

EVALUATION SCHEME

DIPLOMA –CHEMICAL ENGINEERING(6th Sem)

Study And Evaluation Scheme For Diploma Chemical Engineering

SEMESTER-6

SUBJECTCODE	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	
DENVICH601	Environmental Education & Disaster Management	4	-	-	4	30	-	30	70	-	70	100
DCHEMCH602	Chemical Reaction Engineering	4	-	-	4	30	-	30	70	-	70	100
DAUTOCH603	Automatic Process Control	4	1	-	5	30	-	30	70	-	70	100
DPROCCH604	Process Equipment Design	4	1	-	5	30	-	30	70	-	70	100
DAUTOCH605	Automatic Process Control LAB	-	-	2	1	-	25	25	-	25	25	50
DPROJCH606	PROJECT	-	-	12	6	-	100	100	-	100	100	200
Total		16	2	14	25	120	50	170	280	50	330	650

Department of Chemical Engineering
(Faculty of Engineering and Technology)
P.K. University, Shivpuri (MP)
III YEAR VI SEMESTER

L	T	P
4	0	0

DENVICH601
ENVIRONMENTAL EDUCATION & DISASTER MANAGEMENT

1. INTRODUCTION:

- Basics of ecology, Ecosystem, Biodiversity Human activities and its effect on ecology and eco system, different development i.e. irrigation, urbanization, road development and other engineering activities and their effects on ecology and eco system, Mining and deforestation and their effects. - Lowering of water level , Urbanization.
- Biodegradation and Bio-degradability, composting, bio remediation, Microbes
- Use of bio pesticides and bio fungicides.
- Global warning concerns, Ozone layer depletion, Green house effect, Acid rain ,etc.

2. POLLUTION: Sources of pollution, natural and man made, their effects on living environments and related legislation.

2.1 WATER POLLUTION: Flow Measurement: Hot Wire Anemometry, Laser Doppler Velocity meter, Rota meter Temperature Measurement: Thermometers, bimetallic thermocouples, thermostats and pyrometers. Measurements of Force, Torque: Different types of load cells, elastic transducers, pneumatic & hydraulic systems. Seismic instruments Measurements of Acceleration, and Vibration: Accelerometers vibration pickups and decibel meters, vibro-meters.

- Factors contributing water pollution and their effect.
- Domestic waste water and industrial waste water. Heavy metals, microbes and leaching metal. - Physical, Chemical and Biological Characteristics of waste water.
- Indian Standards for quality of drinking water.
- Indian Standards for quality of treated waste water.
- Treatment methods of effluent (domestic waste water and industrial/ mining waste water), its reuse/safe disposal.

2.2 AIR POLLUTION: Definition of Air pollution, types of air pollutants i.e. SPM, NOX, SOX, GO, CO₂, NH₃, F, CL, causes and its effects on the environment.

- Monitoring and control of air pollutants, Control measures techniques. Introductory Idea of control equipment in industries i.e.

A. Settling chambers

B. Cyclones

C. Scrubbers (Dry and Wet)

D. Multi Clones

E. Electro Static Precipitations

F. Bog Fillers. - Ambient air quality measurement and their standards.

- Process and domestic emission control
- Vehicular Pollution and Its control with special emphasis of Euro-I, Euro-II, Euro-III and Euro IV.

2.3 NOISE POLLUTION: Sources of noise pollution, its effect and control.

2.4 RADISACTIVE POLLUTION: Sources and its effect on human, animal, plant and material, means to control and preventive measures.

2.5 SOLID WASTE MANAGEMENT: Municipal solid waste, biomedical waste, Industrial and Hazardous waste, Plastic waste and its management.

3. LEGISLATION:

Preliminary knowledge of the following Acts and rules made there under-

- The Water (Prevention and Control of Pollution) Act
- 1974. - The Air (Prevention and Control of Pollution) Act - 1981.
- The Environmental Protection (Prevention and Control of Pollution) Act -1986. Rules notified under EP Act - 1986 Viz.
- # The Manufacture, Storage and Import of Hazardous Chemical (Amendment) Rules, 2000 # The Hazardous Wastes (Management and Handling) Amendment Rules, 2003.
- # Bio-Medical Waste (Management and Handling) (Amendment) Rules, 2003. # The Noise Pollution (Regulation and Control) (Amendment) Rules, 2002.
- # Municipal Solid Wastes (Management and Handling) Rules, 2000.
- # The Recycled Plastics Manufacture and Usage (Amendment) rules, 2003.

4. ENVIRONMENTAL IMPACT ASSESSMENT (EIA):

- Basic concepts, objective and methodology of EIA.
- Objectives and requirement of Environmental Management System (ISO-14000) (An Introduction).

5. 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.

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DCHEMCH602: CHEMICAL REACTION ENGINEERING

1. **INTRODUCTION:**
Chemical kinetics, classification of reactions variables affecting the rate of reaction;
2. **HOMOGENEOUS REACTIONS:**
Concentration dependent term of a rate equation, single and multiple reaction, series and parallel reactions. Elementary and Non-elementary reactions, Kinetic view for elementary reactions molecularity and order of reaction, Rate constant K. Representation of a reaction rate, Temperature dependent term of a rate equation, Temperature dependency from - (Arrhenius law, Thermodynamics and collision theory). Activation energy and Temperature dependency. Simple numerical problems.
3. **INTERPRETATION OF CONSTANT VOLUME BATCH REACTOR DATA:**
Constant volume batch reactor-Integral method of Analysis of data, Differential method of analysis of data temperature and Reaction rate.
The search for a rate equation. Simple Numerical problems.
4. **IDEAL REACTORS:**
Classification of reactors and application & their comparison, Ideal batch reactor, space time and space velocity, steady-state mixed flow reactor, steady state plug flow reactor. Holding time and space time for flow systems. Simple numerical problems.
5. **INTRODUCTION TO HETEROGENEOUS REACTING SYSTEMS:**
Rate Equation for Heterogeneous Reactions. Contacting pattern for two phase system
Simple Numerical problems.
6. **INTRODUCTION OF VARIOUS TYPES OF INDUSTRIAL REACTORS :** CSTR, Trickle, Sherwood, Packed bed, Fluidized bed.

REFERENCE BOOKS

1. Chemical Engineering Kinetics by J. M. Smith
2. Chemical Reaction Engineering by Octave Levenspiel
3. Reaction Engineering by Walas
4. Chemical Reaction Engineering I & II by K. A. Gawhane

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DAUTOCH603: AUTOMATIC PROCESS CONTROL

1. INTRODUCTION:

What is Automatic control, Advantage of Automatic control, manual and automatic control, physical and block diagram.

2. ELEMENTS OF CONTROL SYSTEM:

Definition-Input means, controlling means, actuating means, measuring means, final control elements.

3. PROCESS CHARACTERISTICS:

Process variables, process degree of freedom, forcing function, step fn., ramp, impulse, sinusoidal function, Laplace transformation.

Elements of process dynamics:- Proportional, Capacitance.

Time constant and oscillatory element, determination of system function or transfer function of the following:- (Sketch physical diagram and block diagram)

(a) Ist order system or time constant element:-

- (i) Naked bulb thermometer.
- (ii) Stirred tank heater.
- (iii) Mixing process.
- (iv) R.C. Circuit.
- (v) Liquid levels.
- (vi) Two time constant type liquid vessel cascaded i.e. Non interacting and non cascaded, i.e. interacting
- (vii) Continuous stirred tank chemical reactor with Ist order chemical reaction.

(b) IInd order system or oscillatory type element.

- (i) Bulb in thermo well.
- (ii) Mechanical damper.
- (iii) Fluid manometer or U tubes.

Response of Ist order system to step, ramp, impulse and sinusoidal inputs, Response of IInd order system to step change (Transient response).

4. CONTROLLER CHARACTERISTICS OR MODES OF CONTROL ACTION:

Elements of controller, proportional control, Integral control, proportional-integral control, proportional derivative control, proportional-integral-derivative control, Two position control.

5. CLOSED LOOP IN AUTOMATIC CONTROL:

Standard block diagram symbol, overall transfer fn. for a single loop system, overall transfer function for change in set point and for change in load, overall transfer fn. multi loop control system, unit step response of the following.

- (i) Proportional control at stirred tank heater for set point change and for load change.

(iii) P.I control of stirred tank heater for setpoint change and load change.

6. PROGRAMMABLE LOGIC CONTROLLER(PLC):

Introduction, Principle of operation, Architecture of programmable controller, Programming the programmable controller, Application of programmable control.

7. DISTRIBUTED CONTROL SYSTEM (DCS):

Real time computer control system - concept, functional requirements of distributed process control system, configuration some popular DCS.

REFERENCE BOOKS

1. Process System Analysis and Control by CoughnowrandKoppel
2. Chemical Process Control by GeorgeStephanopalous
3. Computer Control of Industrial Process by S. Savas,Emenule
4. Industrial Instrumentation by D. P.Eckman

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DAUTOCH604:AUTOMATIC PROCESS CONTROL LAB

LAB LIST OF EXPERIMENT

(At Least 8 experiment to be performed)

1. To measure time constant of a single capacity thermal process (water bath & heater).
 2. Calibration of thermocouple.
 3. To study the transient response of first order system (thermo couple) and find out time constant.
 4. To study the transient response of a simple R-C network and plot Bode's diagram.
 5. To study on of type water level control and to find out steady state voltage.
 6. To study the frequency response of a second order electrical circuit equipment to a physical system (R-L-C network).
 7. Calibration of pressure Gauge by Dead Weight tester.
 8. To study, sketch and operation of strip chart recorder and Directing pen recorder.
 9. Calibration of bimetallic thermometer.
 10. To study the response of bimetallic thermo meter for a step input and find its time constant.
 11. To calibrate the pneumatic control valve (Diaphragm type).
 12. To calibrate the given manometer for level measurement.
 13. To study the response of two tank non interacting liquid level system and two tank interacting liquid level system.
- A study of automatic ON and cut of A.C. supply by a solid state (Built in relay and transformer) voltage stabilizer.

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DPROCCH603: PROCESS EQUIPMENT DESIGN

1. BASIC ENGINEERING MATERIALS:

Ferrous Materials, Non Ferrous materials, Synthetic Materials, Natural materials.

2. BASIC CONSIDERATIONS IN PROCESS EQUIPMENT DESIGN:

Introduction, General Design Procedures, Fabrication Techniques, Equipment Classification, Power for rotational motion.

3. DESIGN CONSIDERATIONS

Introduction, Materials Selections, Corrosion Prevention, Stresses Created due to Static & Dynamic Loads, Elastic Instability, Combined Stresses and Theories of Failure, Fatigue, Brittle, Fracture, Creep, Temperature Effect, Radiation Effects, Effects of Fabrication Methods, Economic Consideration.

4. POWER REQUIREMENT OF PUMPS:

Problems relating calculations of horse power (H.P.), N.P.S.H., for flow of incompressible fluid.

5. PRESSURE VESSELS:

Selection of type of vessels and storage tank, criteria of selection, Fixed head and floating head type storage tanks, causes of failure Of vessels, methods of fabrication, types of formed heads, stress in thin shells subjected to internal pressure, Longitudinal and circumferential stress, joint efficiency and corrosion allowance, Crown and Knuckle radius, Problems relating calculation of shell thickness of cylindrical and spherical shells, Thickness of Tori spherical heads subjected to internal pressure as per I.S. code. Problems associated with tank and vessels.

6. DISTILLATION COLUMN:

Preparation of equilibrium diagram, Problems relating calculation of theoretical plates at a given reflux ratio and total reflux, minimum reflux ratio, Feed plate location, by McCabe-thiele methods for separation of ideal binary mixtures, Derivation of q-line equation.

7. HEAT EXCHANGER AND CONDENSERS:

Problems relating calculation of L.M.T.D., individual and overall heat-transfer coefficients, Number of tubes, Number of passes, Heat-transfer coefficient for condensing vapors by Wilson's plot.

8. EVAPORATORS:

Problems relating calculation of heating area, Steam requirement, Steam economy for single and double effect evaporators. Methods of feeding evaporators and effect of Boiling Point Rise (B.P.R) and Hydrostatic Head.

REFERENCE BOOKS

1. Process Equipment Design by B. E. Brownell & E. M. Young
2. Process Heat Transfer by D. Q. Kern
3. Mass Transfer Operation by R. E. Treybal
4. I. S. Code for Unfire Pressure : IS No. 2825-1969 Pressure Vessel

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DPROJCH605:PROJECT

NOTE-

Every diploma holder have to do a project work before going into the world of work so that he may have sufficient knowledge to face the various problems involved in solving the project. Chemical engineering technician must be well aware of these too. So the project on the design of pressure vessel, storage tanks, heat exchanger, distillation column and evaporator are included in the subject.

Every Student is supposed to design one of the following problems allotted by Head of Deptt. and prepare the complete Project Report. The Students should be acquainted with the various codes and standards and the requirements of inspection and safety.

Problem -I.

Design of Pressure Vessel

- (a) Shell
- (b) Head or Cover
- (c) Nozzle
- (d) Flanged Joint
- (e) Support

Problem-II.

Design of Storage Tanks

- (a) Material
- (b) Bottom Design
- (c) Shell Design
- (d) Wind graders for open - Top Tanks
- (e) Roof - Curb Angles
- (f) Self - Supporting Roof Design
- (g) Column Supported Roofs
- (h) Nozzles and Mountings

Problem - III.

Design of Heat Exchanger (Shell & Tube)

- (a) Shell Design
- (b) Shell Cover
- (c) Tubes
- (d) Tube Sheet
- (f) Tie Rods and Spacers
- (g) Baffles
- (h) Channel
- (i) Channel Cover

Problem - IV.

Design of Distillation Column

- (a) Shell Thickness
- (b) Stresses in Column Shell
- (c) Column Internal Details
- (d) Head
- (e) Support
- (f) Tray

Problem - v

Design of Evaporator

- (a) Shell design
- (b) Shell cover
- (c) Tubes
- (d) Steam Economy & Heating area
- (e) Vacuum creating device
- (f) Impingement Baffles