

GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH CODE: 02 DIPLOMA PROGRAMME IN AUTOMOBILE ENGINEERING

SEMESTER - II

COURSE CODE	COURSE TITLE	TEACHING			CREDITS (L+T+P)	EXAMINATION SCHEME				GRAND TOTAL
		L	T	P		THEORY		PRACTICAL		
						ESE	PA	ESE	PA	
1990001	CONTRIBUTOR PERSONALITY DEVELOPMENT	4	0	0	4	70	30	20	30	150
3300003	ENVIRONMENT CONSERVATION & HAZARD MANAGEMENT	4	0	0	4	70	30	0	0	100
3321902	MATERIAL SCIENCE & METALLURGY	3	0	2	5	70	30	20	30	150
3300014	BASIC OF ELECTRICAL & ELECTRONICS ENGINEERING	3	0	2	5	70	30	20	30	150
3320201	THERMODYNAMICS & HYDRAULICS	3	2	0	5	70	30	0	0	100
3300012	COMPUTER APPLICATION & GRAPHICS	0	0	4	4	0	0	40	60	100
		17	2	8						
TOTAL					27	350	150	100	150	750

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT COURSE CURRICULUM

Course Title: Environment Conservation & Hazard Management
(Code: 3300003)

Diploma Programmes in which this course is offered	Semester in which offered
Biomedical Engineering, Ceramic Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Environment Engineering, Fabrication Technology, Information Technology, Instrumentation & Control Engineering, Mechanical Engineering, Mining Engineering, Textile Design, Transportation Engineering	First Semester
Architecture Assistantship, Automobile Engineering, Chemical Engineering, Electronics & Communication, Mechatronics Engineering, Metallurgy Engineering, Plastic Engineering, Power Electronics, Printing Technology, Textile Manufacturing, Textile Processing	Second Semester

1. RATIONALE

For a country to progress, sustainable development is one of the key factors. Environment conservation and hazard management is of much importance to every citizen of India. The country has suffered a lot due to various natural disasters. Considerable amount of energy is being wasted. Energy saved is energy produced. Environmental pollution is on the rise due to rampant industrial mismanagement and indiscipline. Renewable energy is one of the answers to the energy crisis and also to reduce environmental pollution. Therefore this course has been designed to develop a general awareness of these and related issues so that the every student will start acting as a responsible citizen to make the country and the world a better place to live in.

2. COMPETENCIES

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

- i. **Take care of issues related to environment conservation and disaster management while working as diploma engineer.**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	100
4	0	0	4	70	30	0	0	

Legends: **L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit;
ESE - End Semester Examination; **PA** - Progressive Assessment.

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Ecology and environment	1.1 Enhance knowledge about engineering aspects of Environment 1.2 Correlate the facts of ecology and environment A 1.3 assess the effect of pollution 1.4 List the causes of environmental pollution 1.5 State the major causes of air, water and noise pollution 1.6 Describe how industrial waste contaminates the land 1.7 Describe the effects of radiation on vegetables, animals	1.1 Importance of environment and scope 1.2 Engineering and environment issues 1.3 The natural system, Biotic and a-Biotic components and processes of natural system 1.4 Eco system, food chain and webs and other biological Systems, 1.5 Causes of environmental pollution 1.6 Pollution due to solid waste 1.7 water pollution, air pollution, the Noise as pollution, 1.8 Pollution of land due to industrial and chemical waste 1.9 Radiation and its effects on vegetables and animals
Unit– II Sustainable Development	2.1 Explain the concept of sustainable development 2.2 Justify the need for renewable energy 2.3 Describe the growth of renewable energy in India 2.4 Explain the concepts of waste management and methods of recycling	2.1 Concept of sustainable development, 2.2 Natural resources, a-biotic and biotic resources 2.3 Principles of conservation of energy and management 2.4 Need of Renewable energy 2.5 Growth of renewable energy in India and the world 2.6 Concept of waste management and recycling
Unit – III Wind Power	3.1 Describe the growth of wind power in India 3.2 State the differences between VAWTs and HAWTs 3.3 Explain the differences between drag and lift type wind turbines 3.4 Describe the working of large wind turbines 3.5 List the types of aerodynamic control of large wind turbines 3.6 Name the generators used in large wind turbines	3.1 Growth of wind power in India 3.2 Types of wind turbines – Vertical axis wind turbines (VAWT) and horizontal axis wind turbines (HAWT) 3.3 Types of HAWTs – drag and lift types 3.4 Working of large wind turbines 3.5 Aerodynamic control of large and small wind turbines 3.6 Types of electrical generators used in small and large wind turbines
Unit – IV Solar Power	4.1 Describe the salient features of solar thermal and PV systems 4.2 Describe a solar cooker and solar water heater 4.3 Describe the working of solar PV system 4.4 State the salient features of polycrystalline, monocrystalline and thin film PV systems	4.1 Features of solar thermal and PV systems 4.2 Types of solar cookers and solar water heaters 4.3 Solar PV systems and its components and their working 4.4 Types of solar PV cells 4.5 Solar PV and solar water heaters, rating and costing
Unit – V Biomass energy	5.1 State the different types of biomass energy sources 5.2 Describe about the energy content in biomass 5.3 Describe the working of simple biogas plant	5.1 Types of Biomass Energy Sources 5.2 Energy content in biomass of different types 5.3 Types of Biomass conversion processes 5.4 Biogas production

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – VI Seismic Engineering and disaster management	6.1 Explain the principles of seismic Engineering in design of structure 6.2 State the appropriate actions to be taken during disasters	6.1 Introduction of seismic engineering and its application civil engineering designs 6.2 Features of disasters such as Floods, Earthquakes, Fires, Epidemics, Gas/radioactive leaks etc. 6.3 Management and mitigation of above disasters

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

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1.	Ecology and Environment	8	4	4	0	8
2.	Sustainable Development	10	4	5	1	10
3.	Wind Power	10	4	6	4	14
4.	Solar Power	10	4	6	4	14
5.	Biomass energy	8	4	4	2	10
6.	Seismic Engineering and disaster	10	6	6	2	14
	Total	56	26	31	13	70

Legends:

R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

6. SUGGESTED LIST OF EXPERIMENTS/PRACTICAL EXERCISES

Nil

7. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Prepare paper on various sustainable development
- ii. Make a report after gathering information the values of water, noise pollution and air pollution in your city/town and compare the values in other cities and towns in India with respect to environmentally acceptable levels
- iii. Prepare a paper on air and water pollution in an industry/institute
- iv. Undertake some small mini projects in any one of the renewable energies
- v. Visit an energy park and submit project on various sources of energy
- vi. Prepare powerpoint on clean and green technologies
- vii. Prepare a list of do's and don'ts applicable during disasters
- viii. Submit a report on garbage disposal system in your city/town.

8. SUGGESTED LEARNING RESOURCES

A. List of Books

S. No.	Title of Book	Author	Publication/Year
1	Renewable Energy Technologies	Solanki, Chetan Singh	PHI Learning, New Delhi, 2010
2	Ecology and Control of the Natural Environment	Izrael, Y.A.	Kluwer Academic Publisher
3	Environment Engineering and Disaster Management	Sharma, Sanjay K.	Luxmi Publications, New Delhi
4	Environmental Noise Pollution and Its Control	Chhatwal, G.R.; Katyal, T.; Katyal,	Anmol Publications, New Delhi
5	Wind Power Plants and Project Development	Earnest, Joshua & Wizelius, Tore	PHI Learning, New Delhi, 2011
6	Renewable Energy Sources and Emerging Technologies	Kothari, D.P. Singal, K.C., Ranjan, Rakesh	PHI Learning, New Delhi, 2009
7	Environmental Studies	Anandita Basak	Pearson
8	Environmental Science and Engineering	Alka Debi	University Press
9	Coping With Natural Hazards, Indian Context	K. S. Valadia	Orient Longman
10	Engineering and Environment	Edward S. Rubin	Mc Graw Hill Publ.

B. List of Major Equipment/ Instrument

- i. Digital sound level meters (to check noise pollution)
- ii. Digital air quality meter (to measure air pollution)
- iii. Digital handheld anemometer (to measure wind speeds)
- iv. Digital hand held pyranometer (to measure solar radiation levels)

C. List of Software/Learning Websites

- i. http://www1.eere.energy.gov/wind/wind_animation.html
- ii. http://www.nrel.gov/learning/re_solar.html
- iii. http://www.nrel.gov/learning/re_biomass.html
- iv. <http://www.mnre.gov.in/schemes/grid-connected/solar-thermal-2/>
- v. <http://www.mnre.gov.in/schemes/grid-connected/biomass-powercogen/>

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- Prof. H.L.Purohit , HOD, Civil Engg. Dept. L.E.College. Morbi
- Shri. P.A.Pandya, LCE, Civil Engg. Dept, G.P , Himatnagar

Co-ordinator and Faculty Members from NITTTR Bhopal

- Dr. J.P.Tegar, Professor Dept of Civil and Environmental Engg, NITTTR, Bhopal.
- Dr. Joshua Earnest, Professor and Head, Dept. of Electrical & Electronics Engg, NITTTR, Bhopal

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM

Course Title: Computer Application & Graphics
(Code: 3300012)

Diploma Programmes in which this course is offered	Semester in which offered
Ceramic Engineering, Chemical Engineering, Civil Engineering, Environment Engineering, Fabrication Technology, Mining Engineering, Plastic Engineering, Textile Manufacturing Technology, Textile Processing Technology, Transportation Engineering	First Semester
Automobile Engineering,	Second Semester

1. RATIONALE

This subject envisages making the student know the fundamentals of Computer Application. It will also helps the student to have hands on experience on different application software used for office automation like MS-Word day-to-day problem solving, in particular for creating business documents, data analysis and graphical representations. Computer Application & Graphics is a course where student will be able to write, Draw, Tabulate, Report, Store and Retrieve and also print on Computer using various Hardware and Software.

Moreover 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. Some units in this course has been introduced at Diploma level in order to develop the skills in student so that they can generate various digital drawings as required using various CAD software.

2. LIST OF COMPETENCIES

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

- i. Use MS word software for word processing applications.
- ii. Use relevant software for drafting and editing 2D entities.

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	100
0	0	4	4	0	0	40	60	

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit;
ESE - End Semester Examination; PA - Progressive Assessment.

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Basics of Computer System	1.1 Describe computer hardware and software 1.2 Identify I/O devices 1.3 Describe functioning of CU ALU and memory unit 1.4 Differentiate various types of printers 1.5 Explain use of OS 1.6 Demonstrate various file handling operations	Basics of Computer System <ul style="list-style-type: none"> • Concept of Hardware and Software • Computer block diagram • Input Output unit • CPU, Control Unit, Arithmetic logic Unit (ALU), Memory Unit • Monitor, Printers: Dot matrix, Laser, Inkjet, Plotters, Scanner • System software and Application Software • Operating system concepts, purpose and functions • Operations of Windows OS. • Creating and naming of file and folders • Copying file, renaming and deleting of files and folders, • Searching files and folders, installation application, creating shortcut of application on the desktop • Overview of control Panel, Taskbar.
Unit– II Using MS - Word 2007	2.1 Use basics text formatting features 2.2 Manipulate text 2.3 Use page Setup features 2.4 Use spell and grammar utility 2.5 Work with graphics/ clipart 2.6 Create and manipulate table 2.7 Use auto shapes and its formatting with text	Using MS - Word 2007 <ul style="list-style-type: none"> • Overview of Word processor • Basics of Font type, size, colour, • Effects like Bold, italic, underline, Subscript and superscript, • Case changing options, • Inserting, deleting, undo and redo, Copy and Moving (cutting) text within a document, • Formatting Paragraphs and Lists • Setting line spacing; single • Page settings and margins including header and footer • Spelling and Grammatical checks • Table and its options, Inserting rows or columns, merging and splitting cells, Arithmetic Calculations in a Table. • Working with pictures, Inserting Pictures from Files, • Using Drawings and WordArt; Lines and Shapes, Modifying Drawn Objects, Formatting Drawn Objects, options for Creating and Modifying a WordArt Object
Unit– III Creating digital drawings using a Computer Aided Drafting (CAD) Software	3.1 Start Computer aided drafting software (AutoCAD). 3.2 Invoke commands in AutoCAD. 3.3 Set limits & Coordinate systems. 3.4 Use object selection methods. 3.5 Create basic & advance 2D	Introduction to Basic Draw Commands in any Computer Aided Drafting software like Auto CAD Power draft, Micro station: <ul style="list-style-type: none"> • System requirement & Understanding the interface. • Components of a CAD software window: Such as Title bar, standard tool bar, menu bar, object properties tool bar, draw tool bar, modify toolbar, cursor cross hair. Command window, status bar,

Unit	Major Learning Outcomes	Topics and Sub-topics
	entities. 3.6Close & save your work	drawing area, UCS icon. <ul style="list-style-type: none"> • File features: New file, Saving the file, Opening an existing drawing file, Creating Templates, Quit. • Setting up new drawing: Units, Limits, Grid, Snap, • Methods of Specifying points- Absolute coordinates and Relative Cartesian & Polar coordinates. • Using Object Snap like Endpoint, Midpoint, Intersection, Center Point, Quadrant Point, Nearest, Perpendicular, Apparent Intersection • SNAP, GRID, OTRACK, LINE, PLINE, ARC, CIRCLE, Ellipse, DONUT, Polygon, Region, File Commands: New, Open, Templates Save, Exit, • Standard sizes of sheet. Selecting Various plotting parameters such as Paper size, paper units, Drawing orientation, plot scale, plot offset, plot area, print preview • Concept of model space and paper space. • Creating view ports in model space and creating floating viewport in paper space. Shifting from model space to paper space and vice versa
Unit – IV Editing & viewing a Digital Drawing using a CAD software	4.1Modify existing 2D entities. 4.2Use different arrays in existing 2D drawing. 4.3View given drawing entities properly. 4.4Enquire about various attributes of existing 2D entities.	Introduction to Basic Edit, Inquiry and display Commands in any Computer Aided Drafting software like Auto CAD Power draft, Micro station: <ul style="list-style-type: none"> • Copy, Rotate, Move, Erase, Mirror, Array, Trim, Break, Extend, Chamfer, Fillet • Zoom window, Zoom in-out, PAN • List, Dblist, Area, Massprop
Unit – V Advance editing of a digital drawing using a CAD Software	5.1Use layers for proper management of drawings. 5.2Set properties of existing drawing entities as per requirement. 5.3 Able to dimension given 2D entities with perfection. 5.4Use Blocks effectively to create perfect drawings.	Introduction to Advanced Modify & other utility Commands in any Computer Aided Drafting software like Auto CAD Power draft, Micro station: <ul style="list-style-type: none"> • Properties, Line type, colour, line weight • Concept of Layers: Creating Layers, Naming layers, Making layers ON/OFF, Freeze-Thaw layers, Lock/Unlock Layers. Setting the properties of layers like Color, Line type, Line weight • Concept of Blocks: Local block, global block. Creating, inserting, redefining & exploding blocks. • Concept of Hatch: Selecting Hatch pattern, Hatch styles, Hatch Orientations. Associative Hatch. Boundary Hatch, Hatching Object. • Dimensioning: Types of dimensioning: Linear-Horizontal, Vertical, Aligned, Rotated, Baseline, Continuous, Diameter, Radius, Angular Dimensions. • Dim scale variable. • Editing dimensions.

Unit	Major Learning Outcomes	Topics and Sub-topics
		<ul style="list-style-type: none"> • Text: Single line Text, Multiline text. • Text Styles: Selecting font, size, alignment etc.

5. SPECIFICATION TABLE (for theory)

There is no theory paper and hence specification table for theory is not applicable

6. SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

The exercises/practical/experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency. Following is the list of exercises/practical/experiments for guidance.

S.No.	Unit No.	Practical Exercises
1	1	<ul style="list-style-type: none"> • Create and manage files and folder tree • Use accessories utilities of windows OS • Identify icons, processes going on, messages and interpretation • Write given text using WORD software and beautify • Plot and Print drawing, text on suitable paper • Prepare report using stored text and drawing
2	2	<ul style="list-style-type: none"> • Entering and editing text in document file. • Apply formatting features on Text like Bold, Italics, Underline, font type, colour and size. Apply features like bullet, numbering • Create documents, insert images, format tables Create and manipulate tables • Students will prepare File for the above mentioned practical and assignments on individual basis. • Students will collect photographs from internet which are related to field application of topics.
3	3	<ul style="list-style-type: none"> • Study of different types of drafting packages related to 2D e.g. AutoCAD, Power draft, Micro station. • Creating a new folder in the computer for saving your practical work. • Draw any three complicated 2D shapes using lines only following Absolute, Relative coordinate systems and object snaps. • Draw Five problems on different geometrical shapes in AutoCAD software using Lines, Polylines, Polygon, Circles, Arcs, Ellipse AutoCAD commands. • Construc a common templates for all the following assignments with institutes logo & standard title block. • Plot one drawing using above template and containing some 2D entities on suitable size of paper(A4).
4	4	<ul style="list-style-type: none"> • List different properties of entities made in above activity slot. • Try viewing commands on entities made in above activity slot.

		<ul style="list-style-type: none"> • Create drawing of three different Doors & Windows (Elevations). • Create drawing of a modern Study table (Elevations). • Create drawing of a modern sofa Set (Plan). • Draw three problems with polar & rectangular Arrays. • Create Top view of a circular and a rectangular Dining Table with six chairs using Polar and Rectangular array concept respectively. • Create plan & elevation of a primary school building. • Create plan & elevation of a medium size modular kitchen.
5	5	<ul style="list-style-type: none"> • Convert above door, windows, Bed, Dinning table into Blocks and use these blocks in following activities. • Three problems on 2D entity generation, which involve the use of layers, blocks and hatching. • Dimensioning of above figures. • Create your own text style (individually) • Draw two sheets on template developed at serial no.-3 and Create a plan & elevation of a Duplex Bungalow with following layers: <ul style="list-style-type: none"> • Basic civil structure • Water supply line • Electric supply • Toilet fittings • Furniture(using blocks)

7. SUGGESTED LIST OF STUDENT ACCTIVITY

Teachers can decide on their own the list of student activities to promote the intereste of students in use of computers and develop the competencies

8. SUGGESTED LEARNING RESOURCES

A. List of Books

Sr. No.	Title of Book	Author	Publication
1.	R Taxali	Computer Course	Tata McGraw Hills. New Delhi.
2.	P. Nageswara Rao	AutoCAD For Engineering Drawing Made Easy	Tata McGraw Hill
3.	George Omura	Mastering AutoCAD	BPB publication
4.	Sham Tickoo	AutoCAD 2004	Galgotia Publications,New Delhi
5.	Devid Frey	AutoCAD 2000	BPB publication
6.	A. Yarwood	An Introduction to AutoCAD2000	LongMan
7.	Ron House	Using AutoCAD 2000	Prentice Hall
8.	Autodesk Inc.	Latest AutoCAD Manual	Autodesk Inc.

B. List of Major Equipment/ Instrument

- Computer System
- Printer
- Flat Bed Plotter A4 size

C. List of Software/Learning Websites

- Latest Educational Network version of Auto CAD Software
- MS Office

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- **Prof. H. L. Purohit**, Head of Civil Engineering Department, L. E. College, MORBI
- **Prof. B G RAJGOR**, HOD, Applied Mechanics Department , B & B Institute of Technology

Coordinator & Faculty from NITTTR Bhopal

- **Prof. Sanjay Agarawal**, Professor & Head Dept. of Computer Engg. & Application, NITTTR, Bhopal
- **Prof. Sharad Pradhan**, Associate Professor, Dept. of Mechanical Engg., NITTTR, Bhopal

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM

Course Title: Basics of Electrical & Electronics Engineering
(Code: 3300014)

Diploma Programmes in which this course is offered	Semester in which offered
Fabrication Technology	First Semester
Automobile Engineering	Second Semester

1. RATIONALE

In fabrication engineering, there are many equipment that are electrically operated. Therefore, the basic know of electrical engineering will greatly help the technical person concerned in working effectively in his/her profession. Small faults could be identified and rectified so that the down time of the equipment is reduced. This course is therefore designed to provide the basic understanding of electrical engineering

2. LIST OF COMPETENCIES

The course content should be taught and implemented with an aim to develop different skills leading to the achievement of the following competencies.

- i. Measure basic electrical quantities/parameters.
- ii. Use major electrical/electronic machines//instrument/equipment.

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

Legends: L-Lecture; T – Tutorial/Teacher Guided Student Activity; P - Practical; C – Credit;
ESE - End Semester Examination; PA - Progressive Assessment.

4. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Fundamentals of Electric And Magnetic Circuits	1.1 Determine the current, voltage and resistance in an electric circuit using Ohm's law. 1.2 Explain the terms related with electric and magnetic circuits. 1.3 Determine the energy and power consumed in an electric circuit.	1.1 Ohm's law. 1.2 Definitions of EMF, Current, Potential Difference, Power and Energy. 1.3 Study of terms: - M.M.F, magnetic force, permeability, hysteresis loop, reluctance, leakage factor etc. 1.4 Comparison of magnetic and electric circuit.

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit– II AC Fundamentals and Electromagnetic Induction	2.1 Explain Faraday’s law of electromagnetic induction. 2.2 State the difference between self and mutual induced emf 2.3 Describe the use of capacitors and inductors in AC circuits. 2.4 Explain power consumed in an electric circuit with AC and DC sources.	2.1 State Faraday’s law of electro magnetic induction. 2.2 Dynamically induced emf. 2.3 Statically induced emf.-Self induced emf; Mutually induced emf. 2.4 Definitions and equations of self and mutual inductance. 2.5 Define cycle, frequency, periodic time, amplitude, RMS value, maximum value, instantaneous value, angular velocity or Frequency with reference to alternating emf and current. 2.6 A.C. through pure a) resistors, b) inductors and c) capacitors
Unit– III Electrical Measuring Instruments and Basic Electronics	3.1 Use multimeter in the measurement of voltage, current and resistance 3.2 Select instruments for a given measurement 3.3 Connect measuring instruments correctly in circuits 3.4 Record readings from measuring instruments 3.5 Explain the functions of semiconductor devices & their application.	3.1 Voltmeter, Ammeter, Wattmeter, Megger, Clip-on meter, Energy meter, Luxmeter and Multimeter. 3.2 Methods of connecting various indicating instruments. 3.3 Conductors, insulators and semi conductors; 3.4 P & N type semi conductor. 3.5 Basic function and identification of diode, Transistor and SCR, Photo diode, Photo transistor, Solar cell, LED, LCD, LDR, 555 Timer IC and OPAM.
Unit– IV Transformer and protective devices	4.1 Describe the construction of a simple transformer. 4.2 Describe the types and uses of transformers 4.3 List the types of transformers used in various devices 4.4 State the differences of MCB and ELCB 4.5 State the need of HRC fuses. 4.6 Describe how earthing is done for a domestic building	4.1 General construction and principle of transformers. 4.2 Emf equation and transformation ratio of transformers. 4.3 List various losses in transformers and equation of efficiency. 4.4 Applications of Transformers. 4.5 Construction and uses of auto transformers. 4.6 Different protective devices such as fuse, M.C.B. and ELCB. HRC fuses 4.7 Uninterruptible Power Supplies (UPS) 4.8 Earthing principles and pipe earthing
Unit– V Electrical Machines	5.1 Describe the working principle of DC generator and alternator 5.2 Label the parts of a squirrel cage induction motor 5.3 Describe the working principle of a 3 phase squirrel cage induction motor 5.4 Describe the working principle of a wound rotor induction motor	5.1 DC generator and alternator 5.2 Classification of induction motors. 5.3 Construction, working principle 5.4 Squirrel cage and wound rotor induction motor

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Fundamentals of Electric and Magnetic Circuits	8	6	4	2	12
2.	A.C Fundamentals and Electromagnetic Induction	9	6	6	4	16
3.	Electrical Measuring Instruments and Basic Electronics	9	7	7	4	18
4.	Transformers and protective devices	8	5	4	3	12
5.	Electrical Machines	8	4	6	2	12
	Total	42	28	27	15	70

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

6. SUGGESTED LIST OF EXPERIMENTS/PRACTICAL EXERCISES

The experiments/practical exercises should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the above mentioned competencies.

Out of the present list of experiments/practical minimum 10 may be selected, however it will be better to select more experiments/practical.

S. No.	Unit No.	Experiment/Practical Exercises
1	I	To verify ohm's law.
2	I	To measure voltage, current & power in 1-phase circuit. (with resistive load)
3	II	To measure the voltage across a coil with variable frequency AC input.
4	II	Study AC circuit with resistor, inductor and capacitor at constant frequency.
5	II	Study AC circuit with resistor, inductor and capacitor with variable frequency.
6	II	Explain RC time constant for a 555 Timer in multivibrator application.
7	III	Use Techometer to find speed of a motor at different speeds.
8	III	Use digital multimeter for the measurement of voltage, resistance and current.
9	III	Connect voltmeter, ammeter and energy meter correctly in AC and DC circuits and record readings at different frequency (AC only) and voltages in tables.
10	III	Use multimeter to find working/damaged transistors, resistances, transformers, coils and capacitors.
11	III	Check battery potential and determine polarity by the use of multimeter.
12	III	Use Luxmeter to measure light, at increasing distances/directions from source, from an incandescent lamp, Tube light and CFL.
13	III	Use Solar cell for recording solar insolation at different times in a day.
14	III	Study the use of photo diode, photo transistor and Light Dependent

		Resistor (LDR) in detection and measurement of light.
15	III	Study of different electronics components.
16	III	View the output of half wave & full wave rectifiers on CRO.
17	IV	Measure transformation ratio K of 1- phases transformers.
18	IV	To find efficiency of transformers by OC & SC test.
19	IV	Study the electric Earthing circuit in the institution.
20	IV	Study the types of Fuses used in the institution.
21	IV	Study the functioning of MCB & ELCB.
22	V	Study of DC motor parts & their identification.
23	V	To study three phase induction motor parts & their identification.
24	V	Study the UPS used in the electrical/electronics laboratory.

7. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

Following is the list of proposed student activities like: course/topic based seminars, internet based assignments, teacher guided self learning activities, course/library/internet/lab based mini-projects.....etc. These could be individual or group-based.

For example:

1. Students may be asked to make a list of following items used in electric and electronics circuits. Compare their properties, usage, cost and availability. Collections can be made for small inexpensive items. Each of these can be offered as a project.

- a. Conductors - Copper, Aluminum, Graphite, Carbon, Nichrome, Tin
- b. Commonly used insulators
- c. Transistors
- d. Capacitors
- e. Resistors
- f. Diodes and Rectifiers
- g. Transformers
- h. SCRs, TRIACs, DIACs
- i. LEDs, LCDs
- j. Devices for industrial and residential illumination
- k. Heaters and furnaces
- l. Motors and Alternators
- m. Switches, micro-switches and relays
- n. Soldering, desoldering, welding devices and equipment.
- o. Fans, Blowers and pumps
- p. General purpose digital and analog ICs
- q. General purpose batteries, accumulators, batteries used in mobile phones, cameras and similar devices.
- r. Alarms, Speakers, Beepers, Becons, Hooters, Bells used in industrial and residential locations.
- s. Types of indicators used on electrical/electronics display panels.
- t. Temperature, humidity measuring devices used in electrical/electronics installations.
- u. Smoke detectors, fire alarms used in electrical/electronics installations.
- v. High voltage devices and equipment used and their safety features.

2. Prepare a report on the electrical and electronic devices and equipment used in the Electrical/Electronics department. Tabulate and justify the devices on the basis of their requirement, voltage and power rating, frequency of operation, size of conductor used, protection devices etc.

3. Prepare a report on the indoor and outdoor electrical/electronics devices and equipment. Compare their requirements on the basis of enclosure, rating, portability, noise, safety, repairs & maintenance and similar features.

8. SUGGESTED LEARNING RESOURCES

A. List of Books

S.No.	Author	Title of Books	Publication/Year
1	Bhargava & Gupta	Basic Electronics & Linear Circuits	McGraw Hill Education, New Delhi, ISBN: 0074519654
2	B.L.Theraja	A text book of Electrical Technology vol.1	S.Chand Publication
3	B.L.Theraja	A text book of Electrical Technology vol.2	S.Chand Publication
4	V.K.Mehta	Principles of Power System	S.Chand Publication
5	A K Sawhney	A Course In Electrical And Electronic Measurements And Instrumentation	Dhanpat Rai & Co.
6	V.K.Mehta	Basic electronics	S.Chand Publication

B. List of Major Equipment/ Instrument

1. Voltmeter, Ammeter, Multimeter, Magger, Energy meter, Watt meter, Frequency meter
2. Auto transformer, battery, Resistances, DC/AC power supplies, variable resistances, UPS.
3. CRO, Thermometer, Lux meter, Lamp load for testing.
4. D.C. Machines, Alternator, Squirrel Cage and Wound rotor Induction motors.
5. Capacitors, MCB & ELCB.
6. Semiconductor Diode, Transistor, LED, LCD, SCR, Photo Diode, Photo Transistor, Solar cell, 555 Timer, LM series Operational Amplifier.
7. Half wave and full wave rectifiers.
8. Breadboard, soldering/desoldering facility, PCB development facility.
9. First Aid kits and safety measures against injury due to accident, high voltage and acid hazards.

C. List of Software/Learning Websites

- i. <http://www.animations.physics.unsw.edu.au//jw/AC.html>
- ii. <http://en.wikipedia.org/wiki/Transformer>
- iii. <http://www.alpharubicon.com/altenergy/understandingAC.htm>

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members form Polytechnics

- **Prof. D.A.Dave**, H.O.D., Auto.Dept. Sir Bhavsinhji Polytechnic Inst., Bhavnagar.
- **Shri A.C. Suthar**, Lecturer, Automobile Dept. MLIDS Polytechnic, Bhandu.

NITTTR Bhopal Co-ordinator and Faculty Members

- **Dr Ajit Dixit**, Associate Professor, Dept. of Education, NITTTR, Bhopal
- **Dr. Joshua Earnest**, Professor and Head, Dept. of Electrical & Electronics Engg, NITTTR, Bhopal

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

Course Title: Thermodynamics and Hydraulics
(Code: 3320201)

Diploma Programmes in which this course is offered	Semester in which offered
Automobile Engineering	Second Semester

1. RATIONALE

The laws of Thermodynamics and Hydraulics are used in almost every industry and also in everyday life. The consumer items like vehicle, refrigerators, compressors, heat exchangers etc are based on second law of thermodynamics and Carnot cycle. Therefore, a diploma engineer in automobile is expected to understand the laws of conversion of heat energy into work or power, laws of thermodynamics and its applications in industries and day today life. The course is intended to develop the basic understanding as well as the competency to understand fluid behaviour and its properties with its concepts in the operation of automotive engines.

2. COMPETENCIES

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competencies:

- i. **Explain thermodynamic principles, compressible flow and fundamental of heat transfer**
- ii. **Apply fluid laws and find out the behavior/ properties of the fluid for a given condition.**

3. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme (3 Hrs)				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	
3	2	0	5	70	30	00	00	100

Legends: L-Lecture; T – Tutorial/Teacher Guided Student Activity; P - Practical; C – Credit; ESE - End Semester Examination; PA - Progressive Assessment.

Note: It is the responsibility of the institute heads that marks for **PA of theory & ESE and PA of practical** for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

4. DETAILED COURSE CONTENTS:

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I BASIC OF THERMODYNAMICS	1a.Explain common terms related to thermodynamic system.	1.1 Thermodynamic system 1.2 Properties of substance like pressure, temperature, volume, heat, work, energy.
	1b.Describe the properties of system, form of energy, work and heat.	1.3 Thermodynamic processes & cycles 1.4 Work and heat transfer i Difference between heat and work ii Understanding of work transfer, displacement work, other types of work transfer- electric work, shaft work, pedal(stirring) work, flow work iii Heat transfer, specific heat, latent heat 1.5 Various forms of energy like static energy, kinetic energy, potential energy internal energy, enthalpy etc.
	1c. Explain concept of enthalpy and entropy.	1.6 Concept of enthalpy and entropy
Unit– II LAWS OF THERMODYNAMICS	2a.Describe various laws of thermodynamic to different situation.	2.1 Zeroth Law of Thermodynamics 2.2 First Law of Thermodynamics, its limitations & Application to flow processes. (No numerical) 2.3 Second law of Thermodynamics Kelvin Planck & Claudius statements, Refrigerator & heat pump
	2b. Describe Reversible and irreversible processes.	2.4 Concept of Reversible and irreversible processes
	2c. Explain working principles of heat engine	2.5 Heat Engine 2.6 Concept of Available energy referred to a cycle
Unit– III IDEAL GASES AND PROCESSES :	3a.Explain ideal gas laws and thermodynamic processes. 3b. Draw thermodynamic processes on P-V & T-S diagram	3.1 Ideal gas laws and equation 3.2 Specific heat of ideal gas 3.3 Various thermodynamic processes like constant pressure, constant volume, constant temperature etc.
Unit– IV THERMODYNAMIC CYCLES :	4a.Describe operation of Thermodynamic cycles and their importance.	4.1 Different air standard cycles and their importance- Carnot cycle, Otto cycle, Diesel cycle, Dual cycle.
	4b.Calculate work done and efficiency of different thermodynamic cycles for a given data.	4.2 Determine work done and efficiency of above cycles. 4.3 Applications of different thermodynamic cycles.

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit- V FUNDAMENTALS OF HYDRAULICS	5a. Describe different properties of the fluid	5.1 Properties of Fluid. 5.2 Fluid statics -concept, definitions of total pressure and centre of pressure, buoyant force and criteria for stability of floating body. Pascal's law.
	5b. Use fluid laws to measure various fluid properties.	5.3 Fluid dynamics- Types of flow, continuity equation, Bernoulli's theorem, Euler's equation of motion 5.4 Flow through simple pipes –pressure drop in pipes. 5.5 List of various instruments used for measuring various fluid properties.
Unit- VI FLUID CONTROL SYSTEM AND PUMPS	6a. Describe Fluid control system	6.1 Concept and need of control system
	6b. Explain the working and application of different types of pumps. 6c. Determine the efficiency of various pumps using appropriate formula.	6.2 Types of pumps 6.3 Working of reciprocating pumps 6.4 Working of Centrifugal pumps 6.5 Comparison of RC of CF pumps. 6.6 Simple problems on pumps.

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

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Basic of Thermodynamics	6	04	04	00	08
2.	Laws of Thermodynamics	6	02	06	02	10
3.	Ideal Gases and Processes	6	04	03	03	10
4.	Thermodynamic Cycles	6	02	05	04	11
5.	Fundamentals of Hydraulics	10	06	07	04	17
6.	Fluid Control System	08	03	06	05	14
	Total	42	21	31	18	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as only general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.

6. SUGGESTED LIST OF PRACTICAL/EXERCISES

-----Not Applicable -----

7. SUGGESTED LIST OF STUDENT ACTIVITIES:

Following is the list of student activities:

- Course/topic based seminars
- Internet based assignments
- Teacher guided self learning activities
- Course/library/internet
- lab based mini-projects

8. SUGGESTED LEARNING RESOURCES:**A. List of Books**

Sr. No.	Author	Title of Books	Publication
1	Mathur.M.L. and Gupta.S.C.	Thermodynamic for Engineers	Metropolitan Book Company-1985
2	Shah.C.S. and Pandya.N.C.	Heat Engines	Charotar Publishing House Pvt. Ltd
3	Ballaney.P.L.	Heat Engines	Khanna Publications
4	Khurmi.R.S.	Fluid Mechanics and Hydraulics	S.Chand publication
5	Patel.R.C. & Pandya.A.D.	Hydraulics & Hydraulic machinery	Acharya Book Depot (1967)

B. List of Software/Learning Websites

- i. <http://www.animations.physics.unsw.edu.au/jw/AC.html>
- ii. <http://en.wikipedia.org/wiki/Transformer>
- iii. <http://www.alpharubicon.com/altenergy/understandingAC.htm>
- iv. <http://www.howstuff.com>

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics:**

1. **Prof. M. J. Pathak**, H.O.D., Auto. Dept. Sir Bhavsinhji Poly. Inst., Bhavnagar.
2. **Prof. Shyam Verghese**, H.O.D., Auto. Dept. JNK Polytechnic, Amreli
3. **Prof. D. A. Dave**, H.O.D., Auto. Dept. Sir Bhavsinhji Polytechnic Inst., Bhavnagar.
4. **Prof. M. N. Vibhakar**, Lecturer, Auto. Dept. DR.S&SS Gandhi Polytechnic, Surat
5. **Prof. A. C. Suthar**, Lecturer, Auto. Dept. MLIDS Polytechnic, Bhandu

Coordinator & Faculty Members from NITTTR; BHOPAL:

1. **Dr. K. K. Jain**; Professor and Head Mechanical Engineering Department
2. **Dr (Mrs.) Vandana Somkumwar**, Associate Professor, Dept. of Mechanical Engineering

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

Course Title: Material Science and Metallurgy
(Code: 3321902)

Diploma Programmes in which this course is offered	Semester in which offered
Mechanical Engineering, Automobile Engineering	Second Semester

1. RATIONALE

Engineering Materials play an important role as the vital tool for solving the problems of material selection and application in the production and manufacturing of equipment/machines, devices, tools, etc. Therefore, an engineering diploma student must be conversant with the properties, composition and behavior of materials from the point of view of reliability and performance of the product.

Subject is concerned with the changes in structure and properties of matter. Many of the processes which are involved to bring out these changes, forms the basis of engineering activities. The study of basic concepts of material science and metallurgy will help the students understanding engineering subjects where the emphasis is laid on the application of these materials.

2. LIST OF COMPETENCIES

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competencies:

- i. **Select Engineering materials based on properties, behavior and environmental effect for given engineering application.**
- ii. **Examine microstructure and alloying elements of given engineering materials**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

Legends: L-Lecture; T – Tutorial/Teacher Guided Student Activity; P - Practical; C – Credit;; ESE - End Semester Examination; PA - Progressive Assessment.

Note: It is the responsibility of the institute heads that marks for **PA of theory & ESE and PA of practical** for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

4. DETAILED COURSE CONTENT

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Engineering Materials	1a. Explain different types of bonds material, its construction and characteristics	1.1 Types of bonds, construction and characteristics of electrovalent, covalent, coordinate, hydrogen and metallic
	1b. Draw molecular arrangement in solids, liquid and gases	1.2 Intermolecular force of attraction 1.3 Molecular arrangement in solids, liquid and gases 1.4 Structure of solids i. Concept of crystalline structure. ii. Structure of metal-unit cell, BCC, FCC and HCP. iii. Examples and properties of metallic structures
	1c. Describe various properties of material	1.5 Physical, chemical, electrical, electromagnetic and thermal properties of material
	1d. Explain effects of cooling rate, grain size on materials properties	1.6 Solidification of metals and digital transducers i. Concept. ii. Crystal, grain, grain boundaries and dendritic solidification. iii. Effect of cooling rate on material properties. iv. Effect of grain size on properties of metal
Unit– II Phase Diagrams	2a. Explain the concept of equilibrium diagram 2b. Plot cooling curves for pure metals and alloys	2.1 Equilibrium diagrams. i. Concept, definition and need. ii. Solid solution-definition, properties and examples. iii. Alloys-major elements, reasons to add and important effect on material properties. iv. Cooling curve-concept and method to plot. v. Cooling curve for pure metals and alloys.
	2c. Draw and Interpret TTT curves and Iron carbon diagram	2.2 Time Temperature Transformation curve- (TTT curve). i. Need and application. ii. Steps to construct TTT curve 2.3 Iron carbon equilibrium diagram. i. Concept, need & characteristics. ii. Definition of the terms used. iii. Plotting fundamentals. iv. Interpretation.
	2d. Explain various heat treatment processes	2.4 Heat treatment processes. i. Types of furnaces. ii. Heat treatment processes. (Annealing, normalizing, carburizing, case hardening, hardening, tempering, spheroidising, nitriding, tempering, stabilizing, etc.). Methods, parameters and changes in properties. iii. Types of quenching mediums, their properties and applications.

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit– III Metallurgical Microscope	3a. Prepare specimens for microscopic examination 3b. Examine specimens using microscope	3.1 Metallographic examination and microstructures-need and importance 3.2 Principle & working of metallurgical microscope 3.3 Preparation of specimen for microscopic examinations
Unit– IV Metals And Its Alloys	4a. Identify various ferrous metals and alloys based on composition and properties for prescribed application 4b. Test material for alloying elements content 4c. Interpret material designations	4.1 Classification of metals. 4.2 Flow diagram for the production of iron and steel. 4.3 Ferrous metals i. Classification. ii. Steels-types, composition, properties, applications. (for Plain carbon steel, alloy steel including stainless steel and cast iron.) iii. Designation and coding methods according to BIS for plain & alloy steel and cast iron. iv. Designation and coding (as per BIS, ASME, EN, DIN,JIS)of plain & alloy steel and cast iron. v. Microstructure of mostly used ferrous materials-low carbon steel, alloy steel, cast iron.
	4d. Select various non-ferrous metals and alloys based on composition and properties for given application	4.4 Non ferrous metals i Classification. ii.Types, composition, properties and applications. (for Copper, copper alloys, Aluminum and Aluminum alloys.) iii.Designation and coding methods according to BIS . iv.Designation and coding (as per BIS, ASME, EN, DIN,JIS)of mostly used non ferrous materials. v.Microstructure of mostly used non ferrous materials-(Copper, Brass, Gunmetal, Aluminum).
Unit– V Non Metallic Materials	5a. Identify non-metallic material by judgment and lay-man tests 5b. Select the non metallic material for given simple machine elements	5.1 Introduction and classification of non metallic materials. 5.2 Classification of Polymers on basis of Thermal behavior (Thermoplastics & Thermosetting). 5.3 Properties and applications of polymers (like Polyethylene, Polypropylene, Polyvinyl chloride, Teflon, Polystyrene, Phenol formaldehyde, Acrylonitrile, Epoxy resin.) 5.4 Surface coating methods, setup, working parameters and applications using polymers. 5.5 Composites. i. Introduction of composite. ii.Characteristics of composites. iii.Constituents of composite. iv.Types and applications of composites. 5.6 Other non metallic materials-types, properties and applications.(like rubber, ceramics, refractories ,

Unit	Major Learning Outcomes	Topics and Sub-topics
		insulators, abrasives, adhesives, etc). 5.7 Designation and coding of important non metallic materials as per BIS.
Unit- VI Electrolysis	6a.Select proper electrolyte for specified application. 6b.Select proper electrolysis process for surface coating.	6.1 Introduction 6.2 Electrolytes and Non-electrolytes. i. Types of electrolytes. ii. Construction and working of electrochemical cell. iii. Standard conditions. iv. Standard hydrogen electrodes. v. Electrochemical series, galvanic series. vi. Faraday's Laws of Electrolysis. vii. Industrial applications of electrolysis. viii. Surface coating through electrolysis-setup and working. 6.3 Corrosion-types and reasons.
Unit- VII Fluid And Powder Materials.	7a.Select suitable cutting oil for given machining process 7b.Select suitable lubricants. 7c.Interpret designations of oils and paints. 7d.List areas of powder metallurgy applications.	7.1 Classification of fluid and powder materials. 7.2 Oils. i.Types and properties. ii.Designation methods as per BIS. iii.Applications in Mechanical engineering. 7.3Paints and varnishes. i. Definition and classifications. ii.Surface preparation and coating methods using paints and varnishes. 7.4Powder metallurgy. i. Basic concept of powder metallurgy and its applications, merits and demerits. ii.Manufacturing process of powder coating-setup, equipment used and working.

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

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
I.	Engineering Materials.	05	4	2	2	8
II.	Phase diagrams.	10	6	4	8	18
III.	Metallurgical Microscope	03	3	2	0	5
IV.	Metals and alloys.	10	6	4	6	16
V.	Non metallic materials.	06	3	2	4	09
VI.	Electrolysis.	04	3	0	4	7
VII.	Fluid and powder materials.	04	3	0	4	7
	Total	42	28	14	28	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Notes:

- i) This specification table shall be treated as only general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.
- ii) If midsem test is part of continuous evaluation, unit numbers I, II, III and VII are to be considered. It is also compulsory for student to complete ex.no.1 to 4 to eligible for midsem test.
- iii) Ask the questions from each topic as per marks weightage. Optional questions must be asked from the same topic. That is weightage of compulsory attendance part of questions will be equal to marks allotted to each topic.

6. SUGGESTED LIST OF PRACTICAL/EXERCISES

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the above mentioned expected competencies.

S. No.	Unit No.	Practical/Exercises	Approx Hours. Required
1	I	a: State the criteria to identify any five (3 metallic and 2 non metallic) materials from the selected set of material b: List properties of each above identified materials. Also identify main alloying elements and reasons to add them.	2
2	II	Analyze content of ferrous/non ferrous material using photo spectrometer. (This may be covered during industrial visit).	2
3	II	a: Study various heat treatment furnaces. b: Perform hardening process on ferrous material. Measure the hardness before and after hardening.	4
4	III	Examine the given specimen by use of Metallurgical Microscope.	2
5	IV	Prepare ferrous micro specimens and examine them. Also prepare report on this. –Four specimens. (One of plain carbon steel, second of alloy steel, third of heat treated steel and fourth of cast iron.)	8
6	IV	Prepare non-ferrous micro specimens and examine them. Also prepare report on this. – Three specimens.(One of copper, second of brass and third of aluminium.)	4
7	VI	Study corrosive materials to identify different types of corrosion of metals.	2
8	ALL	Visit one relevant industry which has specifically heat treatment processes facilities and photo spectrometer.	-
9	All	PROBLEM BASED LEARNING: Group of 4-5 students will identify and collect five machine / product components which are made from different engineering materials and which are also failed in their applications. Students will measure and sketch the components (free hand-orthographic views) with dimensions. Students in group will also discuss the reasons of failure and will note down the discussion and outcome.	2
10	All	SCHOOL WITHIN SCHOOL:	2

S. No.	Unit No.	Practical/Exercises	Approx Hours. Required
		a. Each student will explain at least one diagram (assigned by teacher-may be part of iron-carbon diagram, TTT curve for specific material, etc) to all batch colleagues. b. Each student will share experiences of the student activities he/she has carried out.	

NOTES:

1. It is compulsory to prepare log book of exercises. It is also required to get each exercise recorded in logbook, checked and duly dated signed by teacher.
2. Student activities are compulsory and are also required to be performed and noted in logbook.
3. Term work report includes term work, objects taken for identification for laboratory work, student activity; parts experimented in acid as student activity and log book along with student activities. Term work report is compulsory part to be submitted at the time of practical ESE.
4. Term work report must not include any photocopy/ies, printed manual/pages, lithos, etc. It must be hand written / hand drawn by student only.
5. For 20 marks ESE, students are to be assessed for competencies achieved. Students are to be asked to prepare specimens, interpret microstructure-iron-carbon diagram-TTT curves, identify materials, select proper materials, etc.

7. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

- 7.1 Select any five objects (3 metallic and 2 non metallic) which will be used in laboratory and list the material of selected objects.
- 7.2 Prepare the material list of given tools and commonly used items such as razor blade, knife, scissor, hacksaw blade, carpentry chisel, fix spanner, etc. Also give reason(s) for using such material and discuss your answers with the teacher.
- 7.3 Take dilute acid which is commonly used at our home for cleaning purpose and put one scrap iron piece and one non ferrous metal piece in it for minimum 12 hours. Take out these two pieces by following all safety norms/steps (without touching acid) and observe the changes. Discuss with your teacher.
- 7.4 Group of 3-5 students will visit institute's workshop and will identify at least 5 nonmetallic components for a given machine / assembly. Also list the material of identified machine / assembly components.
- 7.5 List at least three questions individually which you would like to ask for followings:
 - i. Comparison of iron and fiber reinforced plastic.
 - ii. Comparison for strength of wood and cast iron.
 - iii. Annealing-heat treatment process.
 - iv. Materials used for construction of any bike.
 - v. Materials used for construction of any home appliance, like mixer, washing machine, iron, etc.
- 7.6 Any other relevant activity added by teacher including preparing industrial visit report.

8. SUGGESTED LEARNING RESOURCES

A. List of Books

S.No.	Author	Title of Books	Publication/Year
1.	GBS Narang	Materials science	Khanna Publishers, New Delhi.
2.	R.K.Rajpoot	Materials science	Laxmi Publication, Dariya ganj, New Delhi.
3.	R.S.Khurmi, R.S.Sedha	Materials science	S.Chand
4	D.S.Nutt	Materials science and metallurgy	S.K.Katariya and sons, Delhi.
5.	V.Raghavan	Materials science and Engineering	EEE Edition, Prentice Hill, New Delhi.
6.	Sidney Avner	Physical Metallurgy	Tata McGraw-Hill Education (2011).

B. List of Major Equipment/ Instrument

1. Metallurgical Microscope.
2. Standard specimens.
3. Furnaces to perform heat treatment process.
4. Sorted/required quenching mediums.
5. Hardness tester-to check Rockwell hardness-scales A,B and C.
6. Other hardness testers like scleroscope, etc.
7. Polishing machine to prepare specimens with necessary consumables.
8. Hand grinder – specifically to prepare specimens and for spark testing.
9. Other consumables.

C. List of Software/Learning Websites

1. <http://vimeo.com/32224002>
2. http://www.substech.com/dokuwiki/doku.php?id=iron-carbon_phase_diagram
3. <http://www-g.eng.cam.ac.uk/mmg/teaching/typd/>
4. <http://www.ironcarbondiagram.com/>
5. <http://uk.ask.com/web?q=Who+Discovered+Carbon%3F&qsrc=14097&o=41647924&l=dir>
6. <http://www.youtube.com/watch?v=fHt0bOfj3T0&feature=related>
7. <http://www.youtube.com/watch?v=cN5YH0iEvTo>
8. <http://www.youtube.com/watch?v=m911tVXyFp8>
9. <http://www.youtube.com/watch?v=98lh5Q0M0cg>
10. <http://www.youtube.com/watch?v=KIyGr-1snMY>
11. http://en.wikipedia.org/wiki/Materials_science
12. <http://www.studyvilla.com/electrochem.aspx>

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnic

- **Prof. Y. R. Joshi**, TPO, B&B Institute of Technology, Vallabhvidyanagar.
- **Prof. D. A. Dave**, Head of Automobile Engineering Department, Sir B.P.I., Bhavnagar.
- **Prof. A. M. Talsaniya**, Lecturer in Mechanical Engineering, Sir B.P.I., Bhavnagar.
- **Prof. R. B. Dhruv**, Lecturer in Mechanical Engineering, R.C.T.I., Ahmedabad.

Co-ordinator and Faculty Member from NITTTR Bhopal

- **Dr. K.K.Jain**, Professor and Head; Dept. of Mechanical Engg,
- **Dr. A.K.Sarathe**, Associate Professor; Dept. of Mechanical Engg,