6.1 ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT

L	T	P
3	-	-

RATIONALE

Entrepreneurship Development and Management is one of the core competencies of technical human resource. Creating awareness regarding entrepreneurial traits, entrepreneurial support system, opportunity identification, project report preparation and understanding of legal and managerial aspects can be helpful in motivating technical/ vocational stream students to start their own small scale business/enterprise. Based on the broad competencies listed above, following detailed contents are arrived to develop the stated competencies.

DETAILED CONTENTS

(1) Entrepreneurship (4 hrs)

- 1.1 Concept/Meaning
- 1.2 Need
- 1.3 Competencies/qualities of an entrepreneur

(2) Entrepreneurial Support System (6 hrs)

- 2.1 District Industry Centres (DICs)
- 2.2 Commercial Banks
- 2.3 State Financial Corporations
- 2.4 Small Industries Service Institutes (SISIs), Small Industries Development Bank of India (SIDBI), National Bank for Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State level

(3) Market Survey and Opportunity Identification (Business Planning) (6 hrs)

- 3.1 How to start a small scale industry
- 3.2 Procedures for registration of small scale industry
- 3.3 List of items reserved for exclusive manufacture in small scale industry
- 3.4 Assessment of demand and supply in potential areas of growth
- 3.5 Understanding business opportunity
- 3.6 Considerations in product selection
- 3.7 Data collection for setting up small ventures

(4) Project Report Preparation (6 hrs)

- 4.1 Preliminary Project Report
- 4.2 Techno-Economic feasibility report
- 4.3 Project Viability

(5) Managerial Aspects of Small Business (8 hrs)

5.1 Principles of Management (Definition, functions of management viz planning, organisation, coordination and control
5.2 Operational Aspects of Production
5.3 Inventory Management
5.4 Basic principles of financial management
5.5 Marketing Techniques
5.6 Personnel Management
5.7 Importance of Communication in business

(6) Legal Aspects of Small Business (6 hrs)

6.1 Elementary knowledge of Income Tax, Sales Tax, Patent Rules, Excise Rules
6.2 Factory Act and Payment of Wages Act

(7) Environmental considerations (6 hrs)

7.1 Concept of ecology and environment
7.2 Factors contributing to Air, Water, Noise pollution
7.3 Air, water and noise pollution standards and control
7.4 Personal Protection Equipment (PPEs) for safety at work places

(8) Miscellaneous (6 hrs)

8.1 Human relations and performance in organization
8.2 Industrial Relations and Disputes
8.3 Relations with subordinates, peers and superiors
8.4 Motivation – Incentives, Rewards, Job Satisfaction
8.5 Leadership
8.6 Labour Welfare
8.7 Workers participation in management

RECOMMENDED BOOKS

1. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
2. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
3. Environmental Engineering and Management by Suresh K Dhamija, SK Kataria and Sons, New Delhi

4. Environmental and Pollution Awareness by Sharma BR, Satya Prakashan , New Delhi
5. Thakur Kailash, Environmental Protection Law and policy in India: Deep and Deep Publications, New Delhi
6. Handbook of Small Scale Industry by PM Bhandari
7. Marketing Management by Philip Kotler, Prentice Hall of India, New Delhi
8. Total Quality Management by Dr DD Sharma, Sultan Chand and Sons, New Delhi.
9. Principles of Management by Philip Kotler TEE Publication

6.2 PROCESS UTILITIES

L	T	P
3	-	-

RATIONALE

This subject is introduced to give the student a thorough knowledge of process utilities such as demineralization of water, stream generation, stream distributing and cooling water etc. which is essentially required for working in any chemical or related industry.

DETAILED CONTENTS

1. Demineralization of Water (8 hrs)

   Flow diagram for demineralization, Equipment used: cation and anion exchanger, mixed bed in exchanger. Brief concept of chemistry of cations and anion resins. Regeneration of cation and anion exchanger degasser

   Testing of industrial water after demineralization

2. Steam Generation (10 hrs)

   Saturated and superheated steam, Quality of steam, Steam calculation including internal energy, entropy and enthalpy (using Mollier diagrams and steam tables). Simple numericals relating to the enthalpy changes.

   Classification of Fuels; Solid (coal, rice husk, liquid and gaseous fuel.

3. Steam Distribution (6 hrs)

   Specification of steam pipe, layout of piping, steam trap, steam ejectors

4. Compressors, Blowers, Pressure Regulators (12 hrs)

6. Cooling Water (12 hrs)

   Showers, cooling towers, recycling of water, principles, details of problems like scaling, use of inhibitors like calgon (sodium hexometa-phosphate) STPP (Sodium Tripolyphosphate)

RECOMMENDED BOOKS

1. Plant Economics by Peter Timmerhaus, McGraw Hill Publication.
2. Applied Process Design for Chemical and Petrochemical Plant by E. Luduig, Gulf Publishing, Houston, Texas, 1983.
3. Unit Operation of Chemical Engineering., McCabe and Smith, McGraw Hill Publication
4. Standard Test Methods for Water by Apha.

6.3 FERTILIZER TECHNOLOGY.

L	T	P
4	-	-

RATIONALE

Fertilizer plants have large employment potential, therefore, this subject is being offered as a core subject. Students will be imparted detailed knowledge of nitrogenous, phosphatic and mixed fertilizers.

DETAILED CONTENTS

1. Introduction (6 hrs)

   Demand and Supply in India. Overview of fertilizer industry in India. Important fertilizer plants in India.

2. Nitrogenous Fertilizers: (20 hrs)

   - Importance of ammonia, its manufacture from different processes, names of important fertilizers made from ammonia.
   - Manufacturing processes of urea- flow sheet and major engineering problems and their solution.
   - Manufacturing processes of Ammonium Nitrate.
     - Prilling Process in description with the help of flow sheet.
     - Crystallization process: Outline of process
     - Stengel process: Outline of process.

     Major Engineering problems like corrosion, safety, crystallization, conditioned air requirements
   - Manufacturing process of nitro lime: Description with the help of flow sheet.

3. Phosphatic Fertilizers: (14 hrs)

   - Manufacturing process of Superphosphate and triple super phosphate: Process description only with the help of flow sheet.
   - Ammonium phosphates: Process description with the help of flow sheet of Diammonium phosphate.

4. Mixed Fertilizers: (16 hrs)

   - Chemical Fertilizer; (A mixture of ammonium phosphate, ammonium sulfate and potash); Flow sheet and description of process.

   - Meaning and grading of N-P-K fertilizers. Importance and application of N-P-K fertilizers. Names of important grades in vogue and percentage of their constituents.

5. Micronutrients: Different micronutrients, their effects. (8 hrs)

RECOMMENDED BOOKS

1. Agriculture in India, Vol. I by Kumar, Aggarwala and Others, Asia Publishing House, Mumbai

2. Handbook on Fertilizer Technology, published by Fertilizer Association of India

3. Fertilizer Quality Guide for Major and Micro Nutrients by HLS Tandon published by Fertilizer Association of India

4. Fertilizer Industry in India, Part I and II by Pritam Singh and VS Awasthi, 1992

6.4 ENVIRONMENTAL ENGINEERING AND SAFETY

L	T	P
4	-	3

RATIONALE

The subject aims at providing students the knowledge of various pollutants with respect to air, water and particularly emissions. The knowledge of students, mode of treatment and analysis techniques for different pollutants will also be imparted. Industrial safety is gaining importance with time and this subject will also cover chemical hazards

DETAILED CONTENTS

1. Introduction (6 hrs)

   Concept of clean environment, different types of effluents (air, water from chemical industries, techniques for measurement of different types of pollutants, effect of chemical pollution on ecology and environment.

2. Liquid Effluents/Water Pollution (14 hrs)

   Types of water pollutants and its sources, liquid discharge, types of sampling (grab and composite), Presentation of samples taken for analysis, BOD, COD Analysis, different treatment methods for effluent (primary, secondary and tertiary), different types of equipments used for treatment of liquid effluent with principles, mechanical details

3. Air Pollution (12 hrs)

   Types of air pollutants and its sources, effect of air pollutants, measurement, collection techniques and devices for gaseous pollutants. Different treatment for containing air pollutants. Various techniques and equipments used for controlling air pollution. For such equipments, basic principles, mechanical details

4. Legislation to Control the Environment (4 hrs)

   Brief introduction to various Acts for water pollution and air pollution and laws framed by Government of India and Law enforcing agencies

5. Solid Waste Management (4 hrs)

Classification of Refuse materials, types, sources and properties of solids wastes, Abatement methods

6. Noise Pollution (4 hrs)

Sound analysis, Units of sound and noise, Effect of thunder and typical sound on human beings

7. Safety (6 hrs)

Importance of safety in chemical industry, knowledge of statutory required for labour and industry.

8. Fire and Prevention (6 hrs)

Fire triangle, classification of fires, flammable and inflammable liquids, various types of fire extinguishers and their applications

9. [Only for diploma in Chemical Engineering (Pulp & Paper)] (8 hrs)

Liquid Pollution and Air Pollution in Paper Industry

Environmental pollution and its control in the pulp and papers industry

OR

[Only for diploma in Chemical Engineering)

Toxic Gases/Chemicals

Threshold Unit Values, hazards from waters and gases/chemicals. Symptoms and their remedial action

LIST OF PRACTICALS

1. Estimation of TS, TDS, SS, VSS
2. Estimation of Dissolved Oxygen
3. Estimation of BODs

4. Estimation of COD by titration method
5. Estimation of pH value, carbonate, bicarbonate and hydroxide alkalinity of waste water sample
6. Estimation of acidity and waste water sample
7. To determine sulphate in waste water sample
8. To determine phosphate in waste water sample
9. To determine the turbidity of waste water sample
10. To determine the hardness of water
11. To determine SPM in Ambient Air by high volume sampler
12. Demonstration of isokinetic sampling of SPM in stack

RECOMMENDED BOOKS

1. Safety and Accident Prevention in Chemical Operation by Fawelt and Wood, Inter Science Publication
2. Chemical Engineering, Vol I, II, II and IV by Coulson and Richardson, Pergamon Press Publication
3. Air Pollution by Perkins, McGraw Hill Publication
4. Fundamentals of Air Pollution by Williamson, Addison Wesley Publication
5. Liquid Wastes of Industries by Nemerow, Addison Wesley Publication
6. Waste Water Engineering by Metcalf and Eddy, McGraw Hill Publication

6.5 (a) POLYMER TECHNOLOGY

L	T	P
4	-	-

RATIONALE

This specialized subject is taught in view of the growing employment potential in the field of polymers. This subject deals with polymer processing techniques and important Industrial polymers which will make the diploma holder in chemical engineering confident to join polymer industry.

DETAILED CONTENTS

1. Introduction (12 hrs)

   - Introduction to polymers.
   - Classification of polymers.
   - Polymer structure: Tacticity, Geometric isomerism, stereo isomerism.
   - Concept of molecular wt. (wt. average ,molecular, number average, molecular wt. effect of molecular wt. on properties of polymers.)

2. Polymer Synthesis (18 hrs)

   - Step Polymerization.
   - Chain Polymerization.
   - Brief Introduction to Copolymers.

3. Polymerization Techniques (08 hrs)

   - Bulk Polymerization
   - Solution Polymerization.
   - Suspension Polymerization.
   - Emulsion Polymerization.

4. Introduction of Some Industrial Polymers (18 hrs)

   Structure, properties & uses of following polymers

   - Polyester
   - Polyethylene

- Polystyrene
- Polypropylene
- Polyvinyl chloride (PVC)
- Nylon (6-6, 6)

5. Polymer Processing Techniques (08 hrs)

Introduction to Extrusion, Injection moulding, Blow moulding, Calendering.

RECOMMENDED BOOKS

1. Polymer Science by Gwarikar
2. Polymer Science & Technology by Joel R. Fried, Prentice Hall of India, Publication
3. Polymer Science by P. Ghosh.

6.5 (b) PAPER TECHNOLOGY

L	T	P
4	-	-

RATIONALE

This subject will expose the students to various processes used in pulp and paper mill along with types of paper, their raw materials, additives. This overview will help them in the field job where they may join later.

DETAILED CONTENTS

I. Introduction (14 hrs)

General description of pulp and paper from the end use point of view. Broad categorization, writing and printing grades, packaging grades, speciality paper, introduction to paper properties

2. Raw materials (14 hrs)

Availability and consumption trends for different raw materials, forest based raw materials like wood, and bamboo, agricultural waste residue, bagasse, recycled specially in the Indian context.

3. Additives (16 hrs)

Various additives and speciality chemicals like sizing materials, dry and wet strength additives, surface treatment additives and filters used for paper making. Process Utilities; viz., water stream.

4. The integrated Pulp and Paper Mill (20 hrs)

Flow diagram of an integrated pulp and paper mill showing the sequence of operations and the point of input of various ingredients. Brief description of each process step with emphasis on important process parameters.

RECOMMENDED BOOKS

1. Pulp and Paper Chemistry & Chemical Technology, Vol. 1 & 3 by Casey, Wiley Eastern Publication
2. Handbook for Pulp and Paper Technology by Smook, Tappi Publication
3. Pulp and Paper Manufacture, Vol. 1 by McDonald, Tappi Publication
4. Handbook of Physical and Mechanical Testing of Paper & Board, Vol. 1 & 2 by Mark, Dekker Publication
5. Pulp and Paper Manufacture by Kocurek, Tappi Publication.

6.5 (c) ALTERNATE ENERGY SOURCES

L	T	P
4	-	-

RATIONALE

This specialised subject is taught to the students of chemical engineering in order to enable them to appreciate the energy crisis and to use alternate sources of energy as remedial and preventive measure.

DETAILED CONTENTS

I. Introduction (6 hrs)

Importance of alternate sources of energy, Present Scenario, Future prospects, Economic criteria.

2. Solar Energy (10 hrs)

Photovoltic cell, Electricity generation, Solar water heaters, Solar furnaces, Solar cookers, Solar stills.

3. Hydro Energy (8 hrs)

Hydro-electric power plants

4. Bio-Energy (8 hrs)

Biomass, Power generation by using gassifiers

5. Wind Energy (8 hrs)

Wind mills, Electricity generation from wind.

6. Geothermal and Tidal Energy (8 hrs)

Steam generation and electricity generation

7. Biogas Plants (8 hrs)

8. Smokeless Chulhas (8 hrs)

RECOMMENDED BOOKS

1. Solar Energy - Principles of Thermal Collection and Storage by S P Sukhatme, Tata McGraw Hill Publication, New Delhi
2. Solar Energy Utilisation by G D Rai, Khanna Publishers, New Delhi
3. Reviews of Renewable Energy Sources, Vol. 3, edited by M S Sodha, S S Mathur, MAS Malik, T C Kandpal, Wiley Eastern Limited, New Delhi
4. Energy Today and Tomorrow by Maheshwar Dayal, Pubications Division, Ministry of Information and Broadcasting, Govt. of India, New Delhi.

6.6 AGRO BASED INDUSTRIES

L	T	P
4	-	-

RATIONALE

Agro based industries have large employment potential in the present times, hence this subject is offered as a core subject. Students will be imparted knowledge about vegetable oils, soaps, essential oils, sugar, starch, paper and food industry.

DETAILED CONTENTS

1. Vegetable Oils & Vanaspati: Extraction methods; Mechanical & Solvent extraction with examples, details of solvent extraction method for soyabean oil. construction details of extractor used for soyabean oil.

   Hydrogenation of vegetable oil. flow sheet of glycerine and essential oils. (10 hrs)

2. Soaps; Laundry soap: raw material and method of production by continuous process. Toilet soap, raw material & manufacturing process. (5 hrs)

3. Glycerine; Production of glycerine as a by product from soap & fatty acid. Industrial uses & properties. (5 hrs)

4. Essential oils; Definition, chemical constituents, General methods of production and their industrial uses. (5 hrs)

CARBOHYDRATES & FERMENTATION INDUSTRIES

1. Sugar:- Raw material and manufacturing process, description with the help of flow sheet, major engineering problems. (7 hrs)

2. Starch:- Starch production from Maize with the help of flow sheet. (5 hrs)

3. Starch derivatives:- Dextrine by starch hydrolysis in a fludized bed; process description with flow sheet. (5 hrs)

4. Fermentation:-General characteristics of fermentation process, manufacture of ethyl alcohol by fermentation- process description with flow sheet. (6 hrs)

5. Paper; Definition types of paper products, raw materials like bamboo, agricultural waste residue, bagasse. General method of paper production by Fourdrinier machine. (8 hrs)

6. Food Industry: - food storage & transport, Engineering aspects of cold storages, Choice of refrigerants, Cold transport of foodstuffs, Food processing-freeze-drying, Food additives. (8 hrs)

RECOMMENDED BOOKS

1. Handbook of Pulp and Paper Technology by Smook, Tappi Publication

2. Chemical Process Industries by Shreve, Mc Graw Hill Publication

3. Outlines of Chemical Technology by Dryden, East-West Press Publishing

4. Esselntials of Food and Nutrition by Swaminathan, Vol I and II, Mc Graw Hill Publishing

6.7 PETROCHEMICALS

L	T	P
4	-	-

RATIONALE

Petroleum industry being one of the fast growing industries has large employment potential, therefore, this subject is being offered as a core subject. Students will be imparted detailed knowledge of petroleum and petroleum products along with processes involved in their production.

DETAILED CONTENTS

1. Names and capacities and location of refineries and petrochemical complexes in India. (6 hrs)

2. Petroleum refinery product classification (List only) (4 hrs)

3. Important petrochemical feed stocks and precursors. (6 hrs)

4. Technology of cracking, reforming, alkylation and sulfonation. (Reaction, conditions and products only). 10 hrs)

5. Definition and practical utility of Flash point, fire point, octane No. Smoke point, aniline point. (10 hrs)

6. Names and uses of important chemicals from (12 hrs)

   - C1 Compounds (methods & synthesis gas)
   - C2 compounds (Ethylene & Acetylene)
   - C3 Compounds (Propylene)
   - C4 Compounds (Butanes & Butenes)
   - Aromatic Compounds.

7. Manufacturing Process of following petrochemicals (16 hrs)

   (Flow sheet & description only). Synthesis Gas, Acetaldehyde, Vinyl acetate, Ethylene Oxide, Vinyl chloride, styrene, Acrylonitrile, propylene oxide, cumene butadiene, isoprene, phenol from cumene only acetone, benzaldehyde, separation of BTX.

RECOMMENDED BOOKS

1. Petroleum Refinery Engineering by W.L. Nelson.
2. Petroleum Processing by RJ Hengsbeck.

6.8 MAJOR PROJECT WORK

L	T	P
-	-	8

Project work aims at developing skills in the students whereby they apply the totality of knowledge and skills gained through the course in the solution of particular problem or undertaking a project. The students have various aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given for a group. The students should identify or given project assignment at least two to three months in advance. The project work identified in collaboration with industry may be preferred.

Each teacher is expected to guide the project work of 5-6 students. The project assignments may consist of:

- Design of process equipment
- Development of prototypes
- Study of the process of manufacturing of paints, detergents etc.
- Fabrication of components/equipments
- Fault diagnosis and rectification experiences
- Bringing improvements in the existing system/equipment
- Calibration and testing of equipment or any other innovative project which can develop creative skills in the students

A suggestive criteria for assessing student performance by the external (personnel from industry) and internal (teacher) examiner is given in table below:

Sr. No.	**Performance criteria**	**Max. marks**	**Rating Scale**				
			Excellent	**Very good**	**Good**	**Fair**	**Poor**
1.	Selection of project assignment	10	10	8	6	4	2
2.	Planning and execution of considerations	10	10	8	6	4	2
3.	Quality of performance	20	20	16	12	8	4
4.	Providing solution of the problems or production of final product	20	20	16	12	8	4
5.	Sense of responsibility	10	10	8	6	4	2
6.	Self expression/communication skills	5	5	4	3	2	1
7.	Interpersonal skills/human relations	5	5	4	3	2	1
8.	Report writing skills	10	10	8	6	4	2
9.	Viva voce	10	10	8	6	4	2
Total marks		**100**	**100**	**80**	**60**	**40**	**20**

The overall grading of the practical training shall be made as per following table

	Range of maximum marks	Overall grade
i)	More than 80	Excellent
ii)	79 <> 65	Very good
iii)	64 <> 50	Good
iv)	49 <> 40	Fair
v)	Less than 40	Poor

In order to qualify for the diploma, students must get "Overall Good grade" failing which the students may be given one more chance of undergoing 8 -10 weeks of project oriented professional training in the same industry and re-evaluated before being disqualified and declared "not eligible to receive diploma ". It is also important to note that the students must get more than six "goods" or above "good" grade in different performance criteria items in order to get "Overall Good" grade.

Important Notes

1. **This criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.**

2. **The criteria for evaluation of the students have been worked out for 100 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.**

3. **The external examiner, preferably, a person from industry/organization, who has been associated with the project-oriented professional training of the students, should evaluate the students performance as per the above criteria.**

4. **It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific nearby industries are approached for instituting such awards.**

The teachers are free to evolve another criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organisations in such an exhibition. It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific industries are approached for instituting such awards.