MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI

TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES

COURSE NAME : DIPLOMA IN PLASTIC ENGINEERING

COURSE CODE : PS

DURATION OF COURSE : 6 SEMESTERS **WITH EFFECT FROM 2012-13**

SEMESTER : FOURTH **DURATION : 16 WEEKS**

PATTERN : FULL TIME - SEMESTER **SCHEME : G**

SR. NO	SUBJECT TITLE	Abbreviation	SUB CODE	TEACHING SCHEME			EXAMINATION SCHEME									SW (17400)
							PAPER HRS.	TH (1)		PR (4)		OR (8)		TW (9)		
				TH	TU	PR		Max	Min	Max	Min	Max	Min	Max	Min	
1	Environment Studies $	EST	17401	01	--	02	01	50#*	20	--	--	--	--	25@	10	50
2	Electrical and Electronics	EAE	17424	04	--	02*	03	100	40	--	--	--	--	25@	10	
3	Polymer Chemistry	PCH	17446	03	--	02	03	100	40	50#	20	--	--	25@	10	
4	Plastic Materials	PMA	17448	04	--	02	03	100	40	25#	10	--	--	25@	10	
5	Plastic Processing-I	PPR	17449	04	--	02	03	100	40	--	--	25#	10	--	--	
6	Computer Programming	CPR	17045	01	--	02	--	--	--	50@	20	--	--	--	--	
7	Professional Practice-II	PPS	17046	--	--	03	--	--	--	--	--	--	--	50@	20	
			TOTAL	**17**	**--**	**15**	**--**	**450**	**--**	**125**	**--**	**25**	**--**	**150**	**--**	**50**
**	**Industrial Training (Optional)**			**Examination in 5th Semester Professional Practices-III**												

Student Contact Hours Per Week: **32 Hrs.**

THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.

Total Marks**: 800**

@ - Internal Assessment, # - External Assessment, [ ] No Theory Examination, $ - Common to all branches, #* - Online Examination,

*** - Practicals of Electrical & Electronics at alternate week.**

Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Term Work, SW- Sessional Work.

**** Industrial Training (Optional) - Student can undergo Industrial Training of four weeks after fourth semester examination during summer vacation. Assessment will be done in Fifth semester under Professional Practices-III. They will be exempted from activities of Professional Practices-III of 5th Semester.**

- Conduct two class tests each of 25 marks for each theory subject. Sum of the total test marks of all subjects is to be converted out of 50 marks as sessional work (SW).
- Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms.
- Code number for TH, PR, OR, TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.

Course Name : All Branches of Diploma in Engineering & Technology

Course Code : AE/CE/CM/CO/CR/CS/CW/DE/EE/EP/IF/EJ/EN/ET/EV/EX/IC/IE/IS/ ME/MU/PG/PT/PS/CD/CV/ED/EI/FE/IU/MH/MI/DC/TC/TX/FG/AU

Semester : Fourth

Subject Title : Environmental Studies

Subject Code : 17401

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
01	--	02	01	50#*	--	--	25@	75

#* Online Theory Examination

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

Environment essentially comprises of our living ambience, which gives us the zest and verve in all our activities. The turn of the twentieth century saw the gradual onset of its degradation by our callous deeds without any concern for the well being of our surrounding we are today facing a grave environmental crisis. The unceasing industrial growth and economic development of the last 300 years or so have resulted in huge ecological problems such as overexploitation of natural resources, degraded land, disappearing forests, endangered species, dangerous toxins, global warming etc.

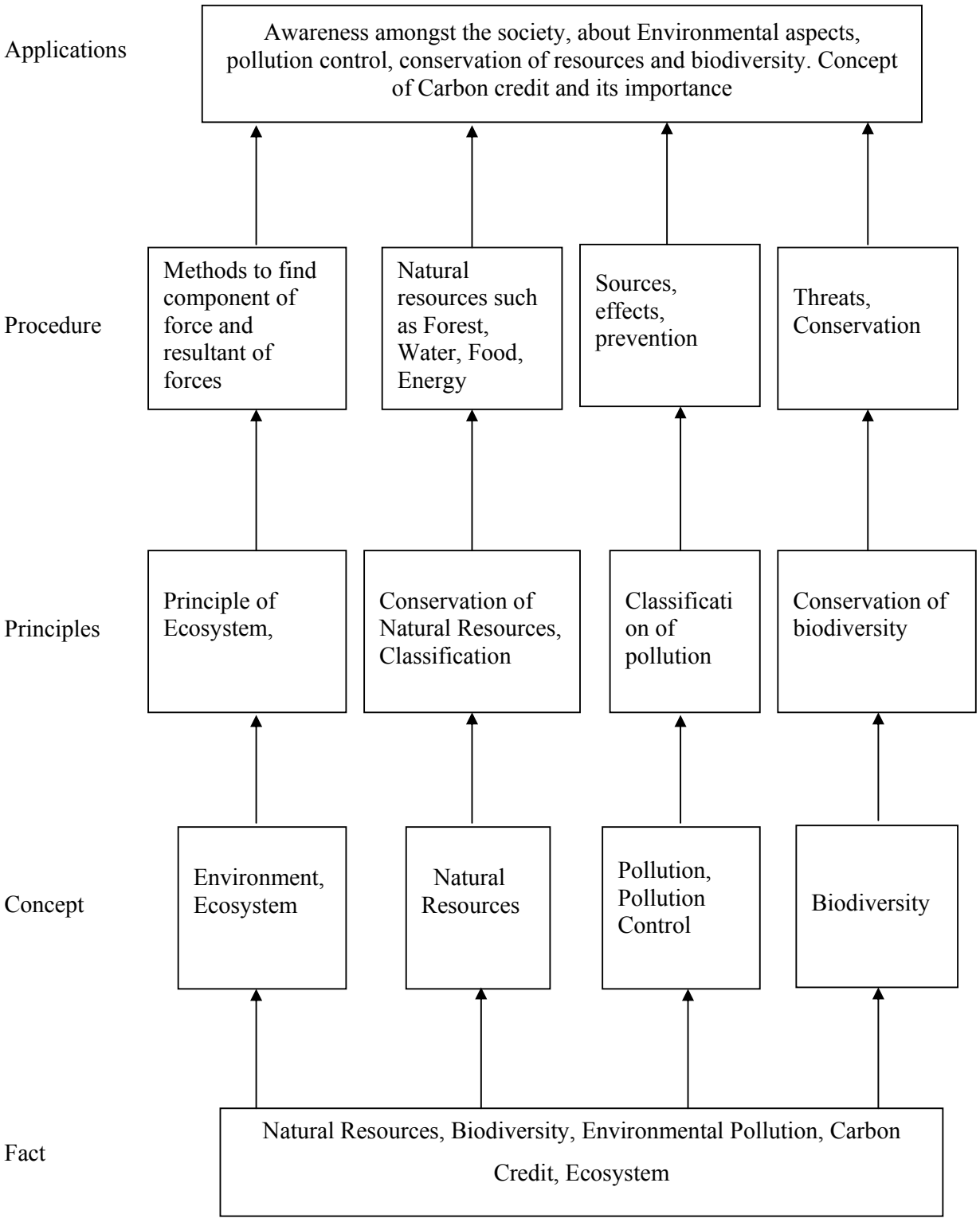
It is therefore necessary to study environmental issues to realize how human activities affect the environment and what could be possible remedies or precautions which need to be taken to protect the environment.

The curriculum covers the aspects about environment such as Environment and Ecology, Environmental impacts on human activities, Water resources and water quality, Mineral resources and mining, Forests, etc.

General Objectives: The student will be able to**,**

1. Understand importance of environment
2. Know key issues about environment
3. Understands the reasons for environment degradation
4. Know aspects about improvement methods
5. Know initiatives taken by the world bodies to restrict and reduce degradation

Learning Structure:



Theory:

Topic and Contents	Hours	Marks
Topic 1: Nature of Environmental Studies Specific Objectives: ➢ Define the terms related to Environmental Studies ➢ State importance of awareness about environment in general public **Contents:** • Definition, Scope and Importance of the environmental studies • Importance of the studies irrespective of course • Need for creating public awareness about environmental issues	01	04
Topic 2: Natural Resources and Associated Problems Specific Objectives: ➢ Define natural resources and identify problems associated with them ➢ Identify uses and their overexploitation ➢ Identify alternate resources and their importance for environment **Contents:** 2.1 Renewable and Non renewable resources • Definition • Associated problems 2.2 Forest Resources • General description of forest resources • Functions and benefits of forest resources • Effects on environment due to deforestation, Timber extraction, Building of dams, waterways etc. 2.3 Water Resources • Hydrosphere: Different sources of water • Use and overexploitation of surface and ground water • Effect of floods, draught, dams etc. on water resources and community 2.4 Mineral Resources: • Categories of mineral resources • Basics of mining activities • Mine safety • Effect of mining on environment 2.5 Food Resources: • Food for all • Effects of modern agriculture • World food problem	04	10
Topic 3. Ecosystems • Concept of Ecosystem • Structure and functions of ecosystem • Energy flow in ecosystem • Major ecosystems in the world	01	04
Topic 4. Biodiversity and Its Conservation • Definition of Biodiversity • Levels of biodiversity	02	06

• Value of biodiversity • Threats to biodiversity • Conservation of biodiversity		
Topic 5. Environmental Pollution • Definition • Air pollution: Definition, Classification, sources, effects, prevention • Water Pollution: Definition, Classification, sources, effects, prevention • Soil Pollution: Definition, sources, effects, prevention • Noise Pollution: Definition, sources, effects, prevention	03	08
Topic 6. Social Issues and Environment • Concept of development, sustainable development • Water conservation, Watershed management, Rain water harvesting: Definition, Methods and Benefits • Climate Change, Global warming, Acid rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust: Basic concepts and their effect on climate • Concept of Carbon Credits and its advantages	03	10
Topic 7. Environmental Protection Brief description of the following acts and their provisions: • Environmental Protection Act • Air (Prevention and Control of Pollution) Act • Water (Prevention and Control of Pollution) Act • Wildlife Protection Act • Forest Conservation Act Population Growth: Aspects, importance and effect on environment • Human Health and Human Rights	02	08
Total	**16**	**50**

Practical:
Skills to be developed:

Intellectual Skills:

1. Collection of information, data
2. Analysis of data
3. Report writing

Motor Skills:

1. Presentation Skills
2. Use of multi media

List of Projects:

Note: Any one project of the following:

1. Visit to a local area to document environmental assets such as river / forest / grassland / hill / mountain.
2. Visit to a local polluted site: Urban/Rural/Industrial/Agricultural.
3. Study of common plants, insects, birds
4. Study of simple ecosystems of ponds, river, hill slopes etc.

Prepare a project report on the findings of the visit illustrating environment related facts, analysis and conclusion. Also suggest remedies to improve environment.

Learning Resources:
Books:

Sr. No.	Author	Title	Publisher
01	Anindita Basak	Environmental Studies	Pearson Education
02	R. Rajgopalan	Environmental Studies from Crises to Cure	Oxford University Press
03	Dr. R. J. Ranjit Daniels, Dr. Jagdish Krishnaswamy	Environmental Studies	Wiley India

Course Name : Diploma in Chemical Engineering/ Plastic Engineering

Course code : CH / PS

Semester : Fourth

Subject Title : Electrical and Electronics

Subject Code : 17424

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
04	--	02*	03	100	--	--	25@	125

*** - Practicals of Electrical & Electronics at alternate week.**

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

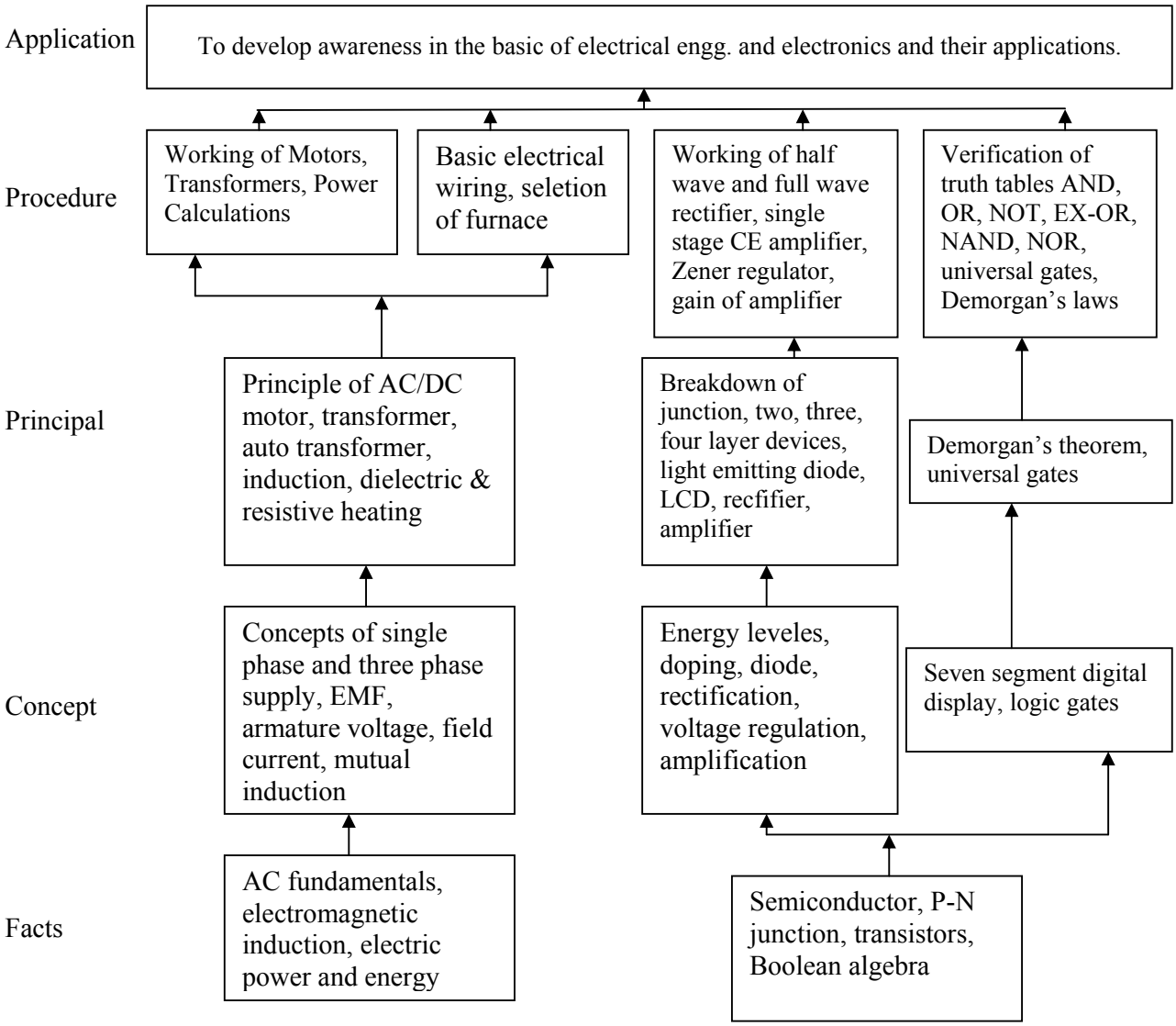
Most of the equipments used in chemical industry are electrically powered. A minor electrical faults can be attended by a shop floor chemical engineer. This subject of electrical engg. addresses the fundamental concepts and operating principles of electrical appliances. It will enable the students in better handling and commissioning of the equipments.

The second section of the subject deals with the basic of semiconductor devices and their circuits necessary for the electronic control gadgets. It provides the information about logic gates, digital displays, small signal amplifiers and power supplies. This will help the students in building skills of effective handling of electronic control equipments.

General Objectives: Student will be able to develop:

- Awareness of Electrical Safety.
- Recognize Electrical fault in Chemical Plant.
- Recognize fault in power supply, display & control panel.
- Understand working of basic semiconductor devices.

Learning Structure:



Theory: :

Section- I
Electrical Engineering

Topic and Content	Hours	Marks
Topic 1: Basic Fundamentals Specific Objectives: ➢ State principle of electromagnetic induction. ➢ Calculate electrical power and energy from given data. Contents: • Ohm's Law – Simple problems on Ohm's Law • Types of supply – A.C. & D.C., definition, representation & comparison. • Principle of electromagnetic induction. • Concept of single Phase & Three Phase A.C. supply, comparison. • Electrical power, energy – definition, equation, simple problems. • Power factor & its importance	07	10
Topics 2: D.C. Motor Specific Objectives: ➢ Draw electrical circuit diagram of D.C. shunt motor. ➢ Draw diagram & explain armature voltage speed control method. Contents: • Working principle, construction, different parts – their material & application. • Types of D.C. motor – Electrical circuit of D.C shunt & series motor. • Speed control of D.C Shunt & Series motor. • Necessity of starter & its principle. • Applications of D.C. motors related to chemical plant.	06	10
Topics 3: A.C. Motor Specific Objectives: ➢ Draw electrical circuit diagram of R – Split single phase induction motor. ➢ State any four parts & their material used for three phase induction motor. Contents: • Three phase induction motor – working principle, construction & application. • Construction, working & application of following single phase induction motors. R – Split, C – Split.	05	08
Topics 4: Transformer Specific Objectives: ➢ Compare core type & shell type transformer. ➢ Define voltage ratio, current ratio & transformation ratio of single phase transformer. Contents: • Working principle of transformer, Elementary theory of an ideal transformer.	06	10

• Construction of core & shell type transformer, comparison. • EMF equation (No Derivation), simple problems. • Transformation ratio – simple problems. • Autotransformer – Concept, advantages, limitations, applications.		
Topics 5: Electrical Wiring & Safety Specific Objectives: ➢ State the necessity of fuse. ➢ State the necessity of earthing. Contents: • Types of wires – V.I.R. , P.V.C. ,T.R.S., Specifications as per IS code. • Fuse – Necessity, kit-kat & HRC fuse - construction, working. • Circuit breakers – MCCB, ELCB, principle & application. • Electrical wiring – one lamp controlled by single way switch, two lamp controlled by two single way switches (independently), stair case wiring, godown wiring. • Lamps – Incandescent lamp, fluorescent lamp, mercury vapour & sodium vapour lamp - construction, application. • Electrical safety – Safety precautions, Instruction for restoration of persons suffering from electric shock. • Earthing – Need, Types – plate & pipe	08	12
Total	**32**	**50**

Section- II
Electronics

Topic and Content	Hours	Marks
Topic 1: Semiconductor Electronic Devices Specific Objectives: ➢ Draw V-I characteristics of different devices. ➢ State the symbols of different components. Contents: 1.1 ---------- 12 **Marks** • Resistor, inductor, capacitor – definition, symbols & applications. • Conductors, semiconductors, Insulators – definition, energy band diagram, examples. • Semiconductors classification – Intrinsic and Extrinsic – N type & P type, definition, charge carrier. • PN junction diode – construction, symbol, working, forward & reverse bias V-I characteristic, applications. • Light emitting diode – Construction, symbol, working principle, applications. • Junction breakdown. • Zener diode - Construction, symbol, working principle, reverse bias V-I characteristic, applications. 1.2 Power devices - (08 marks) SCR - Construction, symbol, working principle, Applications. TRIAC - Construction, symbol, working principle, Applications.	12	20
Topics 2: Bipolar Junction Transistor Specific Objectives:	06	08

➢ Draw output characteristics of CE configuration. ➢ Describe working of transistor amplifier. Contents: • BJT types – NPN & PNP , their symbols & construction, • Working of a NPN transistor. • Transistor characteristics – Common emitter configuration. • Single stage CE amplifier – circuit diagram & working. • Power amplifier – Concept & types. • Applications of transistor.		
Topics 3: Power Supply Specific Objectives: ➢ Draw block diagram of power supply. ➢ Describe working of different rectifier circuits. Contents: • Power supply – Necessity, block diagram. • Rectifier – Types, Half wave, Full wave (center tapped & bridge type) - Circuit diagram, working, waveforms & their comparison. • Filter - Need & types – shunt capacitor, series inductor, LC & π type, circuit diagram. • Voltage regulator - Need, principle of zener shunt regulator.	07	12
Topics 4: Digital circuits Specific Objectives: ➢ State symbols of different logic gates. ➢ Use NAND / NOR gate as universal gates. Contents: • Digital signal, Negative & positive logic. • Boolean algebra. • Logic gates – AND, OR, NOT, NAND, NOR, EX-OR , Symbols, logic expressions ,truth table. • De- Morgan,s theorems – statement, proof using truth table. • Universal gates – definition, NAND, NOR. Digital display – Types of LED & LCD display	07	10
Total	**32**	**50**

Practical:
Skills to be developed:

Intellectual Skills:

- Correlate speed of the motor with its other parameters.
- Identify the simple faults in electrical and electronics systems.

Motor Skills:

- Use various tools and components for different electrical applications.
- Handle various electronic test and measuring equipments.

List of Practicals:
Section-I

1) To verify ohm's law.
2) To measure electrical Power in Single phase AC circuit.
3) To plot the Speed & Armature voltage characteristics of DC shunt motor.
4) To plot the Speed & field current characteristics of DC shunt motor.
5) To determine transformation ratio of single phase transformer.
6) To prepare wiring for one lamp controlled by Single way switch.

Section-II

1) To operate the various laboratory equipments & measuring instruments like power Supply, CRO, DMM.
2) To plot forward & reverse characteristics of Silicon Diode.
3) To measure percentage line regulation of Shunt Zener regulator.
4) To measure voltage gain of single stage common Emitter amplifier at 1 khz.
5) To verify the truth tables of various logic gates.
6) To verify De - Morgan' s First theorem.

Learning Resources:
Books:

Sr. No.	Author	Title	Publisher
1	B.L. Theraja	Electrical Technology Vol. 1 & 2	S.Chand & Company Ltd.
2	S.L. Uppal	Electrical Power	Khanna Publishers, Delhi.
3	N.N. Bhargava, S.C. Gupta	Basic Electronics & Linear N.N. Bhargava, Technical Teachers Circuits	Technical Teachers Training Institute
4	B.L. Theraja	Basic Electronics (Solid State)	S.Chand & Company Ltd.
5	R.P. Jain	Modern Digital Electronics	Tata Mc Graw Hill, Delhi.
6	B.D.Arora	Electrical Wiring & Estimation Costing	R.B. Publications

Course Name : Diploma in Plastic Engineering

Course Code : PS

Semester : Fourth

Subject Title : Polymer Chemistry

Subject Code : 17446

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	50#	--	25@	175

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

As per the present requirement new polymer materials are being invented and some are modified. The properties of these materials depend on the structure of polymer molucules. This subject provides information about monomers and organic chemical compounds. The basic understanding of polymerization reaction, its mechanism will help students to understand classification of polymers.

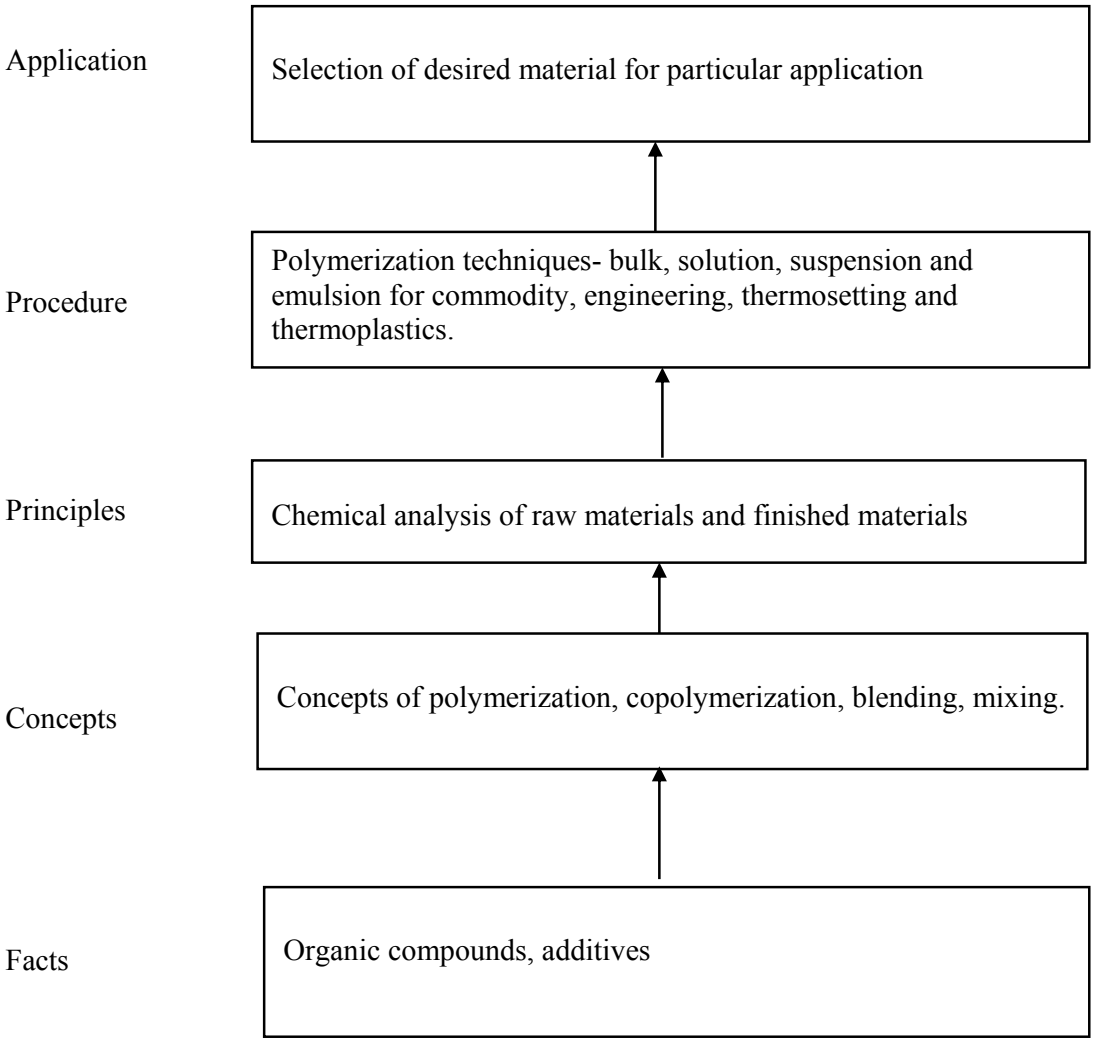
It is a Prerequisite to understand the properties of polymer materials and their applications.

Objectives:

Students should be able to:

1. Classify various organic compounds used for polymer preparation.
2. Differentiate between types of polymers and their applications.
3. Describe various polymerization reactions.
4. Select appropriate polymer on the basis of molecular weight and properties.
5. State the effect of structure on the properties of polymer.

Learning Structure:



Theory

Chapter	Name of Topics	Hours	Marks
1	**Introduction to Polymers:** **Specific Objectives: -** Students should be able to ➢ Define the polymer, monomer and polymerization. ➢ Classify the polymers. ➢ Differentiate between Thermoplastic & Thermosetting plastic. **Content:** Classification of polymers natural, synthetic, organic, inorganic polymers, Plastics, elastomers, fibers & resins. Thermoplastic and Thermosetting plastics, commodity and Engineering plastics, homopolymer, copolymers-alternate, block, random & graft copolymers.	06	16
2	**Polymerization Reactions :** **Specific Objectives: -** Students should be able to ➢ Describe various polymerization reactions. ➢ Understand the concept of functionality, co-polymerization, and free radicals. **Content:** Addition polymerization, Free radical polymerization, Ionic polymerization, Co-ordination polymerization, chain transfer reaction. (Initiation, propagation, termination of each technique). Concept of functionality & its importance, step polymerization, polycondensation, Basic concepts and types of co-polymerization, free radical, ionic & co poly condensation.	10	26
3	**Polymerization Techniques (Introductory Level):** **Specific Objectives: -** Students should be able to ➢ Describe various polymerization techniques. ➢ Compare different techniques with respect to salient features. **Content:** Bulk, Solution, Suspension and Emulsion polymerization, their merits and demerits, comparison of different techniques (salient features).	08	16
4	**Molecular Weight of Polymer:** **Specific Objectives: -** Students should be able to ➢ Select appropriate polymer on the basis of molecular weight and properties. ➢ Determine the average molecular weight by using different instruments. ➢ Understand the concept of 'K' value. **Content:** Concept of average molecular weight i.e. weight average molecular weight and number average molecular weight, molecular weight distribution. Methods for the determination of the average molecular weight of polymers for e.g. Viscometry, Cryoscopy, Ebulliometry, Osmosis, End group analysis, Ultra centrifugation, Sedimentation, concept of 'K' value, practical significance of average molecular weight.	10	22
5	**Significance of Glass transition temperature in Polymers:**	08	10

	Specific Objectives: - Students should be able to ➢ Define glass transition temperature. ➢ Know the importance of glass transition temperature. **Content:** What is glass transition temperature? Factors influencing the glass transition temperature, glass transition temperature and molecular weight, glass transition temperature and plasticizers, glass transition temperature of copolymers, glass transition temperature and melting point, importance of glass transition temperature.		
6	**Degradation of Polymers:** **Specific Objectives: -** Students should be able to ➢ Define the polymer degradation. ➢ Understand the concept of different types of polymer degradation. ➢ Prevent the polymer degradation. **Content:** What is Polymer degradation? Mechanical, Oxidative, Thermal, UV Degradation, Prevention of degradation.	06	10
	TOTAL	**48**	**100**

PRACTICALS:
Skills to be developed:

Intellectual Skills:

1. To prepare the various polymers.
2. To analyze the structure of polymer.
3. To calculate the density of polymer.
4. To distinguish the various polymer.
5. To classify the polymer according to their sources.
6. To analyze the properties of polymer.
7. To compare the various chemicals.

Motor Skills:

1. To handle the instruments properly.
2. To handle the chemicals carefully.
3. To identify the different solvents for different polymers.
4. To find out the different solvents for different polymers.
5. To identify the chemicals.
6. To classify the monomers.

List of Practicals:

1. To prepare Phenol Formaldehyde resin.

2. To prepare Urea Formaldehyde resin.
3. To prepare polystyrene by bulk polymerization technique.
4. To determine Hydroxyl value of given polymer.
5. To determine the viscosity of polymer solution by Ostwald viscometer.
6. To determine the melting point of given polymer.
7. To prepare the Polystyrene by Bulk Polymerization.
8. To compare properties of emulsion & suspension polymer (PVC) from industrial data. (Case Study)
9. To demonstrate manufacturing process of unsaturated polyesters.
10. To demonstrate manufacturing process of epoxies.
11. To demonstrate manufacturing process of alkyds.
12. To demonstrate manufacturing process of PMMA by solution polymerization.

References:

Books:

1. Text Book of Polymer Science By Clindsivy Billmeyer (Willey Interscience)
2. Polymer Science By V. R. Gowarikar (Willey Interscience)
3. Outline of Polymer Technology By R.P.Sinha
4. Text Book of Polymer Science By Ghosh
5. Text Book of Polymer Chemistry By P.J.Flory
6. Plastic Materials by J. A. Brydson (Butterworth)
7. Properties and Structure of Polymers By A. V. Tobolsky (John Will's & Sons)

Course Name : Diploma in Plastics Engineering

Course Code : PS

Semester : Fourth

Subject Title : Plastics Materials

Subject Code : 17448

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
04	--	02	03	100	25#	--	25@	150

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

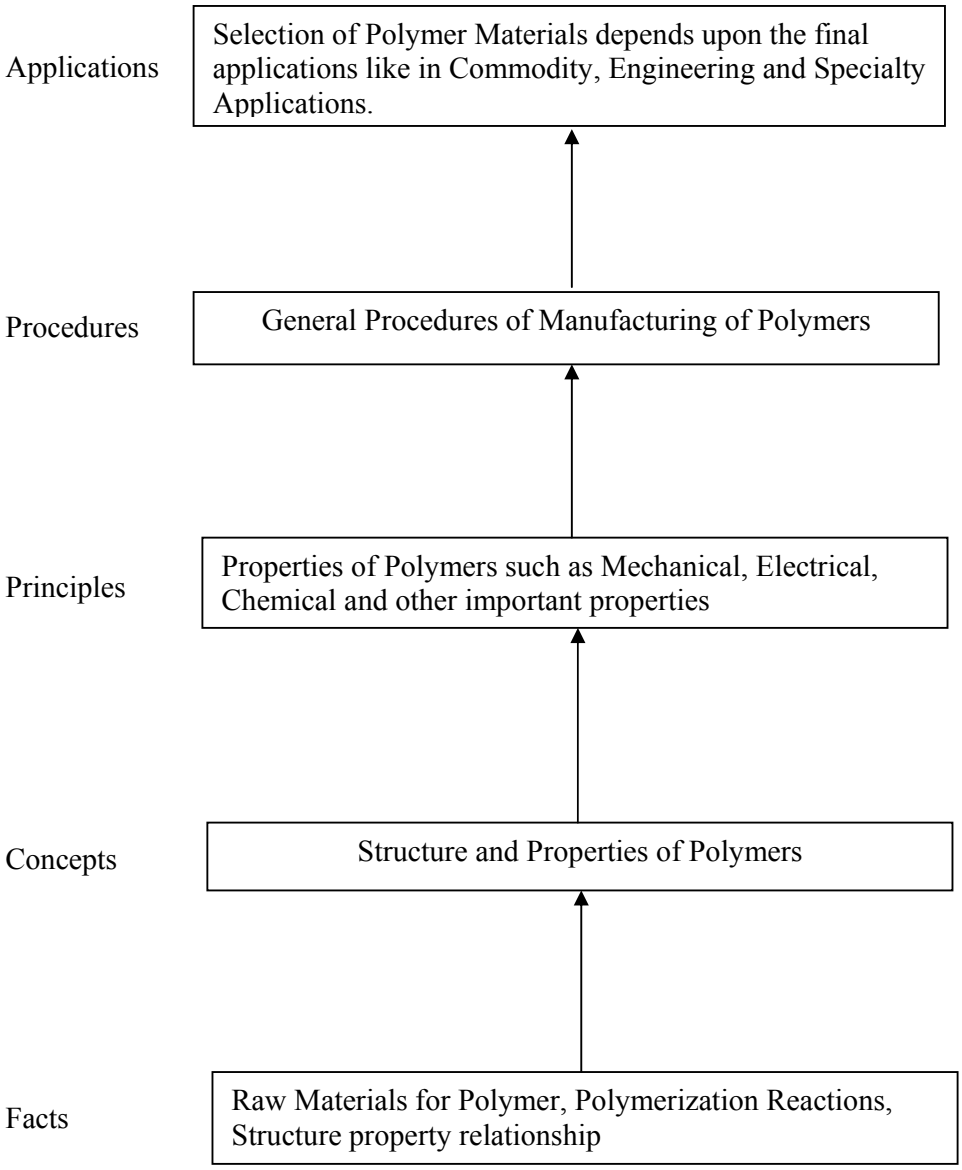
Rationale:

This is an important subject for Plastic engineering. The course gives clear picture of types of Polymer Materials, their Grade and their end applications. The course summarize the Thermoplastic and Thermosetting materials, imparts knowledge about the preparation of Polymer material, which are used in plastic processing industries.

Objectives:

1. To classify the plastics materials used in plastic industries.
2. To elaborate the features of preparation of plastic materials.
3. To interpret the property & application relationship
4. To select suitable plastics material depending on the end application.
5. To compare the different plastic materials according to their properties and structure.
6. To identify the given unknown plastics material.

Learning Structure:



Theory:

Chapter	Name of Topics	Hours	Marks
1	**History & Development of Plastics:** Specific Objectives: ➢ Classify Polymers. ➢ Know the origin of Plastic Materials. **Contents:** • Revision of polymers, its classification, Origin of the materials.	02	02
2	**Principle of Manufacturing, Properties & Applications of Plastics (Detail description of Manufacturing and flow sheet not expected)** **Commodity Plastics:** Specific Objectives: ➢ Classify the plastics materials used in plastic industries. ➢ Understand the Principle of Manufacturing of different Plastic Materials. **Contents:** • Polyethylene (High pressure and low pressure process), Polypropylene (using Ziegler-Natta catalyst process), Polystyrene (using suspension and bulk polymerization technique), High impact polystyrene, Expanded polystyrene. • Poly (methyl methacrylate), Polyacryloamides, Polyacrylonitrile. • Poly (vinyl alcohol) by Hydrolysis process, Poly (vinyl acetate), Poly (vinyl chloride) by cracking process. • Polyesters such as Poly (ethylene terphthalate) and poly (butylenes terphthalate) • Cellulosic's – cellulose and its sources, cellulose nitrate, cellulose acetate and cellulose acetate butyrate.	10 04 06 04 04	18 06 08 08 08
3	**Principle of Manufacturing, Properties & Applications of Plastics (Detail description of Manufacturing and flow sheet not expected)** **Engineering Plastics:** Specific Objectives: ➢ Elaborate the features of preparation of plastic materials. ➢ Interpret properties and applications relationship. ➢ Compare the different plastic materials according to their properties and structures. **Contents:** • Acrylonitrile Butadien Styrene, Polycarbonate, Polyacetals, Polyamides such as Nylon-6, Nylon-66, Polyphenyleneoxide, Polytetrafluroethylene.	10	14
4	**Principle of Manufacturing, Properties & Applications of Plastics (Detail description of Manufacturing and flow sheet not expected)** **Thermosetting Plastics:** Specific Objectives: ➢ Prepare the plastic materials by laboratory method. ➢ Follow standard procedure for polymer preparation. **Contents:**	08	12

	• Phenol formaldehyde, Urea formaldehyde, Melamine formaldehyde, Epoxy, Polyurethane, Unsaturated polyester.		
5	**Principle of Manufacturing, Properties & Applications of Plastics (Detail description of Manufacturing and flow sheet not expected)** **Engineering Plastics:** Specific Objectives: ➢ Compare the plastic materials according to their properties. ➢ Select suitable plastic materials depending on the end applications. ➢ Identify plastics by flame test. **Contents:** • Ethylene vinyl acetate, Styrene acrylonitrile, PPS, PEEK, Polyamide-imide, Bismelamide.	06	08
6	**Additives & Compounding :** Specific Objectives: ➢ Use different additives for Plastic Materials Processing. ➢ Select the suitable compounding equipments. **Contents:** • Need of compounding, Plasticizers, Heat and Light stabilizers, Fillers, Colorants, Lubricants, Extenders, Flame retardants, Impact modifiers, Blowing agents, their functions, examples and selection criteria. Equipments of compounding such as Tumbler mixer, High speed mixer, Internal mixer, Batch mixer, Continuous mixer, Two roll mill and Banbury mixer.	10	16
	Total	**64**	**100**

Practical:
Skills to be developed:

Intellectual Skill

1. To prepare the plastics materials by laboratory methods
2. To select additives for compounding of plastics materials.
3. To compare the plastics materials according to their properties
4. To select the suitable compounding equipment.

Motor Skills

1. To follow standard procedure of polymer preparation.
2. To run machine successfully.
3. To understand the operation of machine.
4. To identify plastics by flame test.

List of Practicals:

Sr. No.	List of Experiments
Identification of commodity plastics by flame and solvent test	
1	To identify the given polymer : Polystyrene (PS)
2	To identify the given polymer : Poly Vinyl Chloride (PVC)
3	To identify the given polymer : Low Density Polyethylene (LDPE)
4	To identify the given polymer : High Density Polyethylene (HDPE)
5	To identify the given polymer : Polypropylene (PP)
6	To prepare compound of Poly (vinyl chloride) by high speed mixer.
7	To Mix the additives with plastics by tumbler mixer.
8	To determine the Bulk factor of Plastic Materials.
9	To determine density of plastic material.
10	To determine acid value of given plastic material.
11	To determine iodine value of given plastic material.
12	Determination of moisture content of plastics materials.
13	Determination of softening range of polymers.
14	Simple test for cure of plastic articles and laminates.

Learning Resources:
Books:

Sr. No.	Title	Author	Publisher
1	Plastic Materials	J. A. Brydson	Butterworth
2	Polymer Science	V. R. Gowarikar	Willey Interscience
3	Text Book of Polymer Science	Clindsivy Billmeyer	Willey Interscience
4	PVC Technology	Titow	Willey Interscience
5	Handbook of Additives	John Murphy	Willey Interscience
6	A Text Book of Polymer (Chem. & Technology of Polymer, Vol. 1 & Vol. 2)	M. S. Bhatnagar	--
7	Plastics Material Properties & Application (Vol. 1,2,3)	Birlen	Willey Interscience
8	Handbook of Plastics Material & Technology	Rubin	Willey Interscience

Course Name : Diploma in Plastics Engineering

Course Code : PS

Semester : Fourth

Subject Title : Plastics Processing-I

Subject Code : 17449

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
04	--	02	03	100	--	25#	--	125

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

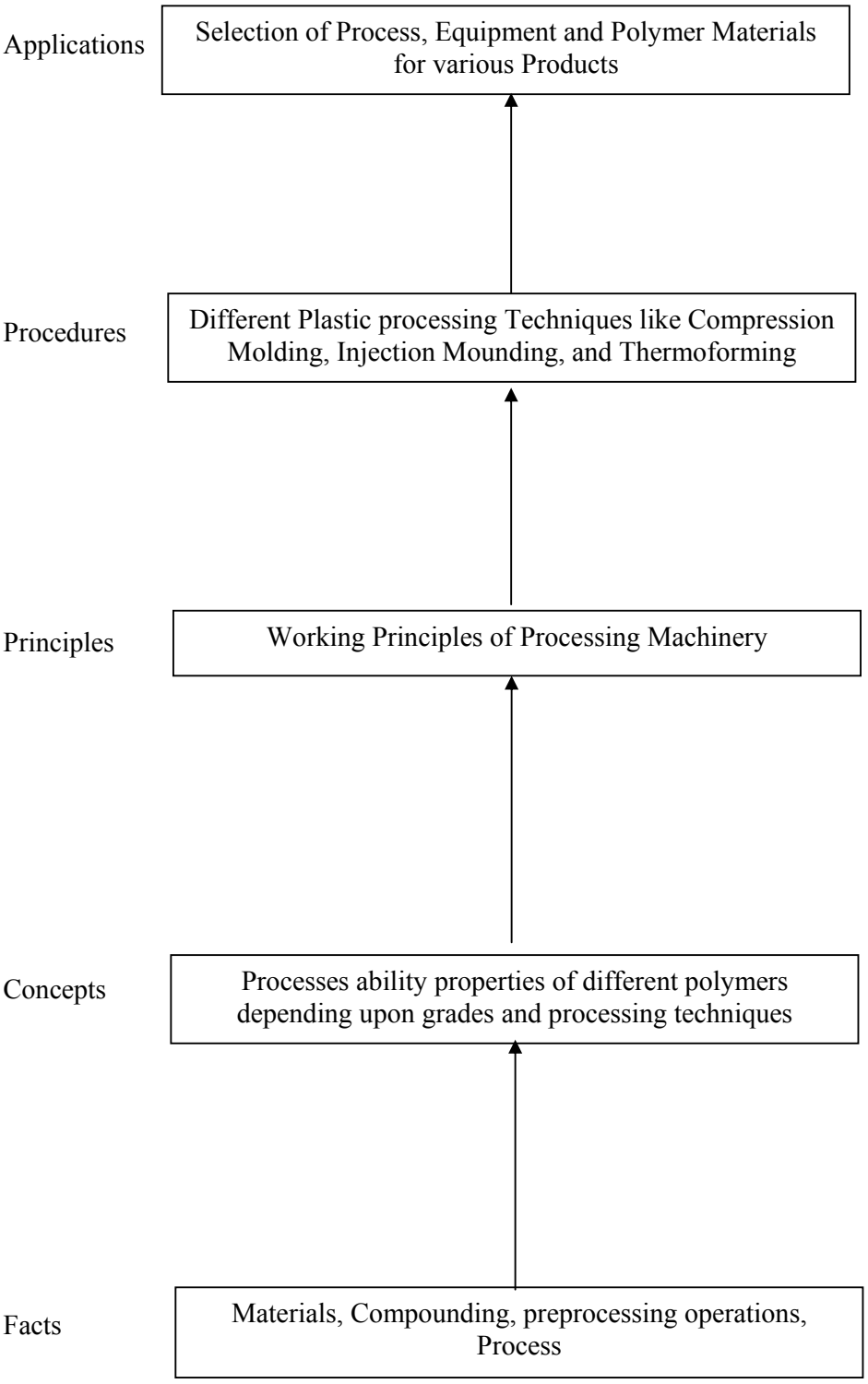
Rationale:

Plastic engineers are supposed to with various plastic processing machines .This course is introduce to induce abilities among the technician by providing the knowledge work of principle construction working and setting parameters of various machinery used for the plastic processing. This course also gives knowledge of process optimization.

Objectives:

1. To select suitable processing technique.
2. To optimize the process.
3. To understand the principle and operation of processing technique.
4. To analyze and overcome the faults arising during processing.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
1	**Extrusion:** Specific Objectives**:** The student will be able to: ➢ Analyse practical significance of extrusion ➢ Describe configuration of extrusion ➢ Find faults, causes and remedies in extruded product **Contents** • Basic process, Single screw extruder- constructional features of different parts such as hopper barrel, screw, heating and cooling systems, breaker plate and screen pack etc. Drive systems for extruder**. (06 Marks)** • Extrusion line diagrams a) Pelletizing unit. Pipe extrusion- Process plant layout and auxiliary equipments such as sizing device, cooling trough, take-off unit, cutter, and coiler. Tilting platform socketing, printing. b) Sheet extrusion- process layout and auxiliary equipments such as cooling unit, stripping roll-unit, gauging heads, cut-out unit, sheet stacker and coiler. c) Blown film extrusion- process plant layout and auxiliary equipments such as venture ring support, bubble blowing unit, cooling unit, bubble collapsing plates film treatment winder unit, co extrusion **(12 Marks)** • Extrusion Dies Description and constructional details of the following extrusion dies. Basic die terminology, General design considerations. Wire and cable coating die, Pipe die and their types- Plain pipe and corrugated pipe, Sheet die and cast film die- Coat hanger die, T-die, and fish tail die, control of thickness.Types of blown film die - side fed & bottom fed**. (10 Mark)** • Twin screw extruder - Types of screw, co-rotating, counter rotating, Driving mechanism, its comparison with single screw. Trouble shooting in extrusion i.e. defects, causes and remedies. **(06 Mark)**	17	34
2	**Injection Moulding:** Specific Objectives**:** The student will be able to: ➢ Analyse practical significance of injection moulding ➢ Describe configuration of injection moulding ➢ Discuss the trouble shooting guide for injection Molding **Contents** • Basic process, types of injection moulding machine- plunger type, screw type moulding machine, criteria for its selection. **(06 Marks)** • Injection moulding cycle, moulding materials. Constructional features of hopper, barrel, screw, nozzle. Description of injection unit, shot capacity, plasticizing capacity, injection pressure. Description of locking unit, mould clamping force, size of platen, daylight opening**.**	17	30

	(10 Marks) • Comparison between mechanical and hydraulic clamping system. Effect of processing parameters on quality of product. Advantages and disadvantages of injection moulding. Moulding defects-causes and remedies**.(08 Mark)** • Injection Moulding of thermosets. Gas assisted injection moulding Reaction injection moulding- basic process, materials & applications. **(06Mark)**		
3	**Blow Moulding** Specific Objectives**:** The student will be able to: ➢ Analyse practical significance of blow moulding, ➢ Describe configuration of blow moulding, ➢ Find faults, causes and remedies in blow moulded products. **Contents-** • Principle, materials and applications, Types of blow molding - continuous extrusion, intermittent extrusion, injection and stretch blow moulding. **(06 Mark)** • Parision cutting devices, Parison thickness control methods, Process parameters and their effect on quality of products, Trouble shooting **(04 Mark)**	14	10
4	**4. Thermoforming:** Specific Objectives**:** The student will be able to: ➢ Analyse practical significance of therforming ➢ Describe configuration of therforming ➢ Know process variables in therforming. ➢ Find defects, causes and remedies in therforming. **Contents-** • Basic process, materials and applications. Methods of Thermoforming, plug assist forming, Drape forming, plug and Ring forming, Slip forming, Ridge forming, Reverse Draw with plug Assists, vacuum forming, snap back forming, match mold forming, plug & ring, pressure forming, dual - sheet forming , trimming methods **(08 Mark)** • Process variables:- air temperature, mould temperature, plastic memory , hot elongation /strength, Remedies and causes of defects in thermoforming. Advantages and disadvantages of thermoforming. Comparison of thermoforming with injection moulding. **(06 Mark)**	10	14
5	**Cellular Plastics-** Specific Objective The student should be able to ➢ Distinguish the application of cellular plastic products ➢ Analyse the practical significance of cellular plastics ➢ Acquire skill of identifying the art of cellular plastics ➢ Understading the principle and operation of calendaring process.	06	12

	Contents: • Basic process, methods of foam manufacturing, chemical blowing agents, choice of chemical blowing agents (azobis isobutyro nitril, dinitroso petamethylene tetramine, azodicarbonamide, benzene sulphonylhydrazide**),(04 Mark)** • Methods of preparation, properties and applications of following foams,-- Polyurethane foam - processing rigid PU foam, processing flexible PU foam (Slab Stock Process), Properties of PU foam, Applications of PU foam. PS foam:- Extruded PS foam and moulded bead PS foam, PS foam properties, applications for PS foam. PVC foam :- method of preparation of PVC foam by using chemical blowing agent, properties, applications**.(08 Mark)**		
	Total	**64**	**100**

Practicals:
Intellectual Skills:

1. Select the process
2. Set process parameters for accurate molding
3. Find out faults of machine ,product during processing & set remedies accordingly
4. Optimization of process

Motor Skills:

1. Start & stop the machine.
2. Select the proper machine for particular job work.
3. Loading & unloading the molds.
4. Run the process successfully without hazards.
5. Take safety precaution during processing.

List of Praticals:

1. Trial on hand injection moulding machine
2. Demonstrate Compression molding process
3. To measure technical specification of single screw extruder
4. To study effect of process parameter on quality of injection molding product.
5. Trial on blow molding machine
6. To study effect of process parameter on quality of blow molding product
7. To demonstrate loading and unloading of injection mould on machine.
8. Trouble shooting in injection moulding.
9. Trial on extrusion blow moulding machine
10. Trouble shooting in blow moulding

11. To demonstrate thermoforming process.

Learning Resources:
Books:

Sr. No.	Title	Author	Publisher
1	Compression and Transfer Moulding	J. Butler	--
2	SPI Plastics Engineering Hand Book	Michael L. Berino	Chapman & hall
3	Handbook of Injection Moulding	Rosato	--
4	Handbook of thermoforming	Throne	HANSER
5	Basic Principles of Thermoforming	Bruins	SPC
6	Plastics Extraction Tech. Handbook	Sidney Lery	Industrial Press
7	A textbook of polymer (chemistry & tech of polymers)	M.S.Bhatnagar	--
8	Moulding of thermosetting plastics	Whealane	--
9	Handbook of Blow Moulding	Rosato	Hanser

Course Name : Diploma in Plastics Engineering

Course Code : PS

Semester : Fourth

Subject Title : Computer Programming

Subject Code : 17045

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
01	--	02	--	--	50@	--	--	50

Rationale:

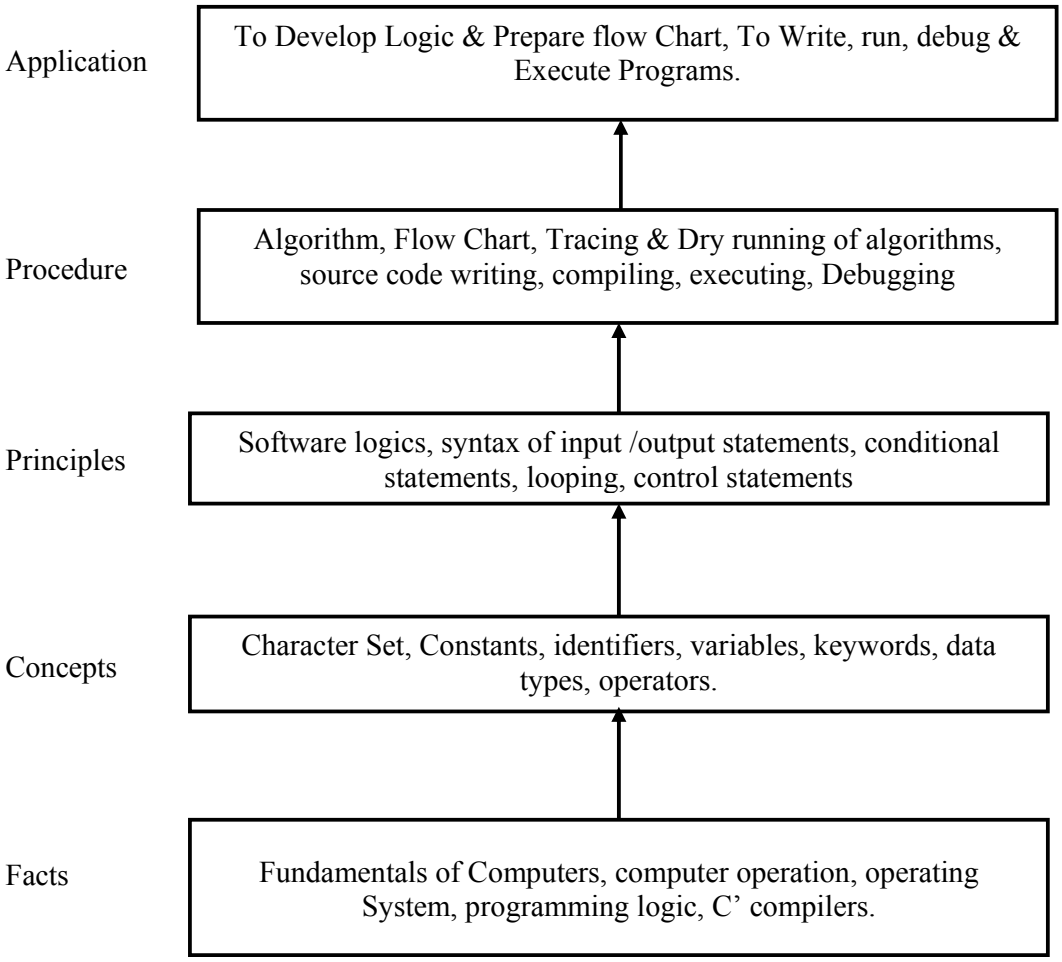
In advanced age of computer, it becomes essential to understand how to give instructions to computers. This course intends to expose a student to the basic principles of programming through a structured programming language like 'C'. Study of this course would enable the students to learn any advanced Object Oriented Language.

Objectives:

Students should be able to:

1. Break a given task into subtasks.
2. Enhance logical thinking.
3. Develop 'C' programs for simple applications.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours
1	**Introduction:** Problem, definition and analysis, algorithm, flow charts, tracing and dry running of algorithms. Introduction to 'C' programming, simple program using Turbo 'C' compiler and execution of 'C' program	02
2	C Fundamentals: Character set, constants, data types, identifiers, key words, variable declarations Types of Operators - unary, binary, arithmetic, relational, logical, assignment. Hierarchy of operators, expressions, library functions, Use of input/ output functions viz. Printf( ), Scanf( ), getch( ), putch( )	03
3	Use of Control Statements: if-else, while loop, do - while loop, for loop, switch, break and continue. Writing, Compiling, Executing and debugging programs	05
4	Introduction to Subscripted variables, arrays, defining and declaring one and two dimensional arrays, reading and writing	03
4	Concept of String, string input / output functions Defining and accessing a user defined functions, Passing of arguments, declaration of function prototypes Storage classes: automatic, external, static variables	03
	Total	**16**

Practical:
Skills to be developed:

Intellectual Skills:

1. Prepare and interpret flow chart of a given problem.
2. Represent data in various forms.
3. Use various control statements and functions

Motor Skills:

1. Write program in 'C' language.
2. Run and debug 'C' program successfully.

List of Practical:
To write simple programme having engineering application involving following statements

1. Use of Sequential structure.
2. Use of if-else statements.
3. Use of for statement.
4. Use of Do-While Statement.

5. Use of While statement.
6. Use of brake and Continue statement.
7. Use of multiple branching Switch statement.
8. Use of different format specifies using Scanf( ) and Printf( )
9. Use of one dimensional array e.g. String, finding standard deviation of a group data.
10. Use of two dimensional arrays of integers/ reals.
11. Defining a function and calling it in the main.

Learning Resources:
Books:

Sr. No.	Author	Title	Publication
01	Byron Gotfried	Introduction to 'C' programming	Tata McGraw Hill
02	Yashwant Kanitkar	Let us 'C'	BPB publications
03	Denis Ritchie and Kerninghan	Introduction to 'C' programming	Prantice Hall Publications
04	Balguruswamy	Programming in 'C'	Tata McGraw Hill

Course Name : Diploma in Plastics Engineering

Course Code : PS

Semester : Fourth

Subject Title : Professional Practices-II

Subject Code : 17046

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
--	--	03	--	--	--	--	50@	50

Rationale:

The purpose of introducing Professional practices is to fulfill the need of students to stand in today's global market with knowledge and confidence. This can be achieved by arranging industrial visits, expert lectures attitude to present them-selves, get alternative solutions and validation of the selected alternatives, socially relevant activities, and modular courses. Professional practices is helpful in broadening technology base of students beyond curriculum. Model making exercises allow students to think more creatively and innovatively and inculcating habit of working with their own hands. Modular courses are introduced with a view of learning and acquiring higher technology skills through industry experts and consultants from the respective fields.

Objectives:

The student will be able to:

1) Acquire information from different sources.
2) Prepare notes for given topics.
3) Present seminar using power projection system.
4) Interact with peers to share thoughts.
5) Work in a team and develop team spirit.

Intellectual Skill:

Student will be able to:

1) Search information from various resources.
2) Prepare notes on selected topics.
3) Participate in group discussions.

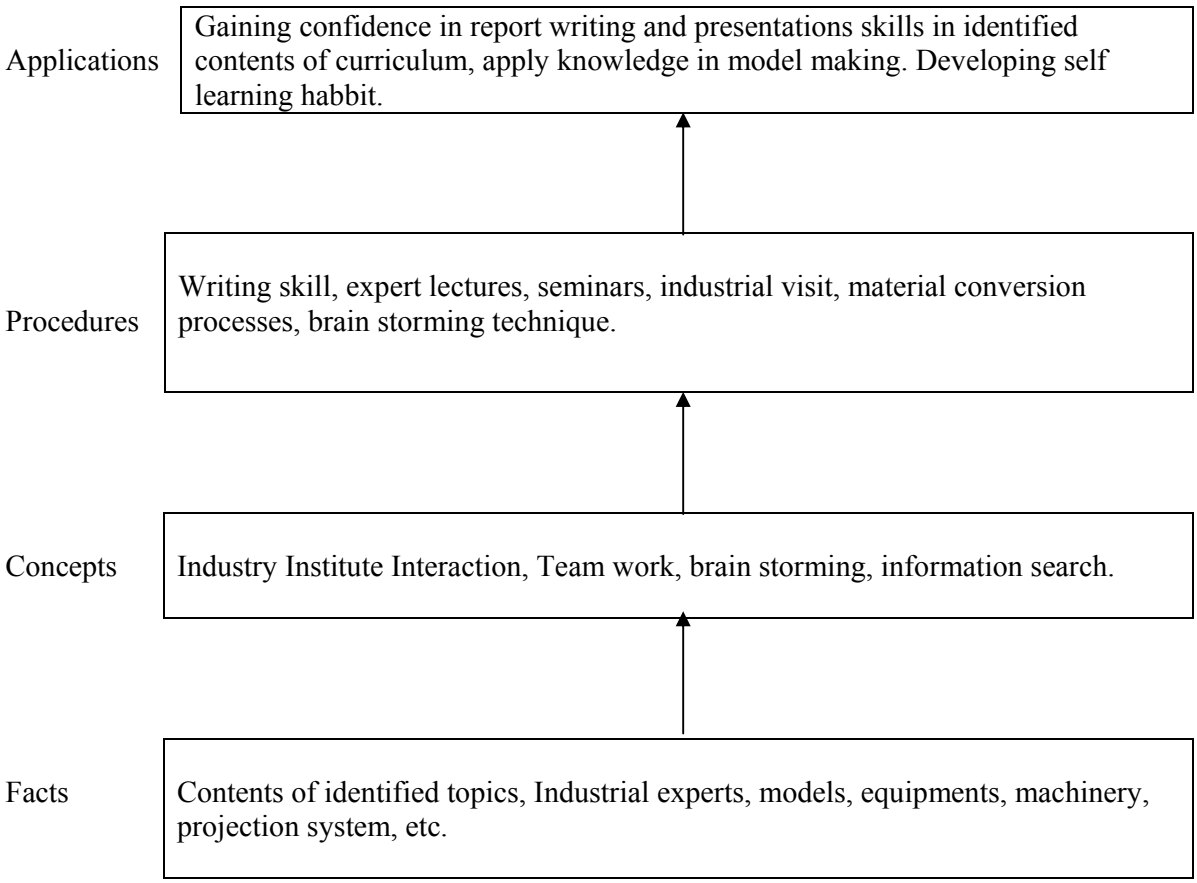
Motor Skills:

1) Observe industrial practices during visits.

2) Prepare slides / charts for presentation in seminar.

3) Develop a model

Learning Structure:



Content: Theory

Topic & Content	Hours
1. Information Search: Information search be made through manufacturers catalogue, Hand books, magazines journal and websites, and submit a report on **any Two Topics** in a group of 3 to 4 students, report size shall not be more than 10 pages. Following topics are suggested, any other equivalent topics may be selected. 1) Collect the information related to manufacturer, suppliers, grades & cost of the plastic materials. 2) Collect the information related to manufacturer, suppliers, type of the plastic machine manufacture 3) Collect the information related to manufacturer, suppliers, of the plastic mold. 4) Collect the information related to different machining carry out on mold plate. 5) Collect the information related to different heat treatment on mold material.	06
2. Lectures by professionals/Industry Experts- Two lectures of two hour duration be arranged on any two topics suggested below or any other suitable topics **to acquire practical information beyond scope of curriculum**. Students shall prepare a brief report of each lecture as a part of their term work. i) Components of project Report. ii) Various loan schemes of banks, LIC and other agencies for education and other purposes. iii) Use of plastics & rubbers in Automobiles industries. iv) Type of processes used to protect material surfaces from environmental effect. v) Product life cycle. vi) Industrial application of PTFE vii) Processing of RPVC for pipe manufacturing application. viii) Quality control in plastic industries. xiii) Industrial drives-Types, components, comparison and applications.	06
3. Seminars: One seminar be arranged on the subjects related to 4 th semester. Or topics beyond curriculum. Each student shall submit a report up to 10 pages and deliver the seminar. batch size – 2-3 students. Source of information – books, magazine , Journals, Website ,surveys, Topics suggested for guidance- i) Foam Extrusion. ii) Two component injection molding. iii) Gas assist injection molding. iv) Multilayer extrusion process. v) On line thermoforming process. vi) Quality control in injection molding. vii) Microinjection molding. viii) Fully electrical operated injection molding machine. ix) Twin screw extrusion techniques.	06

4. Industrial visits Structured industrial visits be arranged and report of the same shall be submitted by each student to form a part of the term work. No of visits- At least one Scale of industry- medium scale unit, large scale unit. Group size- practical batch Report-not exceeding 7 to 10 pages. Purpose : • To study the profile of industry • To see the advanced manufacturing processes & machinery. • To observe working of Plastic industry. • To observe working in different shops in plastic industries • To observe chip less manufacturing machines & processes. • To study process sheets, quality control charts & production drawings, Plastic testing laboratory • To observe Tool room, standards room etc. Following types of industries may be visited in & around the institute. i) Mold manufacturing ii) Extrusion molding process(Pipe/ film) iii) Thermoforming industries iv) Injection molding industries. v) Compression & transfer molding industries vi) Printing & decorating techniques industries.	08
5. Socially Relevant Activities Conduct any one activity through active participation of students and write the report. Group of students- maximum 4 Report- Not more than 6 pages List of suggested activities- (activities may be thought in terms of campus improvement) i) Awareness about carbon credit ii) Anticorruption movement iii) Awareness about cyber crimes. iv) Developing good citizens. v) Management of E- WASTE vi) Recycling of waste materials. vii) Accident prevention & enforcement of safely rules. viii) Awareness about pollution and pollution control. (Any other relevant activity may be performed).	06
6. Individual Assignment At least one Assignment from each theory subject of 4th sem. shall be chosen **to form a part of term work.** ***** Assignment shall be problem solving type, comparative study type, application oriented etc. * Subject teacher of various subjects shall prepare 'question bank 'and allot the Assignment Individually or in a group of 3to4 students.	04

7. Mini Projects Students, in a group of 4, shall perform any one activity listed below. i) Model making out of card board paper, wood, thermocol, plastics, metal, clay etc. a) Any new idea/principle converted into model b) Mechanisms c) Toggles system ii) Toy making with simple operating mechanisms iii Layout of workshop/department/college iv) Experimental set up/testing of a parameter v) Display board indicating different type of machine components like screw, barrel, heater, fasteners, couplings ,pipe fitting, valves, thermocouple, exploded views of assemblies, vi) Any relevant project which will make students to collect information & work with their own hands. Students shall arrange exhibition of all mini projects in the class/hall and present the task to the audience/ experts/examiners. The student shall submit a brief report (Max. 5 pages) of the mini project.	12

Learning Resources:

1. Books:

Sr. No.	Author	Title	Publisher
01	NRDC, Publication Bi Monthly Journal	Invention Intelligence Journal	National Research Development Corporation, GOI.
02	DK Publishing	How things works encyclopedia	DK Publishing
03	Trott	Innovation mgmt.& new product development	Pearson Education
04	Joe Tidd	Managing innovation	Winey Publication
05	E.H. McGrath, S.J.	Basic Managerial Skills for All-Ninth Edition	PHI

2. Web sites

www.start2think.com
www.Innovationgoldmine.com
www.engineeringforchange.org
www.qcfihq.com
www.wikipedia.com
www.slideshare.com
www.teachertube.com

Course Name : All Branches of Diploma in Engineering & Technology

Course Code : AE/CE/CH/CM/CO/CR/CS/CW/DE/EE/EP/IF/EJ/EN/ET/EV/EX/IC/IE/IS/ ME/MU/PG/PT/PS/CD/CV/ED/EI/FE/IU/MH/MI/DC/TC/TX/FG

Industrial Training (Optional) after 4th semester examination.

Note:- Examination in Professional Practices of 5th Semester.

INDUSTRIAL TRAINING (OPTIONAL)

Rational:-

There was a common suggestion from the industry as well as other stakeholders that curriculum of Engineering and Technology courses should have Industrial training as part of the curriculum. When this issue of industrial training was discussed it was found that it will be difficult to make industrial training compulsory for all students of all courses as it will be difficult to find placement for all the students. It is therefore now proposed that this training can be included in the curriculum as optional training for student who is willing to undertake such training on their own. The institutes will help them in getting placement or also providing them requisite documents which the student may need to get the placement.

Details:- Student can undergo training in related industries as guided by subject teachers / HOD.

- The training will be for four weeks duration in the summer vacation after the fourth semester examination is over.
- The student undergoing such training will have to submit a report of the training duly certified by the competent authority from the industry clearly indicating the achievements of the student during training. This submission is to be made after joining the institute for Fifth semester.
- The student completing this training will have to deliver a seminar on the training activities based on the report in the subject Professional Practices at Fifth Semester.
- The student undergoing this training will be exempted from attending activities under Professional Practices at Fifth semester except the seminar.
- The students who will not undergo such training will have to attend Professional Practices Classes/activities of fifth semester and will have to complete the tasks given during the semester under this head.
- There work will be evaluated on their submissions as per requirement and will be given marks out of 50. Or student may have to give seminar on training in Industry he attended.
- Institute shall encourage and guide students for Industry training.
- Evaluation:- Report of Training attended and delivery of seminar and actual experience in Industry will be evaluated in fifth semester under Profession Practices-III and marks will be given accordingly out of 50.