

EVALUATION SCHEME
DIPLOMA –CHEMICAL ENGINEERING (5th SEM)

Study And Evaluation Scheme For Diploma Chemical Engineering

SEMESTER-V

SUBJECT CODE	SUBJECTS NAME	STUDY SCHEME Periods/Week			Credits	Marks In Evaluation Scheme						Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	T	P		Th	Pr	Tot	Th	Pr	Tot	
DINDUCH501	Industrial Management & Entrepreneurship Dev.	4	-	-	4	30	-	30	70	-	70	100
DHEATCH502	Heat Transfer Operations	3	1	-	4	30	-	30	70	-	70	100
DMASSCH503	Mass Transfer Operations	3	1	-	4	30	-	30	70	-	70	100
DPOLLCH504	Pollution Control & Industrial Safety	3	1	-	4	30	-	30	70	-	70	100
DFERTCH505	Fertilizer Technology	4	-	-	4	30	-	30	70	-	70	100
DHEATCH506	Heat Transfer Operations Lab	0	0	2	1	-	25	25	-	25	25	50
DFERTCH507	Fertilizer Technology Lab	0	0	2	1	-	25	25	-	25	25	50
DINDUCH508	Industrial training	0	0	0	2	-	-	-	-	-	-	50
Total		17	3	4	24	150	50	200	350	50	400	600

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DINDUCH501: INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP
DEVELOPMENT

1. Principles of Management

- 1.1 Management, Different Functions: Planning, Organising, Leading, Controlling.
- 1.2 Organizational Structure, Types, Functions of different departments.
- 1.3 Motivation: Factors, characteristics, methods of improving motivation, incentives, pay, promotion, rewards, job satisfaction, job enrichment.
- 1.4 Need for leadership, Functions of a leader, Factors for accomplishing effective leadership, Manager as a leader, promoting teamwork.

2. Human Resource Development

- 2.1 Introduction, objectives and functions of human resource development (HRD) department.
- 2.2 Recruitment, methods of selection, training strategies and career development.
- 2.3 Responsibilities of human resource management – policies and functions, selection–Mode of selection–Procedure – training of workers, Job evaluation and Merit rating.

3. Wages and Incentives

- 3.1 Definition and factors affecting wages, methods of wage payment.
- 3.2 Wage incentive – type of incentive, difference in wage, incentive and bonus; incentives of supervisor.
- 3.3 Job evaluation and merit rating.

4. Human and Industrial Relations

- 4.1 Industrial relations and disputes.
- 4.2 Relations with subordinates, peers and superiors.
- 4.3 Characteristics of group behaviour and trade unionism.
- 4.4 Mob psychology.
- 4.5 Grievance, Handling of grievances.
- 4.6 Agitations, strikes, Lockouts, Picketing and Gherao.
- 4.7 Labour welfare schemes.
- 4.8 Workers' participation in management.

5. Professional Ethics

- 5.1 Concept of professional ethics.
- 5.2 Need for code of professional ethics.
- 5.3 Professional bodies and their role.

6. Sales and Marketing management

- 6.1 Functions and duties of sales department.
- 6.2 Sales forecasting, sales promotion, advertisement and after sale services.
- 6.3 Concept of marketing.
- 6.4 Problems of marketing.
- 6.5 Pricing policy, break even analysis.
- 6.6 Distribution channels and methods of marketing.

7. Labour Legislation Act (as amended on date)

- 7.1 Factory Act1948.
- 7.2 Workmen's Compensation Act1923.
- 7.3 Apprentices Act1961.
- 7.4 PF Act, ESIAct.
- 7.5 Industrial Dispute Act1947.
- 7.6 Employers State Insurance Act1948.
- 7.7 Payment of Wages Act,1936.
- 7.8 Intellectual Property RightsAct

8. Material Management

- 8.1 Inventory control models.
- 8.2 ABC Analysis, Safety stock, Economic ordering quantity.
- 8.3 Stores equipment, Stores records, purchasing procedures, Bin card,Card ex.
- 8.4 Material handling techniques.

9. FinancialManagement

- 9.1 Importance of ledger and cashbook.
- 9.2 Profit and loss Account, Balance sheet.
- 9.3 Interpretation of Statements, Project financing, Project appraisal, return oninvestments.

10. EntrepreneurshipDevelopment

- 10.1 Concept of entrepreneur and need of entrepreneurship in the context of prevailing employmentconditions.
- 10.2 Distinction between an entrepreneur and a manager.
- 10.3 Project identification andselection.
- 10.4 Projectformulation.
- 10.5 Projectappraisal.
- 10.6 Facilities and incentives to an entrepreneur.

11. Fundamental ofEconomics

- 11.1 Microeconomics.
- 11.2 Macroeconomics.

12. Accidents andSafety

- 12.1 Classification of accidents based on nature of injuries, event and place.
- 12.2 Causes and effects of accidents.
- 12.3 Accident-prone workers.
- 12.4 Action to be taken in case of accidents with machines, electric shock, fires and erection and construction accidents.
- 12.5 Safety consciousness and publicity.
- 12.6 Safety procedures.
- 12.7 Safety measures – Do's and Don'ts and good housing keep.

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DHEATCH502: HEAT TRANSFER OPERATIONS

1. **MODES OF HEAT TRANSFER:** Conduction, convection & radiation.
2. **CONDUCTION:** Fourier's law, Thermal conductivity, Conductance, flat Wall, Multilayer flat wall, Hollow cylinder, Multilayer cylinder log mean area, geometric mean area & Arithmetic mean area, Simple numerical problems in S.I. Units.
3. **CONVECTION:**
 Natural and forced convection, Physical significance of dimensionless number .Reynold No, Prandtl No., Nusselt No., Stanton No., Peclet No., Grashoff No., Dittus Boelter's equation-simple numerical problems using Dittus Boelter equation. Fouling factor. Individual heat transfer coefficient and overall heat transfer coefficient.
4. **RADIATION:**
 Reflection, absorption and transmission of radiation, Kirchhoff law, Emissive power, Wien's displacement law, the Stefan Boltzman law, Heat transferred by radiation exchange of energy between two parallel planes of different emissivity, Radiant Heat transfer coefficient, Solar radiation, gray surfaces or gray body.
6. **CONDENSER:**
 Film-wise and Drop-wise condensation. Construction & description of contact condenser and surface condenser.
7. **EVAPORATORS:**
 Construction and description of
 1. Horizontal tube types.
 2. Standard vertical type or Calendria type.
 - (a) Natural and forced circulation type.
 - (b) Entrainment and foam formation.
 - (c) Method of feeding evaporators-Forward, Backward & cross, mixed multi effect evaporation.
 - (d) **BOILING** : Nucleate boiling, film boiling, Transition boiling, Maximum flux and critical temperature drop, construction & description of Kettle type boilers. Boiling point rise (B.P.R) and effect, steam economy for single effect evaporator (Simple Numerical Problem).
8. **CRYSTALLIZERS:** Classification of crystallizers; construction and description
 1. Swenson Walker.
 2. Vacuum crystalizer.
9. **INSULATION:**
 Purpose of insulation common insulators, critical thickness of insulation for cylinder and spheres, optimum thickness of insulation, Heat loss from a pipe.

REFERENCE BOOKS

1. Heat Transfer by D. Q. Kern
2. Unit Operating in Chemical Engineering by McCabe & Smith

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DHEATCH506: HEAT TRANSFER OPERATION LAB

LIST OF EXPERIMENT

(At Least 7 experiment to be Performed)

1. To determine overall heat transfer coefficient for an open pan evaporator in steady state conditions.
2. To determine over all heat transfer coefficient for an open pan evaporator in unsteady state conditions.
3. To determine 'U' for a double pipe heat exchanger in steady state conditions and also to determine efficiency of heat utilization.
4. To determine 'U' for a shell and tube heat exchanger in steady state conditions and also to determine efficiency of heat utilization.
5. To study a shieve plate distillation operation and to calculate over-all efficiency of the distillation column.
6. To determine steam economy of a single and double effect evaporator.
7. To study the rate of drying in a vacuum dryer.
8. To determine the pounds of volatile compounds distilled per unit pounds of steam distilled in a steam distillation operation.
9. To determine rate of setting of crystals in a crystaliser.
10. To study the rate of drying in Rotary dryer.
11. To determine drying rate for a wet material in a Tray Dryer.
12. To study packed tower in various industries.
13. To study various extractors in solvent extraction plant.
14. To study a spray pond in suger and other industries for cooling system.
15. Determination of Thermal conductivity of Asbestos Powder.
16. Study of Insulating Material (Glass wool, Mineral wool, Ceramic blanket, Fire brick, Fire cement, Fire clay, Asbestos powder, Firecrete).

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DMASSCH503: MASS TRANSFER OPERATIONS

1. DIFFUSION:

Definition of diffusion, Rate of diffusion in Mass Transfer, Fick's law, diffusion in the gas phase-Equimolecular counter diffusion, diffusion through a stationary gas (Stefan's Law), Mass. Transfer Coefficient. Film theory and penetration theory of Mass Transfer, Diffusion in solids. Derivation of the following relations.

$$+ \frac{1}{KG.a} = \frac{1}{kG.a} + \frac{m I}{kL.a}$$

$$II. \frac{1}{KL.a} = \frac{1}{kL.a} + \frac{1}{m.kG.a}$$

2. ABSORPTION:

Introduction, importance, absorption with chemical reaction, Mechanism of absorption - two film theory, Diffusion of gases through a stagnant gas, Diffusion in liquid phase, Rate of absorption, Relation between film and overall coefficient, Factors influencing the transfer coefficient. Gas absorption equipments - Plate and packed column, Spray towers, Choice of solvent for absorption, Height of Transfer Unit (HTU), Number of Transfer Unit (NTU), Meaning and their relationship (Simple Numerical Problems).

3. DISTILLATION:

Various distillation methods:-

1. Equilibrium or flash distillation.
2. Differential distillation
3. Batch distillation.
4. Vacuum and Steam distillation.
5. Azeotropic and Extractive distillation.

Types of distillation columns:-

1. Perforated plate or sieve plate column
2. Bubble cap plate column

Vapor liquid equilibrium diagram, Raoult's law; Relative volatility, constant boiling mixtures, equilibrium diagram and construction of equilibrium diagram, Fractionating column calculation- Heat & material balance, Reflux ratio, equilibrium plate, Location of feed plate. Sub cooled reflux; effect of reflux ratio, Total reflux, Minimum reflux ratio Entrainment; Mc-Cabe Thiele diagram-section above and below feed plate; Intersection of operating line. Location of q-line, optimum reflux ratio, calculation of

no. of equilibrium plate by Mc-Cabe Thiele diagram. Overall plate efficiency.

4. EXTRACTION:

1. Applications of this operation.
 2. Choice of solvent.
 3. Steps of extraction operation
 4. Solid Liquid extraction, construction and description of
- A. Moving Bed-Basket type oil seed extractor OR Bollman extractor.
B. Rotocel extractor.

Liquid extractor; description and construction of

- A. Mixer settler extraction system.
B. Perforated plate and baffle towers.

5. HUMIDIFICATION:

Definition and calculation of

1. Humidity
2. Percentage humidity
3. Relative humidity
4. Humid volume.
5. Humid heat.
6. Enthalpy and its calculation.
7. Dry bulb and wet bulb-temp.
8. Adiabatic saturation temperature.
9. Use of humidity chart. Dew point, simple numerical problem using humidity chart, construction and description of cooling towers. (Natural and induced draft)

6. DRYING

General drying behavior-Critical moisture content, equilibrium moisture content: Description and construction of dryer.

1. Tray dryer.
2. Screen conveyor dryer.
3. Rotary dryer.

NOTE:-Atleast One Question From Each Topic.

REFERENCE BOOKS

1. Mass Transfer Operation by R. Treybal
2. Chemical Engineering Vol. II by Richardson & Coulson
3. Unit Operation of Chemical Engineering by McCabe & Smith

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DPOLLCH504: POLLUTION CONTROL & INDUSTRIAL SAFETY

1. INTRODUCTION:

What is environment ? What is Pollution? Classification of pollution e.g. Land, Water, Air, Noise. Impact assessment of development projects. Character and origin of industrial wastes.

2. AIR POLLUTION:

(i) Definition of air pollution, Types of Air pollutants and their sources like SPM, SOX, NOX, NH₃, F, Cl, CFC, CO₂ etc.

(ii) Air pollution control equipment in industries.

(a) Settling chambers

(b) Cyclones

(c) Scrubbers (dry & wet)

(d) Multiclones

(e) ElectroStatic Precipitations (ESPS)

(f) Bag Filters

(iii) Ambient air quality measurement & their standards.

(iv) Vehicular Pollution and its control

(v) Noise Pollution and its control mechanism.

3. WATER POLLUTION:

Water pollution, standards for drinking water, domestic waste water and industrial waste water. Methods of measurement of various parameter like BOD, SS, pH, COD, TDS etc. Methods of treatment of industrial waste water like

(a) Chemical treatment

(b) Physio-Chemical treatment

(c) Bio-chemical treatment

(d) Any other advanced treatment

4. ENVIRONMENT PROTECTION:

Environmental protection from hazardous Chemicals & Waste:-

Terminology relating to chemical hazards and air pollution, classification of chemical hazards and hazardous chemicals, codes of safety for operational hazards in laboratories, industries etc. (Reference should be made of I.S. Codes)

5. RADIO ACTIVE POLLUTION:

Sources and effect on human, animal, plant and material. Measurement, means to control, preventive measures.

6. SOLID WASTE MANAGEMENT:

Municipal solid waste, Biomedical waste, Plastic waste and Its Management.

7. POLLUTION ACTS:

A water pollution prevention control Act 1974, Air pollution Act 1981, Environment protection Act 1986, Hazardous chemical manufacturing, Storage and impact rules 1989 and hazardous waste and management and handling rules 1989, Noise Pollution Act.

8. SAFETY IN CHEMICAL INDUSTRY:

Receiving and storing chemicals-Transporting and moving chemicals-Safety in chemical reactions, Pipe-lines in chemical factories. Precautions in the case of processes in operations involving explosive or inflammable dusts, gases, vapor's etc. Maintenance of chemical plants-corrosion health hazards in common chemical processes, Fire hazards and their Prevention. Codes of practice and specification for safety equipment (Reference should be made from I.S. Codes).

9. DISASTER MANAGEMENT:

Definition of disaster - Natural and Manmade, Type of disaster management, How disaster forms, Destructive power, Causes and Hazards, Case study of Tsunami Disaster, National policy- Its objective and main features, National Environment Policy, Need for central intervention, State Disaster Authority- Duties and powers, Case studies of various Disaster in the country, Meaning and benefit of vulnerability reduction, Factor promoting vulnerability reduction and mitigation, Emergency support function plan.

Main feature and function of National Disaster Management Frame Work, Disaster mitigation and prevention, Legal Policy Frame Work, Early warning system, Human Resource Development and Function, Information dissemination and communication.

REFERENCE BOOKS

1. Safety in Process Plant Design by Wells
2. Safety and Accident Prevention in Chemical Operation by H.H. Tawcette and W S Wood.
3. Engineering Chemistry by P. C Jain

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DFERTCH505: FERTILIZER TECHNOLOGY

1. INTRODUCTION:

Origin and development of commercial fertilizer under Indian conditions. Role of fertilizer in plant growth and their application to soil.

2. CATALYST:

Catalyst used in fertilizer industry-reforming catalyst (Primary & Secondary), High & low temperature shift reaction catalyst, ammonia synthesis catalyst, machinery catalyst etc.

3. NITROGENOUS FERTILIZERS:

Feed stock for production of Ammonia-Natural gas, Associated gas, Coke oven gas, Naphtha fuel oil, coal etc. Process for gasification and methods of production of ammonia. Ammonium-sulphate, Ammonium Nitrate, calcium ammonium nitrate and urea their methods of production, characteristics and specifications. Operation problems of the urea plants.

4. PHOSPHATIC FERTILIZERS:

Raw materials-Phosphatic rock, sulfur, super phosphates of all grades by different process, operational details of the plants.

5. MIXED & COMPOUND FERTILIZERS:

Their advantage and disadvantage. Materials used in mixed fertilizers. Manufacture of various grades of NPK fertilizer. Granulation technique of fertilizers mixture.

6. BIO-FERTILIZER (NITROGEN FIXING):

Introduction to bio-fertilizer (nitrogen fixing).

7. POTASSIC FERTILIZER:

Manufacture of Potassium Chloride and Potassium Sulphate

REFERENCE BOOKS

1. Shreve's Chemical Process Industries by George T. Austin, Randolph Norris Shreve.
2. Outline of Chemical Technology by Charles E. Dryden, M. Gopala Rao, Marshall Sittig

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DFERTCH507: FERTILIZER TECHNOLOGY LAB

LIST OF EXPERIMENTS

(At Least 6 Experiments To Be Performed)

1. Analysis of Fertilizers.
2. Analysis of flue gases by CNH analyser
3. Determination of pH-value.
4. Determination of Turbidity.
5. Determination of Total Dissolved Solid(TDS).
6. Determination of Dissolved Oxygen(DO).
7. Determination of Chemical Oxygen Demand(COD).
8. Determination of Biochemical Oxygen Demand(BOD).
9. Softening of water by Ion-exchange method.
10. Demineralization of water by Ion exchange method.
11. Removal of dissolved solid by Membrane method.

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DINDUCH508: INDUSTRIAL TRAINING

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of 4 weeks duration to be organized during the semester break starting after second year i.e. after 4th semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An external assessment of 50 marks has been provided in the study and evaluation scheme of 5th Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

Teachers and students are requested to see the footnote below the study and evaluation scheme of 4th semester for further details.

The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following:

Punctuality and regularity 15%
Initiative in learning new things 15%
Presentation and VIVA 15%
Industrial training report 55%

