor and its significance.

### **Unit- II – Distribution of Electrical Energy**

**(9hrs) (15marks)**

Voltage levels in the various stages in the flow of electrical power from 110KV substation to 11KV/440V distribution transformer(using single line diagram only).

Method of laying underground cables for distribution of power.

Voltage levels for commercial and domestic use.

Conduit wiring system- surface and concealed, its advantages and disadvantages.

Definition of Earthing, its necessity .

Types of Earth electrodes—Pipe and Plate electrode.

Methods of reducing earth resistance.

### **Unit- III – Cables , Switching and Protective Devices**

**(8hrs) (15marks)**

Construction of three phase PVC insulated power cables.

Specifications of PVC cables.

Colour codes of single phase and three phase PVC cables.

Functions and symbols of Switch-Fuse Unit, Fuse-switch Unit, Contactors, MCB, MCCB and ELCB.

Fuses- Construction and Applications of Rewirable fuses and HRC fuses.

Construction and operation of a simple electromagnetic relay and limit switches.

### **Unit- IV – Transformers**

**(4hrs) (06marks)**

Principle of operation and basic construction of a single phase transformer (core and winding only).

EMF equation(no derivation and no numericals).

Losses in a transformer, efficiency and voltage regulation(no derivation and nonnumericals).

Significance of KVA Rating of transformer.

### **Unit- V – DC Motors**

**(6hrs) (09 marks)**

Working principle of DC motors, main parts of DC motor and their functions,.

Classification of DC motors (shunt, series and compound and their applications).

Necessity of a starter for DC motors (No study of starters).

Methods of reversal of direction of rotation of DC shunt and series motor.

### **Unit- VI – AC Machines**

**(6hrs) (09marks)**

Principle of operation of three phase induction motor.

Main parts of three phasesquirrel cage & Slip Ring Induction motors.

Applications of induction motors.

Necessity of starter, Names of starters used, reversal of direction of rotation.

Working principle of an alternator.

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### Unit- VII – Basic Electronic Devices

(9hrs) ( 12marks)

Semiconductor theory-Construction of Intrinsic and extrinsic semiconductor, P and N type semiconductors, working principle of Diode, diode V-I characteristics, Full wave centre-tap and bridge rectifiers- circuit diagram,operation and waveforms, capacitor filter to reduce ripple voltage.

Transistor -NPN and PNP, construction , symbol and operation. Transistor CE Amplifier-circuit diagram and operation using waveforms only. Applications of transistors (naming only)

### Unit- VIII – Digital Logic Gates

(5hrs) (06marks)

Binary number system, Symbols and Truth Tables of AND, OR,NOT,NAND,NOR,X-OR,X-NOR Gates

### 4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (THEORY)

Unit No.	Unit	Teaching Hours / Semester	Marks
1	AC Fundamentals	2	03
2	Distribution of Electrical Energy	9	15
3	Cables, Switching and Protective Devices	8	15
4	Transformers	4	06
5	DC Motors	6	09
6	AC Machines	6	09
7	Basic Electronic Devices	8	12
8	Digital Logic Gates	5	06

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### 5. SUGGESTED LIST OF EXPERIMENTS

(Any 8-10)

Sr. No.	LIST OF EXPERIMENTS
1	Identification of various components of a Diesel-Engine Generator set and study its operation.
2	Connection of a single phase Transformer and measurement of Input and Output voltages, currents and power for different loads.
3	Simulation of fuse failure on any one primary phase of a 3-phase transformer and study its effect on the secondary voltages.
3	Connection, Starting, speed control and reversal of direction of rotation of DC shunt motor
4	Connection and Starting of three phase induction motor using manual and automatic star delta starter
5	Connection, starting, running and speed control of Slip Ring induction motor
6	Calculations for selection of PVC cables for different currents.
7	Identification of Fuses ,MCBs and ELCBs and study of operation of MCB and ELCB for different simulated faults.
8	Circuit assembly, measurement of input and output voltages and fault simulation and trouble shooting of Bridge and Centre-tap Rectifiers
9	Circuit assembly for ON/OFF control of single phase loads such as lamps, home appliances, etc. using transistorized circuit and a Relay.
10	Verification of truth tables of Logic Gates

### 6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1	B.L. Thereja.	Text book of Electrical Technology	Latest
2	V.K. Mehta	Principles of Electronics Engineering	Latest

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## ( CS 305) COMPUTER AIDED DRAFTING

### 1. RATIONALE:

The market driven economy demands frequent changes in product design to suit the customer needs. With the introduction of computers the task of incorporating frequent changes as per requirement is becoming simpler. This course has been introduced at Diploma level to develop the skills in student so that they can generate various digital drawing s as required using various CAD software.

### 1. Teaching and Examination Scheme

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CS305  COMPUTER AIDED DRAFTING	L	T	P	C	TH	TM	TW	PR/OR	100
	0	-	4	4	-	-	50	50(P)	

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

### 2. COURSE CONTENTS:

#### Teaching hours

1. Introduction and CAD Preliminaries. 2 hours
  - Computer aided drafting concept.
  - Hardware and various CAD software available.
  - Components of a CAD software window such as Titlebar, Standard toolbar, Menu bar, Object properties toolbar, draw tool bar, Modify toolbar, Cursor cross hair, Command window, status bar, Drawing area, UCS icon.
  - File features: New file, Saving the file, Opening an existing drawing file, Creating Templates, Import and Export of file, Quit.
  - Setting up new drawing : Units, Limits, Grid, Snap.
  - Undoing and Redoing action.

2. Drawing using CAD software: 10 hours
- Drawing basic objects : Point, Line, Circle, Arc, Ellipse, Parabolas, polygon, Rectangle, Multiline, Doughnut, Drawing with precision, Drawing construction lines and rays, Calculating distance and angle, Use of measure, Divide, Inquiry commands, redraws and Regenerating screen display.
  - Methods of specifying points, Absolute coordinates, Relative Cartesian, and Polar coordinates.
  - Using Object snap: Endpoint, midpoint, Intersection, Centre Point, Quadrant point, Nearest Perpendicular, Apparent Intersection, etc.
3. Edit/modify features and viewing drawings. 10 hours
- Object Selection : selection set with its options like Pick box, Window, Crossing, Previous, Last drawing, etc.
  - Editing Commands like : Zoom all, Zoom Previous, Zoom Extents, Zoom window, Zoom real time, Zoom Dynamic, Zoom Pan.
  - Modify commands: Erase, Copy, Mirror, Offset, Array, Move, Scale, Stretch, Lengthen, Trim, Extend, rotate, break, join, chamfer, fillet.
4. Organising Drawing: 6 hours
- Concepts of layers: creating layers, naming layers. making layers ON/OFF, freeze-thaw layers, lock/unlock layers, setting the properties of layers like colour, line type, line weight.
  - Concept of blocks : Creating, inserting, redefining and exploding blocks.
  - Concept of Hatch: Selecting hatch pattern, Hatch styles, Hatch Orientation, associative hatch, Boundary hatch, Hatching Object.
  - Polylines: Drawing polylines, editing polylines, drawing spline curves, editing splines.
5. Dimensioning and Tolerancing 8 hours
- Dimensioning : Types of dimensioning, Linear, Horizontal, Vertical, Aligned, rotated, Baseline, continuous, diameter, radius, angular dimension, Leader.



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- Dimension scale variable, adding geometric tolerances
- Editing dimensions
- Single line text, Multiline text.
- Text styles: selecting font, size, arrows, alignment, etc.

### 6. 3D-features 2 hours

- Right hand rule/local global co-ordinate system.
- Specifying 3D coordinates
- Using UCS
- Defining user coordinate system using UCS command with its options.
- Viewing in 3D

### 7. Isometric Drawing: 10 hours

- Settings for isometric drawing, isometric Snap mode, switching between isometric planes, isocircles, simple isometric drawings.

### 8. Solid Modeling 12 hours

- Concept of solid modeling
- Creating predefined solid primitives such as box, cone, cylinder, sphere, torus, wedge.
- Constructing a region, creating an extruded solid, creating a revolved solid.
- Creating composite solids using union, intersection and interface commands.

### 9. Model space, Paper space, viewports and layouts 2 hours

- Concept of model space and paper space.
- Creating viewports in model space and creating floating viewport in paper space.
- Shifting from model space to paper space and vice versa.

10. Printing/ Plotting drawing.

2 hours

- Standard sizes of sheet.
- Selecting various plotting parameters such as paper size, paper units, drawing orientation, plot scale, plot offset, plot area, print preview.

### 3. PRACTICALS

1. Drafting of common template for all the following assignments with Institute logo and standard title block.
2. Five problems on different geometrical shapes.
3. Dimensioning of above figures.
4. Three problems with polar and rectangular arrays.
5. Three problems on 2D entity generation, which involve the use of layers and blocks.
6. Two problems on orthographic views for various Engineering drawing objects covering dimensioning, text, etc.
7. Two problem on isometric drawing of Engineering drawing object.
8. Create at least two solid models, which cover all the features available in solid modeling.
9. Drafting project:
  - a) Civil Engg. & Architectural Engineering: Plan, elevation and section of a single story residential building.
  - b) Electrical & Electronics Engg.: Electrical layout of components like bulbs, fan, A.C., T.V. point, telephone point, etc. for a single story house.
  - c) Mechanical Engg.: Industrial components such as machines, automobiles , jigs and fixtures with dimensioning, tolerancing ,text, title block, etc.
  - d) Shipbuilding Engg.: Body plan of a ship.
  - e) Mining Engg.: Plan and section of an opencast mine benches, Plan and section of an underground mine.
  - f) F.T.E.E. : Front View and Bottom View of a Simple truss like Saw Tooth truss, King-Post truss, Snow Tooth truss. (Any one of the three)

### 4. LEARNING RESOURCES

1. AutoCAD for Engineering drawing made easy – P. Nageshwar Rao- Tata McGraw Hill.
  2. Mastering AutoCAD – George Omura- BPB Publication.
  3. AutoCAD 2004 – Sham Tickoo- Galgotia Publications, New Delhi.
  4. AutoCAD 2000 – Devid Frey- BPB Publication.
  5. An Introduction to AutoCAD 2000 – A. Yarwood- Longman publication.
  6. Using AutoCAD 2000 – Ron House – Prentice Hall.
  7. Latest AutoCAD Manual – Autodesk Inc. – Autocad Inc.
  8. CATIA V6 Essentials by Jones & Bartlett learning.
  9. Inside Catia by Paul Carman, Paul Tigwell.
  10. CATIA Tutorials by Nader G. Zamani.
  11. ProE/Creoelements or any equivalent reference/text books.
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## Semester - IV

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
AT401	Garage Equipment	3	-	2	5	75	25	-	25	125
AT402	Auto Engines-I	3	-	2	5	75	25	-	25	125
AT403	Auto Chasis-I	3	-	2	5	75	25	-	25	125
ME401	Strength of Materials	3	1	2	6	75	25	-	50	150
ME402	Manuf. Process-II	3	-	4	7	75	25	-	50	150
ME404	Hydraulics Machinery	3	1	2	6	75	25	25	50	175
Total		18	2	14	34	450	150	25	225	850

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## (AT401) GARAGE EQUIPMENT

### 1. RATIONALE

Garage tools and equipment form an important component of any maintenance and repair facility. It is ultimately the judicious selection and proper usage of these tools and equipment, which will decide between a good repair job and a poor one. Thus it is of vital importance that the student of automobile engineering should be familiar with the working principle & functioning of the various tools and equipment necessary to carry out the maintenance and repair of automobiles. This course is so designed and aims at achieving the following objectives: To familiarise a student with the various kinds of tools and equipment required in an auto repair shop. To understand the function and working principle of various tools and equipment.

### 2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
AT401  Garage Equipment	L	T	P	C	TH	TM	PR/OR	TW	125
	3	-	2	5	75	25	-	25	

Minimum passing % : Theory 40% and Practical 40%      Duration of Theory Paper: 3 Hrs.

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency .

### DETAILED COURSE CONTENT

#### Unit 1:

##### HAND TOOLS

Specifications and uses of spanners, pliers, creaper, scrapers, screw drivers, taps, files, dies, drifts, punches, reamers, snips, Allen Keys, torque wrench, hammers, vices, nut splitter, circlip plier, stud remover.

#### Unit 2 :

##### SPECIAL TOOLS

Battery testing equipment, grease guns, Mechanical and hydraulic jacks, trolley jack, pulley block, screw extractor, piston ring expander, valve spring compressor, vehicle props, arbor press, tube repair kit, spark plug tester, spark plug cleaner.

## Unit 3:

### INSPECTION TOOLS

Combination Set, Vernier callipers, pitch gauges, cylinder dial gauge, dial gauges, feeler gauges, method of testing and use of compression gauge, vacuum gauge, bearing noise tester, tyre pressure gauge, outside micrometer: flat micrometer, wire micrometer, inside micrometer, depth gauge micrometer, straight edge, Bevel protractor, Surface plate, V-block, Height gauge, Vernier depth gauge, Trammels, callipers.

## Unit 4:

### RECONDITIONING AND SERVICING EQUIPMENT

Specifications and use of Air Compressor, oil pump blowers, Car washers-water and steam, brake drum turning lathe, cylinder honing machine, cylinder boring machine, cylinder head refacing machine, distilled water plant, valve lapping, crankshaft and cam shaft grinding machine, valve refacing machine, flexible shaft grinder, sanders, polishers, engine stands, tyre changer, battery charger, spray painting equipment, 2 & 4 post hydraulic lifts.

## 4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

Unit No.	Topic	Teaching Hours	Theory Marks Distribution for End Semester Exam			
			R level	U level	A level	Total
1	Hand Tools	08				18
2	Special tools	15				18
3	Inspection Tools	10				18
4	<b>Reconditioning and Servicing Equipment</b>	15				21
	<b>Total</b>	<b>48</b>				<b>75</b>

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### 5. SUGGESTED LIST OF EXPERIMENTS

The experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency.

S. No.	Unit No.	Experiment
1	1	Demonstration and use of Torque wrench.
2	2	Demonstration and use of Outside Piston micrometer.
3	3	Demonstration and use of Inside micrometer.
4	4	Demonstration and use of Trammel.
5	5	Demonstration and use of Hydrometer.
6	6	Demonstration and use of Combination set.
7	7	Demonstration and use of Spark plug Tester.
8	8	Demonstration and use of Flywheel puller.
9	9	Demonstration of Cylinder honing machine.
10	10	Demonstration of Cylinder boring machine.
11	11	Demonstration of Cylinder head refacing machine.
12	12	Demonstration of Crankshaft and camshaft grinding machine.
13	13	Demonstration of Valve refacing machine.

### 6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication & Year
1	James D. Halderman Chase D. Mitchell, Jr.	Automotive Engines, Theory & Servicing	
2	Venk & Spicer	Automotive Maintenance & Trouble shooting	
3	Don Knowles	Automotive Engineering, Suspension & Steering Systems, Shop Manual	
4	Crouse & Anglin	Automotive Mechanics	
5	Jack Erjavec	Automotive Engineering Transmission & Transaxle Shop Manual.	

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6	Clifton Owen	Automotive Engineering, Brake Systems Shop Manual.	
7	Ken Pickwill	Automotive Engineering, Performance Shop Manual.	

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## (AT402) AUTOMOBILE ENGINES – I

### 1. RATIONALE

This course forms an essential requirement for any student intending to pursue a career in the field of Automobiles. Though it is restricted to the aspects of knowledge of automobile engine details, without including the coverage of automobile chassis or drive systems, it does include all the necessary inputs taking into consideration the actual job requirements of a technician in an automobile industry. This course also has a provision for laboratory work, which is so designed so as to develop the desired abilities, skills and attitude in the students.

### 2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
AT402 Automobile Engines – I	L	T	P	C	TH	TM	PR/OR	TW	125
	3	-	2	5	75	25	-	25	

Minimum passing %: Theory 40% and Practical 40%

Duration of Theory Paper: 3 Hrs.

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

The course content should be taught and implemented with the aim to develop the knowledge and understanding of Basic Automotive Engine functionalities and components and different types of skills leading to the achievement of the competency.

#### DETAILED COURSE CONTENT

##### Unit 1:

##### BASICS OF AUTO ENGINES

Classification and nomenclature of Auto Engines, Basic terminology for I.C. engines, Comparison between 2 - stroke & 4- stroke, Comparison between C.I. & S.I. automotive engines.

### Unit 2 :

#### CONSTRUCTIONAL DETAILS OF BASIC ENGINE COMPONENTS

Constructional details and functions of Cylinder block, Cylinder head, Crank case(includes oil pan),cylinder liners, gaskets, piston, piston pin, piston rings, connecting rod, main bearings, crankshaft, Poppet valves, valve seats, valve mechanism, camshafts and different types of camshaft arrangements, timing gears, timing chain, timing pulleys, flywheel, vibration damper, inlet manifold, exhaust manifold, exhaust mufflers.

### Unit 3:

#### AUTOMOTIVE COOLING SYSTEM

Heat developed in an engine, Purpose of cooling system, Air cooling system, Automotive water cooling system(pump cooling),Main components - water jackets, water pump, Radiator fan, drive belts, radiators and other heat exchangers, expansion tank,thermostat,radiator pressure cap,anti-freeze and coolant properties,coolant temperature indicator,coolant level indicator. Cooling system trouble diagnosis.

### Unit 4:

#### AUTOMOTIVE LUBRICATION SYSTEM

Purpose of lubricating system,purpose of lubricating oil,properties of lubricating oil,Lubricating system - a) Mist b) Wet sump c) Dry sump system. Main components of Pressure feed system - oil pump,presure relief valve,oil cooler,oil filter, oil sump, oil pressure indicators,oil level indicators. Lubrication system contamination, other automotive lubricants, lubricating system trouble diagnosis.

### Unit 4:

#### AUTOMOTIVE ENGINE FUELS AND FUEL SYSTEMS

Gasoline as fuel, characteristics of gasoline, Octane rating & requirements. Diesel as fuel, Characteristics of diesel, Cetane rating. Clean combustion fuels - Gasohol,Methanol,LPG and CNG.Introduction & Basic Working principle of electronic fuel injection system, Carburetion - theory & working of a simple carburetor, Introduction and Basic working principle of Diesel fuel feed system.

### Unit 4:

#### COMBUSTION PROCESS AND CHAMBER DESIGN

Combustion process in S.I. engines, Combustion process in C.I. engines. Pre-ignition and detonation (Knock) Combustion chamber design in S.I. and C.I. engines.

**4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS  
(THEORY )**

Unit No.	Topic	Teaching Hours	Theory Marks Distribution for End Semester Exam			
			R level	U level	A level	Total
1	Basics of Auto Engines	04				03
2	Constructional details of basic Engine components	12				18
3	Automotive cooling system	09				18
4	Automotive lubrication system	09				18
5	Automotive engine fuels & fuel systems	09				12
6	Combustion process and chamber design	05				06
	<b>Total</b>	<b>48</b>				<b>75</b>

**5. SUGGESTED LIST OF EXPERIMENTS**

The experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency.

S. No.	Unit No.	Experiment
1.	2	Dismantling, assembling & examination of different engine parts of Petrol Engine.
2.	2	Dismantling, assembling & examination of different parts of Diesel Engine.
3.	4	Determination of Viscosity of Multi-grade Engine oils.
4.	5	Determination of Flash point, pour point & fire point of different Fuels.
5.	3	Maintenance of Water cooling system in Automobiles.
6.	4	Maintenance of Lubrication system in Automobiles.

**6. SUGGESTED LEARNING RESOURCES**

<b>S.No.</b>	<b>Author</b>	<b>Title of Books</b>	<b>Publication &amp; Year</b>
1	William.H.Crouse &Donald.L.Anglin	Automotive Mechanics	
2	S Srinivasan	Automotive Mechanics	
3	Joseph Heitner	Automotive Mechanics	
4	Dr. Kirpal Singh	Automobile Engineering - Vol. 2	
5	B.S. Narang	Auto Engineering	

## (AT403) AUTOMOBILE CHASSIS-I

### 1. RATIONALE

In an automobile repair shop it is required to diagnose the fault and give a solution to the existing problem. This course is introduced with a view towards familiarizing a student with the different parts of chassis so that he is in a reasonable position, after some practical exposure, to carry out the activity of fault finding and repair. This course is designed and aims at the following objectives. To know the layout of a vehicle; To know the different types of clutches and how they function; To know the necessity of gear-box and different types of gear boxes; To know about the propeller shafts, differential and about front and rear axles; To know about the different types of brakes.

### 2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
AT403  Automobile Chassis-I	L	T	P	C	TH	TM	PR/OR	TW	125
	3	-	2	5	75	25	-	25	

Minimum passing % : Theory 40% and Practical 40%

Duration of Theory Paper: 3 Hrs.

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency.

### 4. DETAILED COURSE CONTENT

<p><b>Unit 1</b></p> <p><b>Chassis</b></p> <p>History and developments of Automobiles, Components of a chassis. Type of automobiles with respect to: use, capacity, fuel used, make, wheel &amp; axle, drive, suspension system, body and number of doors, transmission.</p> <p>Classification of chassis w.r.t it's control: - Conventional control chassis, semi forward chassis, Full forward chassis.</p> <p>Classification of chassis w.r.t. fitting of engine: - Engine at front, Engine fitted at the back, Engine fitted at the center of chassis.</p>
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### **Unit 2**

#### **Frame and body**

Functions of frame, Types of frames: - Conventional frame, Integral or unit construction, Half Integral and half frame chassis.

### **Unit 3**

#### **Clutch**

Functions of clutch, Principles of operation of clutch, Types of friction clutches Diaphragm spring type single plate clutch, Multiplate clutch. (Construction and working)  
Clutch play lining, clutch pedal free play.

### **Unit 4**

#### **Gear Box**

Necessity and Functions of Gear Box, Construction and working of different types of gear boxes: - sliding mesh, constant mesh, synchromesh.  
Construction and working of a synchronizing unit, Gear shift mechanism.

### **Unit 5**

#### **Propeller Shaft, Axle, Differential**

Open and covered propeller shafts, Driveline for rear wheel drive: - universal joint, slip joint. Drive line for front wheel drive: Constant Velocity joint.

Live Axles and Dead Axles

Rear Drive Axle: - Full floating, semi floating and Three Quarter floating.

Need of differential, Construction and working of differential, limited slip differential, two wheel and four wheel drive, Transfer case.

### **Unit 6**

#### **Brakes**

Functions of brakes

Construction and working of the following:- Hydraulic brakes, Drum brakes, Disc brakes, Mechanical brakes, Air brakes and Vacuum brakes.

Construction and working of master cylinder and wheel cylinder, bleeding of brakes, Properties of brake fluid.

**5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS  
(THEORY )**

Unit No.	Topic	Teaching Hours	Theory Marks Distribution for End Semester Exam
			Total
1	Chassis	07	09
2	Frame and body	05	06
3	Clutch	09	15
4	Gear Box	09	15
5	Propeller Shaft, Axle Differential	09	15
6	Brakes	09	15
	<b>Total</b>	<b>48</b>	<b>75</b>

**6. SUGGESTED LIST OF EXPERIMENTS**

S. No.	Unit No.	Experiment
1	1	Identify different parts of a chassis.
2	2	Removal and Refitting of clutch from engine
3	3	Dismantling, Inspection and Assembling of single Plate Clutch.
4	4	Dismantling and Assembling of Synchromesh gear box
5	5	Dismantling and Assembling of propeller shaft, Universal joint and slip joint.
6	6	Dismantling and Assembling of differential unit
7	7	Dismantling and Assembling of Master cylinder, wheel cylinder assembly
8	8	Air bleeding of the brake system.

**7. SUGGESTED LEARNING RESOURCES**

S.No.	Author	Title of Books	Publication & Year
1	Crouse & Anglin	Automotive Mechanics	
2	Joseph Heitner	Automotive Mechanics	
3	Dr. Kirpal Singh	Automobile Engineering. Volume 1	

**Other learning resources**

1. Lab Manual on 'Workshop Technology', NITTTR Bhopal, 2006
2. Operating Manuals of various equipment/instruments supplied by manufacturers
3. Video films on machine tools



# Directorate of Technical Education, Goa State

## (ME401) STRENGTH OF MATERIALS

### 1. RATIONALE:

Machine parts are subjected to various types of loads resulting in development of stresses and strains. If, these stresses and strains are allowed to develop beyond the safe limit, the concerned part may fail. As a technician, it becomes very essential to understand the effects of loads on any part. All these factors are focussing the attention of the technicians and engineers for need based designs by studying the effects of loads, stresses and strains in the parts and find necessary solutions. This subject deals with the effect of various forces under static situation & the resulting stresses in different components.

### 2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
ME 401	L	T	P	C	TH	TM	PR/OR	TW	150
Strength of Material	3	1	2	6	75	25	-	50	

Minimum passing % : Theory 40% and Practical 40%  
Theory Paper: 3 Hrs.

Duration of

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE:

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency – ***Apply the laws of Statics to estimate different types of stresses & strains under different loading situations.***

### 4. DETAILED COURSE CONTENT

<b>Unit 1</b>	<b>Simple stress &amp; strain</b>
	<ul style="list-style-type: none"><li>▪ Definition of stress &amp; strain.</li><li>▪ Tensile &amp; compressive stress &amp; Strain, elastic limit, Hooke's law, Young's Modulus, Stress- Strain curve for ductile &amp; brittle material, Significant points on stress-strain curve.</li><li>▪ Thermal stresses in homogeneous sections</li><li>▪ Shear load, shear stress &amp; strain, modulus of Rigidity.</li><li>▪ Lateral strain &amp; Poisson's ratio.</li><li>▪ Volumetric strain, Bulk modulus. Relation between modulus of elasticity, bulk Modulus &amp; modulus of rigidity.</li></ul>

<b>Unit 2</b>	<b>Principal stress &amp; strain</b> <ul style="list-style-type: none"><li>• Different states of stresses,</li><li>• Normal &amp; Tangential stress on oblique planes, resultant stress.</li><li>• Principal stresses &amp; principal planes (no derivation)</li><li>• Analytical method to calculate principal stresses.</li></ul>
<b>Unit 3</b>	<b>Shear Force &amp; Bending Moment</b> <ul style="list-style-type: none"><li>• Types of beams &amp; supports.</li><li>• Concepts of shear force &amp; bending moment, sign conventions. Shear force &amp; bending moment diagram for simple cantilever &amp; simply supported beams subjected to point &amp; uniformly distributed load only.</li></ul>
<b>Unit 4</b>	<b>Moment of Inertia</b> <ul style="list-style-type: none"><li>• Centroid and Center of Gravity</li><li>• Definition of M.I., radius of gyration,</li><li>• Perpendicular &amp; Parallel axis theorem.</li><li>• M.I. of Rectangular, Circular, Semi-circular, Triangular, Hollow rectangular, symmetrical I-section, Channel section, Tee &amp; Angle section.</li></ul>
<b>Unit 5</b>	<b>Theory of Simple Bending &amp; Columns with eccentric loading</b> <ul style="list-style-type: none"><li>• Concept of pure bending;</li><li>• Theory of simple bending, neutral axis</li><li>• Bending stress distribution diagram,</li><li>• Moment of resistance &amp; application of flexural formula for solid rectangular &amp; circular section, I-section, hollow rectangular &amp; circular section.</li><li>• Concept of direct &amp; eccentric loads.</li><li>• Stress distribution in symmetrical columns with eccentric loading about one axis.</li></ul>
<b>Unit 6</b>	<b>Torsion</b> <ul style="list-style-type: none"><li>• Concept of pure torsion, moment of resistance,</li><li>• Torsion equation, assumptions in theory of pure torsion,</li><li>• Strength of circular solid and hollow shaft in pure torsion.</li><li>• Shear stress distribution</li><li>• Polar modulus, Power transmitted by shaft.</li></ul>

**Note : Question paper will not carry questions on derivation.**

**5. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS**

Unit No.	Unit	Teaching Hours / Semester	Theory Marks Distribution for End Semester Exam			
			R level	U level	A level	Total
1	Simple stress & strain	10	4	4	7	15
2	Principle stress & strain	6	3	3	6	8
3	Shear Force & Bending Moment	8	2	2	10	14
4	Moment of Inertia	8	2	2	6	12
5	Theory of Simple Bending	8	2	4	8	14
6	Torsion	8	2	2	6	12
	Total	<b>48</b>				<b>75</b>

**Legends:** R = Remembrance; U = Understanding; A = Application and above levels

**6. SUGGESTED LIST OF EXPERIMENTS**

Sr. No.	Unit No.	Title of Practical
1.	1	Demonstration of working of Universal testing machine (UTM)
2.	1	Tensile test on mild steel, brass and aluminum using UTM.
3.	1	Compression test on wood using UTM
4.	1	Single shear & double shear test on mild steel bars using UTM.
5.	1	Hardness tests on metals. (Brinell, Rockwell test, Vickers)
6.	3	Izod impact test on M.S., Aluminum, Brass
7.	3	Charpy impact test on M.S., Aluminum, Brass
8.	6	Flexural test on mild steel/ wood specimen
9.	7	Torsion test on mild steel specimen

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### 7. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title	,Publisher
1.	R.S. Khurmi	Strength of materials	S. Chand Publisher, New Delhi
2	S. Ramamurutham	Strength of materials	Dhanpat Rai & sons
3	I.B. Prasad	Strength of materials	I.B. Prasad
4	Bhavikatti	Strength of materials	
5	B.C. Punamia	Strength of materials	
6	Sadhu Singh	Strength of materials	
7	Timoshenko & Gere	Mechanics of Materials	CBS Publisher & Distributors, New Delhi
8	B.P. Sharma.	Laboratory Experiments in Strength of materials	
9	Surya Narayan	Testing of Metallic materials by	
8.		Strength of Materials	Schaum Series
9.	F.L.Singer	Strength of Materials	London Harper & row

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## (ME402) MANUFACTURING PROCESSES-II

### 1. RATIONALE

This course provides knowledge and hands on experiences on various operations performed on basic and modern machine tools. In this course emphasis is on making the students conversant with concepts, principles, procedures and practices related to various manufacturing processes, so that they are in a position to undertake the task of preparing jobs using various machines/equipment in the workshop. This experience will help the students to undertake various tasks performed in production industries.

### 2. TEACHING AND EXAMINATION SCHEME

Course Code  &  Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
ME 402	L	T	P	C	TH	TM	PR/OR	TW	150
Manufacturing Processes-II	3	-	4	7	75	25	-	50	

Minimum passing % : Theory 40% and Practical 40%  
Theory Paper: 3 Hrs.

Duration of

### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency ***Prepare the job as per given specification by selecting and applying appropriate manufacturing processes following safe working procedures.***

### 4. DETAILED COURSE CONTENT

<b>Unit 1</b>	<b>Capstan and Turret Lathe</b>
Introduction to Capstan lathe and Turret lathe, Principal parts of capstan and turret lathe, Turret indexing mechanism, Bar feeding mechanism, Work holding devices - Jaw and collet chucks, Tool holding devices - Slide tool holder, Knee tool holder, knurling tool holder, recessing tool holder, form tool holder, tap and die holder, box tool holder, bar stops, Introduction to turret tooling layout, Comparison of capstan, turret and conventional lathe.	

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<b>Unit 2</b>	<b>Milling Machines</b>
Introduction, working principle, types of milling machines like - plain milling m/c. vertical milling m/c. & Universal milling m/c, planer type & fixed bed milling m/c. Milling machine attachments & work holding devices, milling-cutters, milling operations. Universal dividing head-construction & working, Indexing -direct indexing & simple indexing only.	
<b>Unit 3</b>	<b>Grinding and Broaching</b>
Introduction, grinding machine types, center-less grinding, work holding devices and attachments, types of abrasives, bonds and bonding process, Grit, Grade and structure of wheels, wheel shapes and sizes, dressing & truing of grinding wheels, marking system of wheels, Nomenclature and selection of grinding wheels, mounting of grinding wheels, balancing of wheels.	
Super finishing operations- Lapping, Honing, polishing.	
Broaching machines-Introduction & Types. Types of broaches, Broach structure, broaching methods, advantages and limitations.	
<b>Unit 4</b>	<b>Planer, Shaper and Slotter</b>
Introduction to planer, shaper and slotter, types of planers, principal parts of double housing planer, planer operations, Work holding devices on Planer. Types of shaper, Principal parts of a standard shaper, Shaper drive mechanism, Shaper feed mechanism, Work holding devices on shaper, Shaper operations, Types of slotting mechanism, Slotter parts, Slotter drive mechanism, Slotter operations, work holding devices on Slotter. Cutting tools for planer, shaper and slotter.	
<b>Unit 5</b>	<b>Non conventional Machining Processes</b>
Introduction and working principle of Ultrasonic Machining (USM), Electro Chemical machining (ECM), Electro Discharge Machining (EDM), Electron Beam Machining (EBM) Laser Beam machining (LBM)	

### 5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

Unit No.	Topic	Teaching Hours	Theory Marks Distribution for End Semester Exam			
			R level	U level	A level	Total
1	Capstan and Turret Lathe	10	5	10	5	20
2	Milling Machines	10	5	10	5	20
3	Grinding and Broaching	12	5	10	5	15

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Unit No.	Topic	Teaching Hours	Theory Marks Distribution for End Semester Exam			
			R level	U level	A level	Total
4	Planer, Shaper and Slotter	10	5	10	5	10
5	Non conventional Machining Processes	06	3	7	-	10
	<b>Total</b>	<b>48</b>				<b>75</b>

### 6. SUGGESTED LIST OF EXPERIMENTS

S. No.	Unit No.	Experiment
1	1.	Observe the operations performed on Turret/ Capstan Lathe in a near by workshop/industry and prepare a report for the same.
2	2.	Produce a rectangular block as per given drawing by face milling and prepare a slot on one face.
3	2.	Produce a gear by indexing device on a milling machine
4	3	Grind lathe tool, drill bit and milling cutter
5	3	Preparing job on following machines:- a) Surface grinder b) Cylindrical grinder
6	4	Prepare a V-block on shaper machine.
7	5	Survey a near by market and prepare a report on cutting fluids and lubricant available in the market for various machine tools
8	6	Compile information from internet related to non conventional machine tools
9		Demonstrate a video film showing non conventional machining processes

### 7. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication & Year
1	S.K.Hajara & A.K. Hajra Chaudhary	Elements of Workshop Technology Vol-1& II	Media Promoters and publishers Ltd.
2	W.A.J. Chapman	Workshop Technology, Vol. I & II	Standard publishers Distributors
3	Raghuwanshi	Workshop Technology, Vol.	Latest
4	Kaushik & Gupta	Workshop Technology, Vol. I & II	Latest
5	M. Adithan and A B. Gupta	Manufacturing technology	New Age International (P) Ltd, New Delhi
6	HMT	Production technology	Tata McGraw Publishers; New Delhi
7	Juneja and Sekhon; Wiley	Fundamentals of metal cutting and machine tools	Eastern Ltd., New Delhi

### Other learning resources

- 1.Lab Manual on 'Workshop Technology', NITTTR Bhopal, 2006
- 2.Operating Manuals of various equipment/instruments supplied by manufacturers
3. Video films on machine tools

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**(ME404) HYDRAULIC MACHINERY**

**1. RATIONALE**

Hydraulic machinery plays an important role in the conversion of hydraulic energy to mechanical energy and vice-versa. Hydraulic turbines are used for meeting our day-to-day power demands. Also different types of pumps are essential equipment in all the industries. Hydraulic systems have a wide range of applications in machine tools, material handling, marine, mining, metal processing, equipment and other fields. Similarly pneumatic control is extensively used as an effective method of automation technique.

**2. TEACHING AND EXAMINATION SCHEME**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
ME 404  Hydraulic Machinery	L	T	P	C	TH	TM	PR/OR	TW	175
	3	1	2	6	75	25	25	50	

Minimum passing % : Theory 40% and Practical 40%  
Theory Paper: 3 Hrs.

Duration of

**3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE**

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency – ***Select, operate and maintain fluid machinery based on fluid characteristics.***

**4. DETAILED COURSE CONTENT**

**Unit 1 Introduction**

Definition and classification of fluids, Branches of hydraulic -Hydrostatics & Hydrodynamics, Fluid properties - Density, Specific gravity, specific weight, viscosity, surface tension, capillarity, compressibility.

## Unit 2 Pressure Measurements

SI Units of Pressure, Pressure head, Atmospheric pressure, Positive and Negative Gauge pressure, Absolute pressure, Pascal's Law.

Pressure measuring devices-manometers-principle & working of piezometer tube, simple 'U' tube, differential 'U' tube and inverted 'U' tube manometers, Bourdon pressure gauge-its working principle & constructions, Calibration of pressure gauges.

## Unit 3 Hydrostatics

Pressure on plane surfaces immersed in liquid – horizontally, vertically & inclined to free surface, calculation of total pressure and determination of centre of pressure for circular, triangular & rectangular surfaces immersed in one type liquid.

## Unit 4 Hydrodynamics

Types of flow - steady; unsteady, - uniform, non-uniform, laminar and turbulent flow, compressible, incompressible flow, Continuity equation. Energies of liquid - pressure head, Datum head, velocity head, Total energy of liquid, Bernoulli's theorem — Pitot tube, Venturi-meter. Definition of an orifice, types, Vena contracta, Hydraulic coefficients  $C_c$ ,  $C_v$  and  $C_d$ , discharge through an orifice (circular & open discharge). -- No Derivation.

## Unit 5 Flow through Pipes

Laws of fluid friction, Reynold's number and its significance, Various losses in pipe flow- major and minor losses- loss of head due to entrance, sudden enlargement, sudden contraction, Hydraulic gradient line and total energy line, Flow through pipes in series and parallel.

## Unit 6 Water – Turbines

Classification of water-turbines, Impulse turbines - Pelton wheel, Construction and working of pelton wheel, Definition of heads,

**Reaction Turbines-** Francis Turbine construction and working, Advantages and Disadvantages of Francis Turbine over a pelton wheel. Propeller and Kaplan turbines – Construction and working, Specific speed of turbines (definition). Performance characteristics of Hydraulic turbines, Main or constant head characteristics curves, Operating or constant speed characteristic curves. Methods of Governing of hydraulic turbines, Cavitation : causes and effects, Water hammer - causes, effect and remedial measures.

( Note- No numerical in this Unit)

## Unit 7 Centrifugal Pumps

Introduction, classification, construction & working of a centrifugal pumps, Types of casings, Types of impellers, manometric head of pump, losses and efficiencies of a centrifugal pump, minimum starting speed. Multistage centrifugal pumps, pumps in series, pumps in parallel, specific speed, characteristics of centrifugal pumps, priming of a centrifugal pump, specifications & selection of pumps, NPSH, pump operating procedure, maintenance- faults & remedies of centrifugal pumps.

(Simple problems to calculate Power, Head, Discharge & Efficiency, without Use of Velocity triangle)

**Unit 8 Reciprocating pumps**

Introduction, classification of reciprocating pumps, main components and working of a reciprocating pump, discharge, Single acting reciprocating pump, Double acting reciprocating pump, Air vessels, functions of air vessels, Application as Vacuum pump.

(Simple problems to calculate Power, Head, Discharge & Efficiency, without Use of Velocity triangle)

**Unit 9 Miscellaneous Pumps, Intensifier and Accumulators**

Construction, working and application of rotary vane pump, screw pump, Gear pumps.

Construction, working and application of hydraulic intensifier and Accumulators.

( Note- No numerical in this unit)

**5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS  
(THEORY)**

Unit No.	Topic	Teaching Hours/ Semester	Theory Marks Distribution for End Semester Exam			
			R level	U level	A level	Total
1.	Introduction	02	2	2	-	4
2.	Pressure Measurements	06				8
3.	Hydrostatics	06	8	10	6	8
4.	Hydrodynamics	06	6	6	4	8
5.	Flow through Pipes	06	2	4	6	10
6.	Water – Turbines	07	4	8	6	12
7.	Centrifugal Pumps	07				12
13.	Reciprocating pumps	04				07
14.	Miscellaneous Pumps, Intensifier and Accumulators	04				06
	Total	48	30	38	32	75

**Legends:** R = Remembrance; U = Understanding; A = Application and above levels

### 6. SUGGESTED LIST OF EXPERIMENTS

The experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency - ***Select, operate and maintain fluid machinery based on fluid characteristics.***

S. No.	Unit No.	Experiment
1	2	Measurement of pressure of water in a pipe by manometer
2	4	Verification of Bernoulli's theorem
3	4	Flow measurement using Venturimeter and orifice plate
4	5	To determine the relationship between loss of head and velocity for pipe flow
5	6	Performance trial on Pelton wheel
6	6	Performance trial on Francis turbine
7	7	To plot performance characteristics of centrifugal pump
8	7	Assembly dismantling and troubleshooting of centrifugal pump
9	8	Assembly dismantling and troubleshooting of reciprocating pump

### 7. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication & Year
1	Khurmi R.S.	A Text book of Hydraulics, Fluid Mechanics and Hydraulic Machines.	
2	Bansal	Fluid Mechanics	
3	Rajput	Hydraulic Machines	
4	Modi P.N./ Seth S.M.	Hydraulic and Fluid Mechanics	
5	Jagdish Lal	Hydraulic and Fluid Machines	

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### Semester - V

Semester - I						
Course code	Name of Course	EXAMINATION SCHEME				Total
		TW		PR/OR		
		Daily Dairy	Progressive Assessment	Training Report	Report Assessment & Seminar/Viva	
AT501	Auto Training Phase I	50	50	50	50	Grade

### Semester - VI

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/ OR	TW	
AT601	Automobile Electrical & Elx.	3	-	2	5	75	25	25	25	150
AT602	Auto Engines II	3	-	2	5	75	25	25	25	150
AT603	Auto Chassis II	3	-	2	5	75	25	25	25	150
AT604	Modern Automotive Systems	3	-	-	3	75	25	25	25	150
AT605	Organisational Behaviour	2	-	2	4	75	25	-	25	125
AT606	Auto Workshop Practice	-	-	6	6		-	50	50	100
Total		14		14	28	375	125	150	175	825

FOR INDUSTRIAL TRAINING OF V<sup>TH</sup> & VIII<sup>TH</sup> SEMESTER :

- Grades will be awarded based on marks scored as follows:
  - 80% and above Marks – Grade ‘A’
  - 60% to 79% Marks – Grade ‘B’
  - 40% to 59% Marks – Grade ‘C’
  - Marks below 40% - Grade ‘D’
- TW and PR/OR shall be separate Heads of passing. Student has to secure minimum Grade ‘C’ for passing.
- Student with Grade D, under the Head TW, shall be declared T.N.G. and a student whose term is granted but obtains Grade D, under the Head PR/OR, shall be declared Failed/ATKT.

## **SEMESTER V**

### **(AT501) AUTO TRAINING -I**

**Rationale:** During the course of Industrial training a student will get an opportunity to familiarize himself with the industrial environment & work culture & also understand & appreciate the organizational structure and set up besides getting an understanding of the management systems & roles of different departments. It would also enable him to identify the various tools, machines, equipment & instruments used in the auto industry and also identify the different components of an automobile. This phase of training would also enable him to assimilate more effectively the theory taught to him on his return to the Institute for the subsequent terms.

Course code	Name of Course	EXAMINATION SCHEME				Total
		TW		PR/OR		
		Daily Dairy	Progressive Assessment	Training Report	Report Assessment & Seminar/Viva	
AT501	Automobile Training -I	50	50	50	50	Grade

### **Course Content:**

Students are required to perform and/or familiarize themselves with at least 6 of the following jobs/ assignments/tasks during the training period:

- Periodic Maintenance Servicing of a vehicle
- Dismantling & Assembling of an Engine
- Dismantling & Assembling of a gear Box/Transmission
- Dismantling & Assembling of a Clutch Assembly
- Dismantling & Assembling of a Driveline & Differential
- Dismantling & Assembling of a Suspension System
- Engine Tune-up
- Maintenance & Repair of a Braking System
- Maintenance & Repair of a Steering System
- Maintenance & Repair of a Engine Cooling System
- Maintenance & Repair of the Electrical/Electronic Systems

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Maintenance & Repair of the Hydraulic/Pneumatic Systems

Body Engineering aspects of Denting / Sheet metal work

Body Engineering aspects of Painting

Body Engineering aspects of Corrosion Protection

Body Engineering aspects of Chassis lubrication.

### **Term Work:**

Every student undergoing Inplant Training is required to maintain a '**Daily Diary**' in the prescribed booklet supplied to them, giving a brief account of the various activities performed during the day for the entire period of the training. The entries should be authenticated /validated on a regular basis by the supervising authority at the place of work.

In addition the student is expected to write a detailed '**Training Report**', in a hard bound booklet, which should include diagrams, pictures, graphs etc, of the major activities undertaken during the training, which will be evaluated at the end of the term.

The evaluation system will also include 3 '**Assessments**' during the training period. There will be two assessments done at the institute wherein a student will be required to give a presentation of the jobs undertaken by him during his training. Besides these there will also be an assessment done at the industry in consultation with industry personnel.

Assessment of Training Report be based on Knowledge, Presentation, Quality of contents and Sketches.

## **VI SEMESTER**

### **(AT601) AUTOMOBILE ELECTRICAL AND ELECTRONICS**

**1. RATIONALE:** Every automobile possesses various kinds of electrical/electronic equipment required for the functioning of the vehicle and sometimes simply as supporting systems to the main vehicle system. This course provides valuable insight into these areas while equipping a student with the necessary fundamentals to tackle problems arising out of malfunctioning of any of these systems.

### **2. TEACHING AND EXAMINATION SCHEME**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credi ts	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
AT601  Automobile Electrical And Electronics	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	2	5	75	25	25	25	

*Minimum passing %: theory 40%,*

*Duration of the theory papers: 3 hours*

*L: Lectures, T: tutorials, P: Practical, C: Credit, TH: end semester theory, TM: Test Marks, TW: term work, PR/OR: End Semester Practical/Oral Exam,*



### 3. DETAILED COURSE CONTENT

Unit	Topics and Sub-topics
<b>Unit – I</b>  <b>AUTOMOTIVE BATTERIES</b>	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types of Cells.</li> <li>• Lead Acid battery its construction and operation, main components, chemical action, connecting cells.</li> <li>• Battery Sizes, Rating, Charging.</li> <li>• Battery Testing and Failures.</li> <li>• Battery maintenance, service and safety measures.</li> <li>• Indication of fully charged battery.</li> <li>• Maintenance-Free batteries.</li> <li>• Jumpstarting and safety steps.</li> </ul>
<b>Unit-II</b> <b>WIRING AND ELECTRICAL ACCESSORIES</b>	<ul style="list-style-type: none"> <li>• Role of electricity in modern vehicles and energy demand.</li> <li>• Automotive Lighting: Purpose and construction of each lamp.                             <ul style="list-style-type: none"> <li>▪ Head lamps: Beam setting and adjustments</li> <li>▪ Halogen lamps (components)</li> <li>▪ Fog lamp, Park lamp, Door Lamp, Roof Lamp.</li> <li>▪ Headlight reflectors: parabolic and bi-focal</li> <li>▪ Sealed beam.</li> <li>▪ Signaling lamps: Turn lights, hazard lights, brake lights, reversing lights.</li> <li>▪ Headlight dazzle &amp; preventive measures.</li> </ul> </li> <li>• Automotive Wiring:                             <ul style="list-style-type: none"> <li>▪ Electric cables</li> <li>▪ Cable color codes</li> <li>▪ Wiring harness</li> <li>▪ Types of cables (Advantages and Disadvantages).</li> <li>▪ Symbols used in electrical wiring.</li> <li>▪ Insulated &amp; Earth return systems</li> <li>▪ Positive &amp; negative earth systems.</li> <li>▪ Protective devices - Fuses, circuit breakers.</li> </ul> </li> <li>• Accessories:                             <ul style="list-style-type: none"> <li>▪ Ignition warning light</li> <li>▪ Horn relay</li> <li>▪ Oil pressure indicator light</li> <li>▪ Fuel gauge</li> <li>▪ Window glass panel operating system.</li> </ul> </li> </ul>

<b>Unit - III CHARGING SYSTEM</b>	<ul style="list-style-type: none"> <li>• Introduction.</li> <li>• Purpose of charging system.</li> <li>• Alternator:                             <ul style="list-style-type: none"> <li>▪ Component</li> <li>▪ Principle of operation</li> <li>▪ Rectification from AC to DC</li> <li>▪ Regulators: Electronic voltage regulator and its advantages.</li> <li>▪ Maintenance, trouble shooting and its remedies.</li> </ul> </li> </ul>
<b>Unit - IV STARTING SYSTEM</b>	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Engine starting requirement</li> <li>• Basic motor principle</li> <li>• Starting motor:                             <ul style="list-style-type: none"> <li>▪ Construction and Operation</li> <li>▪ Starter motor drive</li> <li>▪ Positive engagement starters: Over-running clutch</li> <li>▪ Solenoid shift starter</li> <li>▪ Gear reduction starters</li> </ul> </li> </ul>
<b>Unit - V IGNITION SYSTEM</b>	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Requirements</li> <li>• Conventional ignition system:                             <ul style="list-style-type: none"> <li>▪ Working</li> <li>▪ Components: - Ignition coils, distributor, contact breaker, dwell angle, ballast resistor, capacitor.</li> </ul> </li> <li>• CDI system</li> <li>• Distributer-less ignition system</li> <li>• Electronic ignition system with contactless trigger.</li> <li>• Electronic dwell</li> <li>• Spark-plug its heat range, hot and cold plug</li> <li>• Electronic Spark advance.</li> </ul>

**4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )**

Unit No.	Topic	Teaching Hours/ Semester	Marks
1	Automotive Batteries	10	18
2	Wiring and Electrical Accessories	10	15
3	Charging System	08	12
4	Starting System	10	15
5	Ignition System	10	15
	<i>Total</i>	48	75

**5. SUGGESTED LIST OF EXPERIMENTS**

S. No.	Experiment
1	Study of various components Lead Acid Battery.
2	Study of various components of different types of Ignition system.
3	Study of Voltage Regulator.
4	Study of various components of a Dynamo.
5	Study of various components of an Alternator.
6	Study of various components of a Starter Motor.

**6. SUGGESTED LEARNING RESOURCES**

<b>S.No</b>	<b>Title of Book</b>	<b>Author</b>	<b>Publication</b>
1	Automotive Technology (Electricity and Electronics)	Al Santini	Cengage Learning
2			
3	Automotive Mechanics	W. Crouse & D. Anglin	McGraw Hill
4	Auto Electrical Systems	A.W Judge	

**(AT602) AUTO ENGINES-II**

**1. RATIONALE:** This subject deals with the aspects of injection systems in both Petrol as well as Diesel Engines, while also covering up topics like supercharging, emission control and HVAC systems which are important features of the modern day automobile. It also provides a student with a brief insight into the diagnostics of the engine.

**2. TEACHING AND EXAMINATION SCHEME**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
AT602 AUTO ENGINES-II	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	2	5	75	25	25	25	

*Minimum passing %: theory 40%,*

*Duration of the theory papers: 3 hours*

*L: Lectures, T: tutorials, P: Practical, C: Credit, TH: end semester theory, TM: Test Marks, TW: term work, PR/OR: End Semester Practical/Oral Exam,*

### 3. DETAILED COURSE CONTENT

Unit	Topics and Sub-topics
<b>Unit – I</b>  <b>SUPERCHARGERS</b> <b>AND</b> <b>TURBOCHARGERS</b>	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Objectives</li> <li>• Supercharging of SI and CI engines, its effects on performance</li> <li>• Supercharging Limits,</li> <li>• Reducing Supercharger drag</li> <li>• Types of Superchargers:                         <ul style="list-style-type: none"> <li>▪ Root type</li> <li>▪ Spiral or (Scroll) type,</li> <li>▪ Centrifugal type.</li> </ul> </li> <li>• Turbocharger construction and operation</li> <li>• Electronically controlled Wastegate.</li> <li>• Turbocharger Lag</li> <li>• Turbocharger trouble diagnosis and service.</li> </ul>
<b>Unit-II</b>  <b>EMISSION</b> <b>CONTROL</b> <b>SYSTEMS.</b>	<ul style="list-style-type: none"> <li>• Types of Pollutants &amp; their causes.</li> <li>• Emission Control Systems/Devices.                         <ul style="list-style-type: none"> <li>▪ Evaporative Emission Control System.</li> <li>▪ Pre-combustion Systems.                                 <ul style="list-style-type: none"> <li>➤ Engine Design Changes.</li> <li>➤ PCV System.</li> <li>➤ Spark Control Systems.</li> <li>➤ EGR systems.</li> </ul> </li> <li>▪ Post Combustion Systems.                                 <ul style="list-style-type: none"> <li>➤ Catalytic Converters (Three way and Two way)</li> <li>➤ Air Injection Systems.</li> </ul> </li> </ul> </li> <li>• Exhaust Gas Analysis.                         <ul style="list-style-type: none"> <li>▪ Theory of Gas Analysis.</li> <li>▪ Exhaust Gas Analysis.                                 <ul style="list-style-type: none"> <li>➤ Concentration Sampling.</li> <li>➤ Constant Volume Sampling.</li> </ul> </li> </ul> </li> </ul>

<p><b>Unit - III</b> <b>PETROL &amp; DIESEL</b> <b>ELECTRONIC</b> <b>INJECTION</b> <b>SYSTEM</b></p>	<ul style="list-style-type: none"> <li>• Petrol EFI systems:- <ul style="list-style-type: none"> <li>• Petrol EFI System functions, Operating Principles, Air-Fuel ratio metering &amp; requirement, Stoichiometric A/F ratio</li> <li>• Types of Petrol EFI systems:- TBI &amp; MPFI.</li> <li>• Main components of the Petrol EFI system <ul style="list-style-type: none"> <li>(a) Air Induction system components &amp; it's function :- <ul style="list-style-type: none"> <li>• Air Filters.</li> <li>• Throttle body assembly.</li> <li>• Air box &amp; Intake Manifold.</li> </ul> </li> <li>(b) Fuel Injection system &amp; it's function :- <ul style="list-style-type: none"> <li>▪ Fuel Tank &amp; Electric Fuel Pumps.</li> <li>▪ Fuel Pressure Regulator &amp; Fuel Lines.</li> <li>▪ Fuel Filters.</li> <li>▪ Fuel Accumulator.</li> <li>• Fuel Injector Design &amp; operation.</li> </ul> </li> <li>(c) Electronic control system &amp; it's function:- <ul style="list-style-type: none"> <li>• Functions &amp; Composition of the Engine control Unit.</li> <li>• Closed loop &amp; open loop operations.</li> <li>• Sensing Devices &amp; it's applications in EFI:- <ul style="list-style-type: none"> <li>➤ O<sub>2</sub> sensors.</li> <li>➤ Thermistors.</li> <li>➤ Potentiometers.</li> <li>➤ Pressure sensors.</li> <li>➤ Mass Air Flow sensors.</li> <li>➤ Magnetic sensors.</li> <li>➤ Hall Effect Switches.</li> <li>➤ Optical Sensors.</li> <li>➤ Detonation sensors.</li> <li>➤ Switches.</li> <li>➤ E-cells.</li> </ul> </li> <li>• Actuating devices &amp; it's applications in EFI:- <ul style="list-style-type: none"> <li>➤ Solenoids.</li> <li>➤ Relays.</li> <li>➤ Electric Motors.</li> </ul> </li> </ul> </li> </ul> </li> </ul> </li> <li>• Diesel EFI systems:- <ul style="list-style-type: none"> <li>• Diesel EFI systems functions, Operating Principles.</li> <li>• Types of Diesel EFI systems:- EUI &amp; CRDI</li> <li>• CRDI:-</li> <li>• Advantages of a CRDI system over conventional systems.</li> </ul> </li> <li>• Common Rail Fuel Injection sub-systems: -</li> </ul>
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	<ul style="list-style-type: none"><li>➤ Low pressure ,High pressure delivery and fuel leak back circuit</li><li>➤ Electronic control and closed loop functions.</li><li>• Common Rail Fuel Injection main components and their function:-<ul style="list-style-type: none"><li>➤ Fuel tank and Transfer pump.</li><li>➤ Fuel Filters.</li><li>➤ High pressure fuel pump.</li><li>➤ Fuel metering control valve.</li><li>➤ Fuel rail pressure control valve.</li><li>➤ Fuel rail pressure sensor.</li><li>➤ Common rail.</li><li>➤ Fuel Injectors.</li><li>➤ ECM</li><li>➤ Other Sensors &amp; Actuators.</li></ul></li></ul>
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<b>Unit - IV HEATING, VENTILATION, AIR CONDITIONING.</b>	<ul style="list-style-type: none"> <li>• Purpose of the HVAC system.</li> <li>• Air conditioning components(Function, Construction and Operation)                             <ul style="list-style-type: none"> <li>▪ Compressor (Piston type, Vane type, Swash plate type)</li> <li>▪ Condenser.</li> <li>▪ Evaporator.</li> <li>▪ Orifice tube.</li> <li>▪ Thermostatic Expansion Valve.</li> <li>▪ Receiver-dryer.</li> <li>▪ Accumulator.</li> </ul> </li> <li>• Servicing of AC systems.                             <ul style="list-style-type: none"> <li>▪ Refrigerant Identification.</li> <li>▪ Vacuum Pump.</li> <li>▪ Evacuating Procedure.</li> <li>▪ Refrigerant Charging.</li> <li>▪ Refrigerant Recovery.                                     <ul style="list-style-type: none"> <li>➤ Refrigerant Management Centers.</li> </ul> </li> </ul> </li> </ul>
<b>Unit - V DIAGNOSTICS</b>	<ul style="list-style-type: none"> <li>• Types of Faults.</li> <li>• Diagnostic Trouble Codes.                             <ul style="list-style-type: none"> <li>▪ Memory DTCs.</li> <li>▪ On-Demand DTCs.</li> </ul> </li> <li>• Data Streams.</li> <li>• Functional Tests.</li> <li>• Technical Service Bulletins.</li> <li>• Pinpoint testing.                             <ul style="list-style-type: none"> <li>▪ Method.</li> <li>▪ Testing of a sensor.</li> <li>▪ Testing of a load component.</li> <li>▪ Testing of PCM.</li> </ul> </li> <li>• Purpose, Function, Advantages &amp; Limitation of the following diagnostic Equipment.                             <ul style="list-style-type: none"> <li>▪ Scan tools.</li> <li>▪ Breakout Boxes.</li> <li>▪ Non-Powered Test Lights.</li> <li>▪ Logic Probes.</li> <li>▪ Digital Volt –Ohmmeters.</li> <li>▪ Digital Storage Oscilloscopes.</li> </ul> </li> </ul>

#### 4. SUGGESD SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

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Unit No.	Topic	Teaching Hours/ Semester	Marks
1	Superchargers And Turbochargers	6	12
2	Emission Control Systems.	8	15
3	Petrol & Diesel electronic Injection System	12	18
4	Heating, Ventilation, Air Conditioning.	10	12
5	Diagnostics	12	18
	<i>Total</i>	48	75

### 5. SUGGESTED LIST OF EXPERIMENTS

S. No.	Experiment
1	Study of various components of Turbocharger.
2	Study of injection system for SI system.
3	Study of injection system for CI system.
4	Study of various emission control systems.
5	Study of various components of automotive HVAC system.

### 6. SUGGESTED LEARNING RESOURCES

S.No	Title of Book	Author	Publication
1	Automotive Mechanics	W. Crouse & D. Anglin	McGraw Hill
2	Automotive Engineering (Engine Performance)	Ken Pickerill	CENGAGE Learning

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3	Automotive Mechanics	Joseph Heitner	
4			

### (AT603) AUTOMOBILE CHASSIS - II

**1. RATIONALE:-** Every Automobile Engineer is expected to possess knowledge about the constructional details and various chassis systems of a vehicle. This would help one to understand the functioning of a vehicle better and also to carry out maintenance and repair of the vehicle.

#### 2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
AT603 AUTOMOBILE CHASSIS - II	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	2	5	75	25	25	25	

*Minimum passing %: theory 40%,*

*Duration of the theory papers: 3 hours*

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*L: Lectures, T: tutorials, P: Practical, C: Credit, TH: end semester theory, TM: Test Marks, TW: term work, PR/OR: End Semester Practical/Oral Exam,*

## 3. DETAILED COURSE CONTENT

Unit	Topics and Sub-topics
<b>Unit-1</b> Automotive Body Engineering & Aerodynamics:-	<ul style="list-style-type: none"> <li>• Introduction to Body Engineering &amp; Aerodynamics.</li> <li>• Monocoque and Space frame construction.</li> <li>• Vehicle major body sections.</li> <li>• Assembly &amp; nomenclature of various structural body parts.</li> <li>• Vehicle body protection &amp; rust prevention techniques.</li> <li>• Industrial automotive painting process.</li> <li>• Introduction to Aerodynamics.</li> <li>• Aerodynamic drag and drag coefficient.</li> <li>• Aerodynamic lift.</li> <li>• Down force and grounding effect in cars.</li> <li>• Diffusers, Vortex generators and Spoilers.</li> <li>• Wind tunnel testing.</li> </ul>
<b>Unit-2</b> Steering Systems:-	<ul style="list-style-type: none"> <li>• Purpose &amp; necessity of steering systems.</li> <li>• Types of steering gears: - Recirculating ball type, Rack &amp; pinion type (construction, working &amp; main components).</li> <li>• Power steering systems: - Hydraulic power steering &amp; Electronic power steering (construction, working &amp; main components).</li> <li>• Front wheel geometry &amp; wheel alignment parameters.</li> <li>• Basics of Wheel alignment and Wheel balancing.</li> <li>• Diagnosis &amp; troubleshooting of steering systems.</li> </ul>
<b>Unit 3</b> Suspension Systems:-	<ul style="list-style-type: none"> <li>• Purpose &amp; necessity of suspension systems.</li> <li>• Types of springs: - Coil, Leaf, Torsion, Air spring.</li> <li>• Types of Shock absorber: - Twin-tube shock, Mono-tube, Spring-Assisted, Adjustable, Air shock absorber.</li> <li>• Front &amp; Rear Suspension systems:-</li> <li>• a). <u>Coil spring suspension</u> :- Double wishbone(SLA),Twin I-Beam axle.</li> <li>• b). <u>MacPherson Strut suspension</u></li> <li>• c). <u>Leaf spring suspension</u></li> <li>• d). <u>Torsion bar suspension</u></li> <li>• e). <u>Trailing arm suspension</u></li> <li>• f). <u>Air suspension systems.</u></li> <li>• Diagnosis &amp; troubleshooting of Suspension systems.</li> </ul>

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<b>Unit 4</b> Automatic transmissions:-	<ul style="list-style-type: none"> <li>• Introduction to Automatic gearboxes,</li> <li>• Manual v/s Automatic gearboxes,</li> <li>• Epicyclic Gear Trains – Construction, Operation &amp; Applications.</li> <li>• Automatic Gearbox types:-</li> <li>• a). Hydraulic Automatic transmissions – Introduction, Working principle, Construction &amp; Operation.</li> <li>• b). Dual clutch transmissions – Introduction, Working principle, Construction &amp; Operation.</li> <li>• c). Semi Automatic (Paddle-shift) Transmissions - Introduction, Working principle, Construction &amp; Operation.</li> <li>• d). Continuously variable transmissions – Introduction, Working principle, Construction &amp; Operation.</li> </ul>
<b>Unit-5</b> Wheels and Tires:-	<ul style="list-style-type: none"> <li>• Purpose &amp; necessity of wheels &amp; tires.</li> <li>• Types of Wheels: - Steel wheels &amp; Cast alloy wheels.</li> <li>• Wheel construction &amp; dimensioning.</li> <li>• Tire Construction and Materials (Tubed and Tubeless tires).</li> <li>• Classification of Tires based on: - Ply arrangements, Tire treads.</li> <li>• Tire pressure and pressure monitoring.</li> <li>• Tire dimensioning and side wall markings.</li> <li>• Basic Maintenance and Service of wheels and tires.</li> </ul>

### 4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

Unit No.	Topic	Teaching Hours/ Semester	Marks
1	<b>Automotive Body Engineering &amp; Aerodynamics:-</b>	8	15
2	<b>Steering Systems:-</b>	10	12
3	<b>Suspension Systems:-</b>	12	18
4	<b>Automatic transmissions:-</b>	12	18
5	<b>Wheels and Tires:-</b>	6	12
	<i>Total</i>	48	75

### 5. SUGGESTED LIST OF EXPERIMENTS

S. No.	Experiment
1.	Study of Conventional Steering systems: - Recirculating ball type & Rack & Pinion

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	type steering.
2.	Study of Conventional Suspension systems:- MacPherson, SLA, Leaf spring type suspension.
3.	Study of a Twin-Tube type Shock absorber.
4.	Study of Tire sidewall markings and dimensioning.
5.	Study of an Epicyclic gear train.
6.	Study of a Two-Wheeler Variomatic transmission system.

**6. SUGGESTED LEARNING RESOURCES**

<b>S.No.</b>	<b>Title of Book</b>	<b>Author</b>	<b>Publication</b>
1	Automotive Mechanics	William H. Crouse &Donald L. Anglin	
2	Automotive Chassis systems	Thomas. Birch	
3	Basic Automobile Engineering	C.P. Nakra	

**(AT604) MODERN AUTOMOTIVE SYSTEMS**

**1. RATIONALE:** An automobile engineer is supposed to be on par with current advances in vehicular technology. This would involve one to possess knowledge about recent advances in various automotive systems such as Stability, braking, safety, Engine, drive train and other comfort & convenience technologies. This would help one to be completely equipped with advancing knowledge in this field.

**2. TEACHING AND EXAMINATION SCHEME**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
AT604  MODERN AUTOMOTIVE SYSTEMS	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	-	3	75	25	25	25	

*Minimum passing %: theory 40%,*

*Duration of the theory papers: 3 hours*

*L: Lectures, T: tutorials, P: Practical, C: Credit, TH: end semester theory, TM: Test Marks, TW: term work, PR/OR: End Semester Practical/Oral Exam,*

**3. DETAILED COURSE CONTENT**

Unit	Topics and Sub-topics
Unit- 1.  Modern Automotive Braking, Suspension & Stability systems:-	<ul style="list-style-type: none"> <li>• <u>Traction control systems.</u></li> <li>• Anti-lock braking systems (Main components &amp; Working)</li> <li>• <u>Electronic Brake-force distribution.</u></li> <li>• <u>Electronic Stability Control.</u></li> <li>• <u>Emergency brake assist.</u></li> <li>• Active suspension systems.</li> <li>• Electronically controlled Air suspensions.</li> <li>• Liquid filled engine mountings.</li> <li>• Four Wheel steering systems.</li> </ul>



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Unit-2  Modern Automotive Safety systems:-	<ul style="list-style-type: none"> <li>• <u>Crumple zones</u></li> <li>• <u>Laminated and Tempered glass windshields</u></li> <li>• <u>Advanced Automatic Collision Notification</u></li> <li>• <u>SRS Airbags</u></li> <li>• Pedestrian protection systems</li> <li>• <u>Reverse backup sensors</u></li> <li>• <u>Adaptive headlamps</u></li> <li>• Rain sensing wipers</li> <li>• Auto retracting seatbelts</li> <li>• Automatic high-beam control</li> <li>• Collision mitigation braking system</li> <li>• Whiplash protection system or Active head restraint</li> <li>• Child safety seats</li> <li>• Collapsible steering &amp; Tilt Steering</li> </ul>
Unit-3  Modern Automotive Engine systems:-	<ul style="list-style-type: none"> <li>• VVT ( Variable lift &amp; Cam Phasing)</li> <li>• VGT</li> <li>• Variable displacement systems or Active fuel management</li> <li>• Start-stop system</li> <li>• Hybrid engine vehicles</li> <li>• Electric Vehicles</li> <li>• Flexible fuel vehicles</li> <li>• Gasoline Direct Injection</li> </ul>
Unit-4  Modern Automotive Cabin Comfort & Convenience systems:-	<ul style="list-style-type: none"> <li>• Telematics.</li> <li>• Push Button and Keyless Go Ignitions.</li> <li>• Power windows.</li> <li>• Electrical adjusting exterior mirrors.</li> <li>• Power seats.</li> <li>• Heads up display.</li> <li>• UV &amp; IR reducing glass.</li> <li>• Light automotive materials.</li> <li>• Climate control.</li> <li>• Antitheft systems (Central Locking, Vehicle Immobilizer, Alarm systems)</li> <li>• Parking assistance systems.</li> <li>• <u>Adaptive cruise control.</u></li> </ul>
Unit-5  Modern Automotive Drive Systems:-	<ul style="list-style-type: none"> <li>• Viscous Coupling differentials</li> <li>• All Wheel Drive (Full time &amp; Part time)</li> <li>• Electronic Limited slip differentials</li> <li>• No-Flat and Run-flat tires.</li> <li>• Tire Pressure monitoring.</li> </ul>

**4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )**

<b>Unit No.</b>	<b>Topic</b>	<b>Teaching Hours/ Semester</b>	<b>Marks</b>
1	<b>Modern Automotive Braking, Suspension &amp; Stability systems</b>	12	20
2	<b>Modern Automotive Safety systems</b>	12	15
3	<b>Modern Automotive Engine systems</b>	10	15
4	<b>Modern Automotive Cabin Comfort &amp; Convenience systems</b>	8	15
5	<b>Modern Automotive Drive train Systems</b>	6	10
	<i>Total</i>		

**(AT605) ORGANISATIONAL BEHAVIOUR**

**1. RATIONALE :**

To prepare students for successful careers that meet the global Industrial and Corporate requirements while also providing an environment for students to work on multidisciplinary projects as part of different teams and to enhance their team building capabilities like leadership, motivation, teamwork etc.

**2. TEACHING AND EXAMINATION SCHEME**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
Organisational behaviour	L	T	P	C	TH	TM	TW	PR/OR	125
	2	-	2	4	75	25	25	--	

*Minimum passing %: theory 40%,*

*Duration of the theory papers: 3 hours*

*L: Lectures, T: tutorials, P: Practical, C: Credit, TH: end semester theory, TM: Test Marks, TW: term work, PR/OR: End Semester Practical/Oral Exam,*

**3. DETAILED COURSE CONTENT**

Unit	Topics and Sub-topics
Unit – I REPORT WRITING	1.1 Objectives of report writing 1.2 Language and Style in a report 1.3 Types of reports 1.4 Formats of reports: Memo, letter, project and survey based
Unit-II TECHNICAL PROPOSALS	2.1 Objective of technical proposals 2.2 Parts of proposal
Unit - III INTRODUCTION TO INTERPERSONAL SKILLS	3.1 Emotional Intelligence 3.2 Leadership 3.3 Team Building 3.4 Assertiveness 3.5 Conflict Resolution 3.6 Negotiation Skills 3.7 Motivation 3.8 Time Management
Unit - IV MEETINGS AND DOCUMENTATION	4.1 Strategies for conducting effective meetings 4.2 Notice 4.3 Agenda 4.4 Minutes of the meeting

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Unit - V  INTRODUCTION TO CORPORATE ETHICS AND ETIQUETTES	5.1 Business Meeting etiquettes, Interview etiquettes, Professional and work etiquettes, Social skills 5.2 Greetings and Art of Conversation 5.3 Dressing and Grooming 5.4 Dining etiquette 5.5 Ethical codes of conduct in business and corporate activities (Personal ethics, conflicting values, choosing a moral response, the process of making ethical decisions)
Unit VI EMPLOYMENT SKILLS	6.1 Cover letter 6.2 Resume 6.3 Group Discussion 6.4 Presentation Skills 6.5 Interview Skills

### 4. SUGGESTED SPECIFICATION TABLE WITH HOURS

Unit No.	Topic	Teaching Hours/ Semester	Marks allotted
1	Report Writing -	2	6
2	Technical Proposals -	2	6
3	Introduction to Interpersonal Skills-	13	30
4	Meetings and Documentation -	3	6
5	Introduction to Corporate Ethics and etiquettes -	5	12
6	Employment Skills -	7	15
	Total	32	75

### 5. SUGGESTED LIST OF ASSIGNMENTS

S. No.	Assignment
1	Report Writing
2	Making a Technical Proposal
3	Interpersonal Skills( Group Activity & Role Play)
4	Mock Meetings & Documentation
5	Corporate Ethics & Etiquette(Dining & Social Etiquette)

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6	Writing of a Cover Letter & Resume
7	Team Building & Leadership Camp

### 6. SUGGESTED LEARNING RESOURCES

S. No	Title of Book	Author	Publication
1	Organisational Behaviour	Stephen Robbins	PHI
2	Organisational Behaviour	Fred Luthans	McGraw Hill
3	Report Writing for Business	Lesiker & Petit	McGraw Hill
4	Technical Writing & Professional Communication	Huckin & Olsen	McGraw Hill
5	Soft Skills	Dr K Alex	S Chand
6	Professional Ethics	R Subramaniam	Oxford University Press

**(AT606) AUTOMOBILE WORKSHOP PRACTICE**

**1. RATIONALE :** This course is designed to provide a student with the basic knowledge and skills required in the adjustments, testing & repair of some automobile engine components.

**2. TEACHING AND EXAMINATION SCHEME**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
AT606 Automobile Workshop Practice	L	T	P	C	TH	TM	TW	PR/OR	100
	-	-	6	6	-	-	50	50	

*L: Lectures, T: tutorials, P: Practical, C: Credit, TH: end semester theory, TM: Test Marks, TW: term work, PR/OR: End Semester Practical/Oral Exam,*

**3. DETAILED COURSE CONTENT**

Unit	Topics and Sub-topics
<b>Unit-I</b> <b>Testing &amp; Performance</b>	<ul style="list-style-type: none"> <li>• Performance Test on a Single Cylinder 2 stroke Petrol Engine</li> <li>• Performance Test on a Single Cylinder 4 stroke Petrol Engine</li> <li>• Performance Test on a Single Cylinder 4 stroke Diesel Engine</li> <li>• Morse Test on a Double Cylinder 4 stroke Diesel Engine</li> </ul>
<b>Unit-II</b> <b>Wheel Balancing</b>	<ul style="list-style-type: none"> <li>• Demonstration of Wheel Balancing Procedure</li> </ul>
<b>Unit-III</b> <b>Wheel Alignment</b>	<ul style="list-style-type: none"> <li>• Demonstration of Wheel Alignment Procedure</li> </ul>
<b>Unit-IV</b> <b>Exhaust Gas Analysis</b>	<ul style="list-style-type: none"> <li>• Demonstration of Exhaust Gas Analysis on a Petrol Engine using Gas Analyser</li> <li>• Demonstration of Exhaust Gas Analysis on a Diesel Engine using Smokemeter</li> </ul>
<b>Unit-V</b> <b>Denting &amp; Painting</b>	<ul style="list-style-type: none"> <li>• Practice on Denting &amp; painting a sheet metal body surface using Manual Spray painting procedure</li> </ul>

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Semester - VII										
Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
AT701	Garage Organisation & Transport Magmt.	3	-	2	5	75	25	-	25	125
AT702	Road Transp. & Vehicle laws	3	-	2	5	75	25	-	25	125
AT703	Design of Automobile Components	3	3	-	6	75	25	-	25	125
E2	Elective-II	3	-	2	5	75	25	25	25	150
AT704	Automobile Project	-	-	6	6	-	-	50	50	100
CS501	Entrepreneurship Development	-	-	2	2	-	-	-	50	50
Total		12	3	14	29	300	100	75	200	675

Elective-II

AT711- Automobile Sales

IE6\*\* Institutional Elective

### Semester - VIII

Course code	Name of Course	EXAMINATION SCHEME				Total
		TW		PR/OR		
		Daily Dair y	Progressive Assessment	Training Report	Report Assessment & Seminar/Viva	
AT801	Auto Training Phase II	50	50	50	50	Grade

FOR INDUSTRIAL TRAINING OF V<sup>TH</sup> & VIII<sup>TH</sup> SEMESTER :

4. Grades will be awarded based on marks scored as follows:

- e. 80% and above Marks – Grade ‘A’
- f. 60% to 79% Marks – Grade ‘B’
- g. 40% to 59% Marks – Grade ‘C’
- h. Marks below 40% - Grade ‘D’

5. TW and PR/OR shall be separate Heads of passing. Student has to secure minimum Grade ‘C’ for passing.

6. Student with Grade D, under the Head TW, shall be declared T.N.G. and a student whose term is granted but obtains Grade D, under the Head PR/OR, shall be declared Failed/ATKT.



## **SEMESTER VII**

### **(AT701) GARAGE ORGANISATION & TRANSPORT MANAGEMENT**

**1. RATIONALE:** Organisation & management of any garage, depot or transport undertaking forms a very important activity for any Automobile Engineer. It is only sound principles of management with a clear idea of organisational structure, policies & procedures that will result in the effective handling of personnel & activities within the organisation, which will ultimately result in the overall development of an undertaking. This subject provides sufficient insight in this area.

#### **2. TEACHING AND EXAMINATION SCHEME**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
AT701 GARAGE ORGANISATION & TRANSPORT MANAGEMENT	L	T	P	C	TH	TM	TW	PR/OR	125
	3	-	2	5	75	25	25	--	

*Minimum passing %: theory 40%,*

*Duration of the theory papers: 3 hours*

*L: Lectures, T: tutorials, P: Practical, C: Credit, TH: end semester theory, TM: Test Marks, TW: term work, PR/OR: End Semester Practical/Oral Exam,*

### 3. DETAILED COURSE CONTENT

Unit	Topics and Sub-topics
<i>Unit – I</i> <b>LOCATION AND LAYOUT OF GARAGE.</b>	Types of Garages Location of a Garage Layout of a Garage Functions of Garage Personnel required in a Garage Safety procedures of Garages and Service stations
<i>Unit -II</i> <b>GARAGE PROCEDURES</b>	Diagnostic sheets Estimate of repairs Job card Job loading Time booking Inspection Final report Billing of repairs Feedback. Types of Spares Purchase procedures Stock records & Inventory Control Economics of rebuilding.
<b>Unit- III COSTING.</b>	Job costing Unit costing Batch costing Process costing Marginal costing.
<b>Unit-IV SALES.</b>	Marketing trends Advertising and display Publicity and public relations Fundamentals of Salesmanship Importance of after sales service Warranty procedures Market trends for resale Assessment of used vehicles for sale Estimate of repairs for resale Procedures for repairs & sale of used vehicles.
<i>Unit-V</i> <b>FUNCTIONS OF MANAGEMENT.</b>	Different functions of management like forecasting, planning, organizing, communicating, directing, coordinating & control, motivating, Decision making.

<b>Unit-VI</b> <b>PERSONNEL</b> <b>ADMINISTRATION.</b>	Functions of Personnel department Human Resource Planning Selection & Recruitment Training & Placement Promotion & Transfer Welfare & safety of personnel Industrial relations Labour & Labour relations Industrial hygiene Industrial safety Wages & Incentives-Types of Wage plans, Characteristics of a good wage plan, Objectives & advantages of incentives, individual & group incentives,
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#### 4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

Unit No.	Topic	Teaching Hours/ Semester	Marks
I	LOCATION AND LAYOUT OF GARAGE.	9	13
II	GARAGE PROCEDURES	8	10
III	COSTING.	3	6
IV	SALES	9	16
V	FUNCTIONS OF MANAGEMENT.	9	12
VI	PERSONNEL ADMINISTRATION	10	18
	Total	48	75

#### 5. SUGGESTED LEARNING RESOURCES

S. No	Title of Book	Author	Publication
1	A Text book on Automobile Engineering	R.K. Rajput	
2	Industrial Organisation & Management	O.P. Khanna	
3			
4			

**(AT702) ROAD TRANSPORT AND VEHICLE LAWS**

**1. RATIONALE:** Every automobile engineer needs to know about the different forms of road transport and also the rules & regulations stipulated under the Motor Vehicles Act, which govern the use of such vehicles.

**2. TEACHING AND EXAMINATION SCHEME**

Course Code  &  Course Title	Periods/ Week (In Hours)			Total Credi ts	Examination Scheme				
					Theory Marks		Practical Marks		
Road Transport & Vehicle Laws	L	T	P	C	TH	TM	TW	PR/OR	125
	3	-	2	5	75	25	25	--	

Minimum passing %: theory 40%,

Duration of the theory papers: 3 hours

**L:** Lectures, **T:** tutorials, **P:** Practical, **C:** Credit, **TH:** end semester theory, **TM:** Test Marks, **TW:** term work, **PR/OR:** End Semester Practical/Oral Exam,

### 3. DETAILED COURSE CONTENT

Unit	Topics and Sub-topics
<b>Unit – I</b>  <b>ROAD</b>  <b>TRANSPORT</b>	<ul style="list-style-type: none"> <li>• History of road transport</li> <li>• Functions of transport: Economic, Social, Military</li> <li>• Modes of urban passenger transport</li> <li>• Modes of rural passenger transport</li> <li>• Demand for transportation service</li> <li>• Characteristics of different modes of transport.</li> </ul>
<b>Unit-II</b>  <b>BUS TRANSPORT</b> <b>OPERATION</b>	<ul style="list-style-type: none"> <li>• Fare, Basic principles of fares charging: Flat fares, Telescopic fares, Cost of service, Value of service, Special rates, Differential rates for different types of services.</li> <li>• Organization Setup: Government, Semi- Government, Private.</li> <li>• Labour and labour relations, Incentive Schemes: Financial Incentive, Semi-Financial Incentive, Non Financial Incentive.</li> <li>• Taxation: Types of Taxes: Road Tax, Passenger Tax. Value Added Tax.</li> <li>• Passenger amenities.</li> </ul>
<b>Unit - III</b> <b>BUS TRANSPORT</b> <b>MANAGEMENT</b>	<ul style="list-style-type: none"> <li>▪ Essentials of transport system, Planning a new service: Geographical and Economic considerations</li> <li>▪ Depot layout, Object of a good layout, Effective handling of peak load, Depot Management, Developing the traffic, Traffic Investigation, Route planning and development, Management Information systems.</li> <li>▪ Scheduling: Basic factors in bus, crew and maintenance scheduling.</li> </ul>
<b>Unit - IV</b> <b>GOODS</b> <b>TRANSPORT</b>	<ul style="list-style-type: none"> <li>• Goods Vehicle, Route, Trip.</li> <li>• Market potential: Type of goods, Period of use, Probable competition.</li> <li>• Legal Compliance: Documents required as per M.V.A.</li> <li>• Freight Calculation: Time base, distance base, Contract, Cubic feet, Tone method, Hiring of trucks, Toll, Staff wages.</li> </ul>

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<b>Unit - V DRIVING SKILLS</b>	<ul style="list-style-type: none"> <li>Traffic signs: Mandatory signs, Cautionary signs, Informatory signs. Traffic signals.</li> <li>Causes and analysis of accidents, measures to avoid accidents</li> </ul>
<b>Unit - VI MOTOR VEHICLES ACT 1988</b>	<ul style="list-style-type: none"> <li>Licensing of Drivers of Motor Vehicles: Necessity, Age limit, Responsibility of owners, Restriction on holding of driving licence, Grant of learner's and driving licence.</li> <li>Conductor's Licence: Necessity, Grant of conductor's licence and Disqualification for grant of conductor's licence.</li> <li>Registration of Motor Vehicles: Necessity, Where to be made, How to be made, Temporary registration, Production of vehicle at the time of registration, Transfer of ownership.</li> <li>Control of Transport Vehicles: Necessity for permits, Transfer of permit.</li> <li>Control of Traffic: Limits of speed, Limits of weight and limitations on use, Duty to obey traffic signs, Wearing of protective headgear.</li> <li>Insurance of Motor Vehicles: Procedure for accident claim.</li> </ul>

#### 4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

Unit No.	Topic	Teaching Hours/ Semester	Marks
1	ROAD TRANSPORT	06	15
2	BUS TRANSPORT OPERATION	12	15
3	BUS TRANSPORT MANAGEMENT	12	15
4	GOODS TRANSPORT	04	09

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Unit No.	Topic	Teaching Hours/ Semester	Marks
5	DRIVING SKILLS	02	06
6	MOTOR VEHICLES ACT 1988	12	15
	TOTAL	48	75

### 5. SUGGESTED LIST OF EXPERIMENTS

S. No.	Experiment
1.	Collection and study of a Fare table of the State of Goa.
2.	Collection and study of a Depot Layout.
3.	Collection and study of Road Tax and Passenger Tax of the State of Goa
4.	Collection and study of different types of RTO forms.

### 6. SUGGESTED LEARNING RESOURCES

S.No	Title of Book	Author	Publication
1	MOTOR VEHICLES ACT 1988		Home Department (M.S.)
2	BUS STATION MANAGEMENT	Dr. P. Sudarsanam	CIRT, PUNE
3	BUS AND CREW SCHEDULING	Dr. P. Sudarsanam	CIRT, PUNE
4	FARE STRUCTURE IN STU	Dr. P. Sudarsanam	CIRT, PUNE
5	PASSENGER AMENITIES IN STU	Dr. P. Sudarsanam	CIRT, PUNE
6	ECONOMICS OF TRANSPORT	S.K.Shrivastava	
7	TRANSPORT DEVELOPMENT IN INDIA		S.CHAND & CO. PVT LTD., NEW DELHI.

**(AT703) DESIGN OF AUTO COMPONENTS**

**1. RATIONALE:** This subject deals with the basic concepts of design of some of the components used in an automobile. Although modern methods of design are far advanced, the fundamentals involved in each of these are all the same. The learning of this subject will brief the student on the analysis of possible modes of failure of the components, selection of materials, their properties, shapes & sizes of sections.

**2. TEACHING AND EXAMINATION SCHEME**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
At703 DESIGN OF AUTO COMPONENTS	L	T	P	C	TH	TM	TW	PR/OR	125
	3	3	-	6	75	25	25	--	

**Minimum passing %: theory 40%,**

**Duration of the theory papers: 3 hours**

**L: Lectures, T: tutorials, P: Practical, C: Credit, TH: end semester theory, TM: Test Marks, TW: term work, PR/OR: End Semester Practical/Oral Exam**



### 3. DETAILED COURSE CONTENT

Unit	Topics and Sub-topics
<b>Unit – I</b>  <b>Basic concepts of design</b>	1.1 Introduction to design 1.2 General consideration for selection of material and manufacturing processes 1.3 General design consideration 1.4 Design procedure 1.5 Stress analysis: 1.5.1 types of external loads 1.5.2 types of induced stresses: tensile, compressive, shear, crushing and bearing pressure, bending, torsion, buckling, combined bending and twisting, combined bending, twisting and direct load 1.5.3 stress- strain diagram for ductile and brittle material and its importance 1.5.4 factor of safety , factors to be considered for selection of factor of safety 1.5.5 Selection of material and justifications for automobile components. Ergonomics: Design and requirement of driver, passenger and child seat.
<b>Unit-II</b>  <b>Design of shafts</b>	2.1 Design of shaft subjected to twisting moment 2.2 Design of shaft subjected to bending moment and twisting Moment

<b>Unit - III</b> <b>Design of screwed fasteners</b>	3.1 Bolts subjected to direct tensile load 3.2 Bolts subjected to shear load 3.3 Bolts subjected to eccentric load 3.3.1 Bolt axis and load line are parallel to each other 3.3.2 Bolt axis and load line are perpendicular to each other
<b>Unit - IV</b> <b>Design of springs</b>	4.1 Helical spring 4.1.1 Spring terminology 4.1.2 End connections for compression helical springs 4.1.3 Design of helical compression spring 4.1.4 Applications and functions of helical spring 4.2 Semi elliptical leaf spring 4.2.1 Design of semi elliptical leaf spring 4.2.2 Applications and functions of Semi elliptical leaf spring
<b>Unit - V</b> <b>Design of clutch</b>	5.1 Design of single plate clutch 5.2 Design of multiplate clutch
<b>Unit - VI</b> <b>Design of engine components</b>	6.1 Buckling of struts and columns 6.2 Application of Euler's and Rankine's formulae 6.3 Design of connecting rod 6.4 Design of connecting rod – small end

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	<p>6.5 Design of connecting rod –big end and bolts</p> <p>6.6 Design of push rods</p> <p>6.7 Design of piston crown by bending strength and thermal considerations</p> <p>6.8 Design of piston rings and skirt length</p>
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### 4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	Marks
1	BASIC CONCEPTS OF DESIGN	10	18
2	DESIGN OF SHAFTS	04	09
3	DESIGN OF SCREWED FASTENERS	08	12
4	DESIGN OF SPRINGS	05	12
5	DESIGN OF CLUTCH	05	06
6	DESIGN OF ENGINE COMPONENTS	16	18
	TOTAL	48	75

### 5. SUGGESTED LEARNING RESOURCES

S.No	Title of Book	Author	Publication
1	MACHINE DESIGN	R.S. KHURMI	
2	MACHINE DESIGN	PANDYA & SHAH	
3	ELEMENTS OF MOTOR VEHICLE DESIGN	DONKIN	

4	MECHANICAL ENGINEERING DESIGN	J.F.SHIGLEY	MCGRAWHILL
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### (AT704) AUTOMOBILE PROJECT

**1. Rationale:** It is the primary task of every engineering technician to apply the concepts, principles & fundamentals of science to everyday situations and problems in the most effective manner possible. This course would enable them to apply the knowledge acquired by undertaking a job related to his field of study. In the process of doing so he would be called upon to carry out the tasks of Planning, Scheduling and Coordinating and also develop certain skills and abilities.

### 2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		
AT704 Automobile Project	L	T	P	C	TH	TM	TW	PR/OR	100
	-	-	6	6	-	-	50	50	

#### Course Objectives:

1. To develop an ability to follow the correct procedures
2. To develop the ability to observe ,record & interpret
3. To develop the ability of problem solving
4. To develop the ability of decision making
5. To develop imagination, creativity & resourcefulness
6. To develop the ability to reason
7. To develop team spirit

## **Course Contents:**

The course will be covered in different stages as follows:

### **1. Selection of Project**

- a) Students in groups of not more than 5 will in consultation with the respective staff member appointed by the Head of Department, choose a developmental topic in Automobile Engineering for their project.
- b) Some areas or fields from which the project is chosen could include - modification of existing automotive systems, Traffic investigations and surveys, simple design & fabrication of auto components/systems, design & fabrication of testing equipment and devices
- c) The project selected should be related to the courses covered by the students

### **2. Planning stage**

- a) Listing down the various activities/tasks involved till the completion of the project
- b) Finalisation of the plan in consultation with the guide

### **3) Execution Stage**

- a) The work should proceed according to the plan
- b) Any deviations from the plans should be monitored & corrected or else the plan should be modified to suit the prevailing conditions
- c) Students should maintain a daily diary to record all the activities carried out
- d) All the activities should be in consultation & coordination with the guide

### **4. Report Writing Stage.**

- a) Students are required to prepare a detailed report containing some or all of the following information- Introduction or foreword, theory related to the project, design calculations, drawings , charts, sketches, catalogues, graphs, photographs, etc related to the project, Observations ,readings or any other data, suggestions if any. Conclusions or inferences and references
- b) The above report should be typewritten and hard bound and submitted in duplicate to the department

### **5. Evaluation & Assessment Stage.**

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The Evaluation and assessment of the project will be done periodically during the term followed by an end of term oral examination.

### (CS501) ENTREPRENEURSHIP DEVELOPMENT

#### 1. RATIONALE

The course on Entrepreneurship Development focuses on creating awareness regarding entrepreneurial traits, entrepreneurial support system, opportunity identification, project report preparation and understanding of legal and managerial aspects related to setting up of enterprise. This can be helpful in motivating technical students to start their own small-scale business/enterprise.

#### 2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
CS501 Entrepreneurship Development	L	T	P	C	-	-	PR/OR	TW	50
	-	-	2	2	-	-	-	50	

Minimum passing % Practical 40%

#### 3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency – *Prepare a detailed project report for an identified product/service.*

#### 4. DETAILED COURSE CONTENT

##### Unit 1:Introduction

(7 Hours, 12 Marks)

Meaning of entrepreneurship, need in the present scenario, definition of an entrepreneurship, qualities of an entrepreneur, functions of an entrepreneur, risks and rewards of entrepreneurship.

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Definition of Micro, Small And Medium Enterprises ( MSME).Classification of Micro, Small And Medium Enterprises ( MSME). Types of Enterprises - manufacturing, service and franchisee.

**Unit 2:Forms of Business Organisation**

( 2 Hours, 9 Marks)

Main features of Sole Proprietorship, Partnership, Private Limited Company, Public Limited Company, Co-operative Society.

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### **Unit 3: Entrepreneurial Support System**

(6 Hours, 9 Marks)

Central Government Agencies: Functions of Small Industries Development Bank of India (SIDBI), National Bank for Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC), Micro, Small And Medium Enterprises -Development Institute (MSME- DI), Technology Business Incubator (TBI), Khadi & Village Industries Commission (KVIC).

State Government Agencies: Functions of District Industries Centre (DIC), Goa Industries Development Corporation (GIDC), Economic Development Corporation (EDC), Financial Institutions-Banks, Goa Handicrafts and Rural Small Scale Industries Development Corporation (GHRSSIDC), Rural Development Agency (RDA), Khadi and Village Industries Board (KVIB).

### **Unit 4: Business Opportunity Identification**

(7 Hours, 6 Marks)

Evaluation of business opportunity:- selection of industry, initial prospects study, product marketing concept, decision to proceed, feasibility study, project evaluation.

### **Unit 5: Market Research**

(6 Hours, 12 Marks)

Definition of demand, factors affecting demand, law of demand, demand curves

Definition of supply, factors affecting supply, law of supply, supply curves.

Preparation of questionnaire. Data collection for setting up a small enterprise.

### **Unit 6: Legal Aspects**

(4 Hours, 9 Marks)

Procedure of registration of Micro, Small And Medium Enterprise (MSME), meaning and registration of Value Added Tax (VAT), Service Tax, PAN. Slabs of Income tax.

### **Unit 7: Project Report**

(16 Hours, 18 Marks)

Need for project report, importance of Project report,

scope of project report: Economic aspects, technical aspects, financial aspects, managerial aspects, production aspects.

List the contents of a project report.

Proforma of a project report which includes:- Introduction, scheme, profitability and projections, infrastructure, break-even point, names and addresses of suppliers, remarks.

Project Profile.

Project appraisal criteria:- technical feasibility, financial feasibility, economic viability, commercial viability, managerial competency, political and labour considerations.



**5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)**

<b>Unit No.</b>	<b>Topic</b>	<b>Teaching Hours/ Semester</b>	<b>MARKS</b>
1	Introduction	7	12
2	Forms of Business Organisation	2	9
3	Entrepreneurial Support System	6	9
4	Business Opportunity Identification	7	6
5	Market Research	6	12
6	Legal Aspects	4	9
7	Project Report	16	18
<b>TOTAL</b>		<b>48</b>	<b>75</b>

**6. MANDATORY ASSIGNMENTS**

1. Preparation of a Case Study on leading entrepreneurs of Goa. (To be taken while conducting Unit 1)
2. Preparation of a Case Study on leading entrepreneurs of India. (To be taken while conducting Unit 1) Unit 1)
3. Filling of template of “Business Model Canvas”
4. Preparation of Project Profile.
5. Preparation of Project Report.

**7. SUGGESTED ACTIVITIES:**

1. Visits to related departments (DIC,Banks,Tecnology Business Incubators, MSME-DI, NSIC, KVIC, KVIB).
2. Study visits to industries.
3. Organise entrepreneurship related event / activities.
4. Organise lectures/seminars with successful entrepreneurs.
5. Organise brainstorming sessions on ideation.
6. Establish an Entrepreneurship Development Cell.

**8. SUGGESTED LEARNING RESOURCES**

S.No.	Author	Title of Books	Year of Publication
1.	<i>Sharad jawadekar, shobha dodlani,</i>	<i>Business entrepreneurship</i>	<i>Suvichar prakashan mandal pune,</i>
2.	<i>S.S. Khanna</i>	<i>Entrepreneurship development</i>	<i>S. Chand &amp; Co. Ltd, New Delhi,</i>
3.	<i>Vasant Desai</i>	<i>Management of small Scale Industry in India</i>	<i>Himalaya Publishing House</i>
4.	<i>Dilip Sarwate</i>	<i>Entrepreneurial development Concepts and practices</i>	<i>Everest Publication House, Pune</i>
5.	<i>CB Gupta and P Srinivasan</i>	<i>Entrepreneurship Development</i>	<i>S. Chand and Sons, New Delhi</i>
6.	<i>PM Bhandari</i>	<i>Handbook of Small Scale Industry</i>	

**(AT711) AUTOMOTIVE SALES**

**1. RATIONALE:** Although sales is quite often considered as an 'art' , it is based on a few basic principles which generally apply to all forms of sales. A person intending to venture into sales would need to familiarise himself with these basic fundamentals and aim to apply them in all his dealings whether it involves the task of selling vehicles or even for that matter service. This subject.

**2. TEACHING AND EXAMINATION SCHEME**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credi ts	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
AT711 AUTOMOTIVE SALES	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	2	5	75	25	25	25	

**Minimum passing %: theory 40%,**

**Duration of the theory papers: 3 hours**

**L: Lectures, T: tutorials, P: Practical, C: Credit, TH: end semester theory, TM: Test Marks, TW: term work, PR/OR: End Semester Practical/Oral Exam,**

### 3. DETAILED COURSE CONTENT

Unit	Topics and Sub-topics
<b>Unit – I</b>  <b>SALES</b>	<ul style="list-style-type: none"> <li>• Introduction of sales and its importance</li> <li>• Factors affecting sales</li> <li>• Qualities of a good sales executive:-educational requirement, ethics and responsibilities.</li> </ul>
<b>Unit-II</b>  <b>SALES PROCESS</b>	<ul style="list-style-type: none"> <li>• Complete dealership involvement</li> <li>• Sales process flow chart</li> <li>• Presales process</li> <li>• Sales process</li> <li>• Delivery process</li> <li>• Post sales follow up</li> </ul>
<b>Unit - III</b> <b>FINANCE</b>	<ul style="list-style-type: none"> <li>▪ Market overview- What is finance, who is a finance partner</li> <li>▪ Benefits of finance</li> <li>▪ Terms used in finance:-Rack rate, subvention, fore closure charges ,EMI-step up ,step down ,Bullet, processing fees ,late payment charges, margin amount ,post dated cheque, hypothecation ,electronic clearance system ,zero percent finance ,loan to value</li> <li>▪ Finance documentation-individual ,private and public ltd. Company ,proprietorship and partnership, vehicle finance calculation</li> </ul>
<b>Unit - IV</b> <b>INSURANCE</b>	<ul style="list-style-type: none"> <li>• Overview of auto insurance market:-three zones in India ,motorcar insurance in India</li> <li>• Terms used in insurance:-package policy, third party policy, endorsement, proposal form, personal accident, compulsory accessories, voluntary deductibles, no claim bonus, sum assured</li> <li>• Insurance process:-selling insurance-at dealerships, from workshop, through flyers, through RTO data, manufacturer record sale Actual process:-policy issuance, payment collection, payment deposition, payment reconciliation, process for endorsement, unpaid, paid and refund process in case of break in insurance</li> <li>• Benefits of insurance for customers:-near cashless repairs, quality service available across manufacturer</li> </ul>

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	network, convenience and fulfillment of all transactions without hassles
<b>Unit - V VALUE ADDED SERVICES</b>	<ul style="list-style-type: none"> <li>Extended warranty:-what is extended warranty, eligibility for extended warranty, services offered and covered for warranty, registration procedure for extended warranty, claim procedure, benefits of warranty to customers, precautions, important information</li> <li>Accessories:-accessory sources:-local market, Indian brands, imported brands, manufacturer brands</li> <li>Accessories categorization:-interior, exterior, electrical, electronic, miscellaneous</li> <li>TCA-Teflon cavity antirust, benefits to the customer</li> </ul>
<b>Unit - VI VEHICLE RESALE</b>	<ul style="list-style-type: none"> <li>Objective of exchange</li> <li>Overview of vehicle exchange market</li> <li>Initiatives taken by manufacturers to initiate exchange process and its benefits to the customer and manufacturers</li> <li>Evaluation program</li> <li>Scope and future of exchange market</li> </ul>

### 4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY )

Unit No.	Topic	Teaching Hours/ Semester	Marks
1	SALES	03	06
2	SALES PROCESS	05	09
3	FINANCE	10	15
4	INSURANCE	10	15

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Unit No.	Topic	Teaching Hours/ Semester	Marks
5	VALUE ADDED SERVICES	10	15
6	<i>VEHICLE RESALE</i>	10	15
	<i>TOTAL</i>	48	75

**5. SUGGESTED LIST OF ASSIGNMENTS**

<b>S. No.</b>	<b>Assignments</b>
1	Assignment on Sales Process
2	Assignment on Finance Schemes
3	Assignment on Insurance

**6. SUGGESTED LEARNING RESOURCES**

<b>S.No</b>	<b>Title of Book</b>	<b>Author</b>	<b>Publication</b>
1	Secrets of closing the sale	Zig Ziglar's	Revell,
2	Selling 101: What every successful sales professional needs to know	Zig Ziglar's	Thomas Nelson Publishers
3	How to sell your way through life	Napoleon Hill	Wiley

## (IE6\*\*) INSTIUTIONAL ELECTIVE

### 1. RATIONALE :

It has been observed that the curriculum prescribed, is many times out of context of Industry, on account of the pace with which technology development is taking place at Industry end. Due to this, gap exists between the Industry requirement of manpower and manpower produced by the Polytechnics. Board takes some time to incorporate the development of technology in the curriculum and many a times technology becomes outdated when it is incorporated in the curriculum. Further the expertise to train students as per Industry current requirement is available at the institute, but the same cannot be taught to students, as it is not a part of curriculum.

To address this situation, Board has decided to permit Institutions affiliated to Board, to identify such technologies or other aspects and teach the same to the students as an elective subject called "Institutional Elective". Through this Institutional Elective subject, Institutions will be able to cater to the requirements of Industry by identifying their immediate requirement and prepare the students for the requirement by developing the curriculum in consultation with the Industry.

As many a time's same subject may not be offered more than one or two years, a non conventional way of teaching – learning may be required to be adopted. Participation of Industry experts, guest lecturers, visit to Industry, exploring the knowledge available on net, etc may be essential to achieve the objectives.

### 2. TEACHING AND EXAMINATION SCHEME :

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory		Practical		
IE6** INSTIUTIONAL ELECTIVE	L	T	P	C	TH	TM	PR/OR	TW	150
	3	-	2	5	75	25	25	25	

### 3. DETAILED COURSE CONTENTS :

- Curriculum shall be drafted by the concerned department by interacting with Industry counterpart in regards to the Newer Technology required to be transferred for purpose of Teaching /Learning process.
- Department shall work out the modalities of execution of the curriculum at Industry/Institute Level.
- Curriculum shall be forwarded to Board for approval before its implementation.



## **SEMESTER VIII**

### **(AT801) AUTO TRAINING - II**

**Rationale:** During the course of the second phase of Industrial training a student will get a more detailed insight into the industrial environment, work culture, management systems & roles of different departments. It would also enable him to obtain a hands-on experience in the use of the various tools, machines, equipment & instruments used in the auto industry. This phase of training would also enable him to assimilate more effectively the management principles and concepts taught to him during his final term at the institute.

Course code	Name of Course	EXAMINATION SCHEME				Total
		TW		PR/OR		
		Daily Dairy	Progressive Assessment	Training Report	Report Assessment & Seminar/Viva	
AT801	Automobile Training -II	50	50	50	50	Grade

### **Course Content:**

- Students are expected to undertake a ' project' ,in consultation with the Industry personnel, on a topic related to the area of training
- Students are required to perform and/or familiarize themselves with at least 4 of the following jobs/ assignments/tasks during the training period:
  - Periodic Maintenance Servicing of a vehicle
  - Dismantling & Assembling of an Engine
  - Dismantling & Assembling of a gear Box/Transmission
  - Dismantling & Assembling of a Clutch Assembly
  - Dismantling & Assembling of a Driveline & Differential
  - Dismantling & Assembling of a Suspension System
  - Engine Tune-up
  - Maintenance & Repair of a Braking System
  - Maintenance & Repair of a Steering System
  - Maintenance & Repair of a Engine Cooling System

## Directorate of Technical Education, Goa State

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Maintenance & Repair of the Electrical/Electronic Systems

Maintenance & Repair of the Hydraulic/Pneumatic Systems

Body Engineering aspects of Denting / Sheet metal work

Body Engineering aspects of Painting

Body Engineering aspects of Corrosion Protection

Body Engineering aspects of Chassis lubrication.

Role of a Supervisor/Foreman/Service advisor

### **Term Work:**

Every student undergoing Inplant Training is required to maintain a '**Daily Diary**' in the prescribed booklet supplied to them, giving a brief account of the various activities performed during the day for the entire period of the training. The entries should be authenticated /validated on a regular basis by the supervising authority at the place of work.

In addition the student is expected to write a detailed '**Training Report**', in a hard bound booklet, which should include diagrams, pictures, graphs etc, of the major activities undertaken during the training, which will be evaluated at the end of the term.

The evaluation system will also include 3 '**Assessments**' during the training period. There will be two assessments done at the institute wherein a student will be required to give a presentation of the jobs undertaken by him during his training. Besides these, there will also be an assessment done at the industry in consultation with industry personnel.

Assessment of Training Report be based on Knowledge, Presentation, Quality of contents and Sketches.