NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Third Year Chemical Engineering

Faculty of Engineering and Technology

Teacher and Examiner's Manual

SEM – V

W.E.F 2014 – 2015

Process Equipment Design- I

Teacher, Paper setter and Examiner should follow the guidelines as given below.

Unit- I

Teacher should facilitate learning of Design Considerations and Corrosion.

1.	Design Considerations and Corrosion:		Lectures required	Reference No.
	a)	Design codes, Maximum working pressure and Design pressure	02	1 & 3
	b)	Design Temperature, Design stress, Factor of safety and Selection of factor of safety	01	1 & 3
	c)	Design wall thickness, Corrosion allowance and Poisson ratio	01	1 & 3
	d)	Criteria of failure and Elastic stability	01	1 & 3
	e)	Corrosion: Types of Corrosion, Corrosion prevention, Protective coating and Choice of materials	03	3

Unit- II

Teacher should facilitate learning of Design of Keys and Design of Heads.

2.	Design of Keys and Design of Heads :		Lectures required	Reference No.
	a)	Keys: Introduction Types of keys	01	4
	b)	Strength of sunk key, Effect of key ways, Design of keys	01	4
	c)	Numerical	02	4
	d)	Design of Heads: Introduction, Analysis and design of Flat cover head	01	1
	e)	Analysis and design of conical head, and Standard dished heads	01	1
	f)	Numerical	02	1

Unit- III

Teacher should facilitate learning of Pipe joints, Storage vessels and Supports for vessels.

3.	Pipe joints, Storage vessels and Supports for vessels:		Lectures required	Reference No.
	a)	Pipe joints: Standard pipe flanges for steam, Hydraulic pipe joints for high pressure, Design of circular flange pipe joints	03	4
	b)	Storage vessels: Introduction, Design of fixed conical roof cylindrical tank and Storage of gases in Spherical vessels	02	3 & 5
	c)	Supports for vessels: Introduction of Bracket or Lug supports and Leg supports	01	3 & 5
	d)	Numerical	02	3

Unit- IV

Teacher should facilitate learning of Design of Process Vessels and Pipes under External Pressure.

4.	Design of Cylindrical Vessels under internal Pressure and Design of process vessels and pipes under external pressure:		Lectures required	Reference No.
	a)	Design of Cylindrical Vessels under internal Pressure: Introduction	01	1,3 & 5
	b)	Thin wall vessels, Design Equations	02	1 & 3
	c)	Design of process vessels and pipes under external pressure: Introduction and Determination of safe pressure against elastic failure	01	1
	d)	Determination safe external pressure against plastic deformation	01	1
	e)	Circumferential stiffness, Pipes and tubes under external pressure	01	1
	f)	Numerical	02	1

Unit- V

Teacher should facilitate learning of Process Hazards and Safety Measures in Equipment Design and Design of packed absorption tower.

5.	Process Hazards and Safety Measures in Equipment Design and Design of packed absorption tower:		Lectures required	Reference No.
	a)	Process Hazards and Safety Measures in Equipment Design: Introduction, Hazards in Process Industries, Hazards Analysis	01	3
	b)	Safety Measures, Safety Measures in Equipment Design, Pressure relief Devices	02	3
	c)	Design of packed absorption tower: Introduction	02	2
	d)	Design of height & diameter of Packed Absorption Tower	01	2
	e)	Numerical	02	2

References:

1 B.C. Bhattacharya, Introduction to Chemical Equipment Design (Mechanical Aspects), CBS Publisher and Distributors, New Delhi.
2 Coulson & Richardson Chemical Engineering (Vol. VI), Butterworth-Heinmann (Elsevier) (Sixth Edition).
3 M.V.Joshi, V.V. Mahajani Process Equipment Design, Macmillan Publishers India Ltd. (Fourth Edition).
4 R. S. Khurmi, J.M. Gupta, A Text Book of Machine Design, S. Chand & Company Ltd, New Delhi.
5 S.D. Dawande, Process Equipment Design (Vol. I), Denett & Co., Nagpur.

Process Heat Transfer

Teacher, Paper setter and Examiner should follow the guidelines as given below.

Unit- I

Teacher should facilitate learning of Modes of Heat Transfer – Conduction, Convection and Radiation. Heat flow through cylinder & Thermal insulations.

1.	Modes of Heat Transfer:		Lectures required	Reference No.
	a)	Heat transfer by conduction in solids: Fourier's law of heat conduction	02	1,3 & 7
	b)	Steady state heat conduction through walls (single and multilayer), heat flow through cylinder, unsteady state heat conduction	02	1,3 & 7
	c)	Derivation of Fourier's heat conduction equation in three dimensions, equation for one dimensional conduction	02	1,3 & 7
	d)	Thermal insulation- insulating material, design factor and properties, economics of thickness, critical thickness	02	1,3 & 7

Unit- II

Teacher should facilitate learning of Basic Principles of Fin efficiency and its Conditions.

2.	Heat transfer through extended surface of uniform cross section:		Lectures required	Reference No.
	a)	Fin efficiency and its conditions, fin efficiency and effectiveness	02	2, 4 & 5
	b)	Counter current and parallel flows, energy balances, overall heat transfer coefficient	01	2,4 & 5
	c)	Log mean temperature difference, individual heat transfer coefficient	02	2, 4 & 5
	d)	Calculation of overall heat transfer coefficient from individual coefficients	01	2,4 & 5
	e)	Transfer units in heat exchangers	02	1,4 & 5

Unit- III

Teacher should facilitate learning of Phase Change and its Behavior.

3.	Convection without phase change: practical use of Nusselt's equations, and application in petroleum industry:		Lectures required	Reference No.
	a)	Types of convection, empirical equations for forced convection	01	1, 2 & 6
	b)	Heat transfer in laminar and turbulent flow through tubes over a flat plate and submerged plate	02	1, 2 & 4
	c)	Drop wise and film type condensation	02	1, 2 & 7
	d)	Coefficient for film type condensation	01	1, 2 & 7
	e)	Nusselt's equations, and application in petroleum industry	02	1, 3 & 4

Unit- IV

Teacher should facilitate learning of Heat transfer of Boiling Liquids.

4.	Heat Transfer of Boiling Liquids:		Lectures required	Reference No.
	a)	Boiling of saturated liquids, maximum flux and critical temperature drop, maximum Flux and film boiling	02	3 & 7
	b)	Radiation heat transfer: Fundamental of radiation	01	3 & 7
	c)	Black body radiation, laws of radiation	01	3 & 7
	d)	Radiant heat exchange between non black surfaces	02	3 & 7
	e)	Greenhouse effect and radiation shape factor and numerical	02	3 & 7

Unit- V

Teacher should facilitate learning of basic terms of Heat Transfer Equipments and Evaporators.

5.	Heat Exchangers and Evaporation:		Lectures required	Reference No.
	a)	Heat exchanger single pass 1-1 exchanger, 1-2 shell and tube heat exchanger	02	3, 5 &7
	b)	Correction for LMTD for cross flow	01	3, 5 &7
	c)	Design calculation (Kern Method) in heat exchanger	02	3, 5 &7
	d)	Liquid characteristics and types of evaporator	01	3, 5 &7
	e)	Single effect evaporator calculation and Numerical	01	3, 5 &7
	f)	Pattern of liquid flow in multiple effect evaporators	01	3, 5 &7

References:

1 D.S.Kumar, Process Heat Transfer, S.K.Kataria and Sons Publisher, New Delhi
2 W.L.McCabe and J.C.Smith, Unit Operations of Chemical Engineering, McGraw Hill/ International Edition (Seventh Edition).
3 Coulson & Richardson Chemical Engineering (Vol.II), Butterworth-Heinmann (Elsevier) (Sixth Edition).
4 Coulson & Richardson Chemical Engineering (Vol.V), Butterworth-Heinmann (Elsevier) (Sixth Edition
5 Donald Q. Kern. Process Heat Transfer, Tata McGraw Publishing Company Limited, New Delhi (Tenth Edition).
6 S.S.Barkade and Mrs. P.L.V.N. Saichandra, Heat Transfer, Denett & Co., Nagpur.
7 S.D.Dawande, Heat and Mass Transfer, Denett & Co., Nagpur.

Instrumentation & Instrumental Analysis

Teacher, Paper setter and Examiner should follow the guidelines as given below.

Unit- I

Teacher should facilitate learning of Qualities of Measurement and Expansion Thermometers.

1.	Qualities of Measurement and Expansion Thermometers:		Lectures required	Reference No.
	a)	Qualities of Measurement: Meaning of measurement, Elements of instruments	02	1
	b)	Static Characteristics, Dynamic characteristics	02	1, 4 & 5
	c)	Expansion Thermometers: Introduction, Temperature scales	01	1
	d)	Constant volume gas Thermometer, Bimetallic Thermometer	02	1
	e)	Industrial pressure spring Thermometer, Response of Thermometer	01	1

Unit- II

Teacher should facilitate learning of Thermoelectric Temperature Measurement Techniques and Resistance Thermometry.

2.	Thermoelectric Temperature Measurement Techniques and Resistance Thermometry:		Lectures required	Reference No.
	a)	Thermoelectric Temperature Measurement: Introduction, Simple thermocouple circuit	02	1
	b)	Industrial thermocouples, Thermocouple lead wires, Thermal wells, response of thermocouples	02	1
	c)	Resistance Thermometer: Introduction, Industrial resistance-thermometer bulbs	02	1
	d)	Resistance thermometer element, Resistance thermometer circuit, RTD	02	1

Unit- III

Teacher should facilitate learning of Radiation Pyrometry, Pressure & Vacuum Measurement.

3.	Radiation Pyrometry, Pressure & Vacuum Measurement:		Lectures required	Reference No.
	a)	Radiation Temperature Measurement: Introduction, Black body conditions , Black body devices	01	1
	b)	Radiation receiving elements, Thermopile and Vacuum thermocouples	01	1
	c)	Radiation pyrometers, Lens type thermal radiation receiver Photoelectric pyrometers, Photoelectric radiation receiver, Optical pyrometer	02	1
	d)	Pressure and Vacuum Measurement: Introduction, Indicating pressure gage	01	1
	e)	Bellows pressure element, Useful ranges of absolute pressure measuring gages, McLeod vacuum gage	01	1
	f)	Measurement of Pressure in Corrosion Fluids: The steam gage siphon, Diaphragm seal in Pressure measurement, Liquid seal in pressure measurement	01	1
	g)	Response of mechanical pressure gages	01	1

Unit- IV

Teacher should facilitate learning of Level Measurement Techniques & Instrumental Techniques of Analysis.

4.	Level Measurement Techniques & Instrumental Techniques of Analysis:		Lectures required	Reference No.
	a)	Measurement of Level: Float and tape liquid level gage, Float & shaft liquid level unit	01	1
	b)	Level measurement in pressure vessels, Gamma ray method	01	1
	c)	Ultrasonic method & resistive method	01	1,5
	d)	Introduction, Theory, Instrumentation, advantages, and Application of pH measurement	01	2,3 & 6
	e)	Potentiometry, Refractrometry	02	2,3
	f)	Flame photometry, Colourimetry, Conductometric titrations	02	2,3

Unit- V

Teacher should facilitate learning of Chromatographic Techniques & Spectroscopy

5.	Chromatographic Techniques & Introduction to Spectroscopy		Lectures required	Reference No.
	a)	Introduction, Theory, Instrumentation, Advantages and Application of: Gas chromatography	01	2,3
	b)	Thin layer chromatography	01	2,3
	c)	Paper chromatography, HPLC	02	2,3
	d)	Introduction, Theory, Instrumentation, Advantages and Application of Infrared spectroscopy	01	2,3
	e)	Ultraviolet spectroscopy	01	2,3
	f)	Mass spectroscopy	01	2,3
	g)	NMR spectroscopy	01	2,3

References:

1. D.P.Eckman, Industrial Instrumentation, Willey Eastern Ltd., New Delhi.
2. Dr.B.K.Sharma, Instrumentation methods of chemical analysis, Goel Publishing House, Meerut, U.P.
3. Gurdeep Chatwal and Sham Anand, Instrumental methods of Chemical analysis, Himalaya Publication House, Mumbai.
4 Nakra B.C. and K.K. Chaudhary, Instrumentation Measurement & Analysis, Tata – McGraw Hill, New Delhi.
5 Patranabis D. Industrial Instrumentation, Tata – McGraw Hill Publications, New Delhi.
6 V.P. Kudesia and S.S. Sawhaney, Instrumental methods of chemical analysis, Pragati Prakashan, Meerut,U.P.

Mass Transfer-I

Teacher, Paper setter and Examiner should follow the guidelines as given below.

Unit- I

Teacher should facilitate learning of Diffusion Phenomenon and Types of Diffusion.

1.	Diffusion Phenomenon and Types of Diffusion:		Lectures required	Reference No.
	a)	Introduction to mass transfer operations, classification of mass transfer operations, diffusivity, Fick's law of diffusion	02	1,3 & 5
	b)	Steady state molecular diffusion in fluid at rest, molecular diffusion in gases and liquids	03	1,3 & 5
	c)	Multicomponent mixture diffusion, Maxwell's law of diffusion	01	1
	d)	Diffusion in solids	01	3
	e)	Unsteady state mass transfer	01	1

Unit- II

Teacher should facilitate learning of Interphase Mass Transfer.

2.	Interphase Mass Transfer :		Lectures required	Reference No.
	a)	Eddy (turbulent) diffusion, relation between mass transfer coefficients.	01	3
	b)	Mass transfer coefficient in laminar and turbulent flow	01	3 & 4
	c)	Theories of Mass Transfer	03	1,3 & 4
	d)	Equilibrium for mass transfer process: Local two phase mass transfer	01	1 & 3
	e)	Local overall mass transfer coefficient, Use of local overall coefficient	01	1 & 3

Unit- III

Teacher should facilitate learning of Material balances over Mass Transfer Operations/Equipments and Humidification

3.	Material balances over Mass Transfer Operations/Equipments and Humidification :		Lectures required	Reference No.
	a)	Equipments for gas liquid operation.	01	1 & 3
	b)	Material balances for steady state co current, countercurrent, cross flow cascade, counter flow cascade	04	1 & 3
	c)	Introduction to humidification: vapor liquid equilibrium, humidification terms	01	1
	d)	Determination of humidity, humidification and dehumidification, cooling towers	02	1,3 & 5

Unit- IV

Teacher should facilitate learning of Gas Absorption/Stripping Operation.

4.	Gas Absorption:		Lectures required	Reference No.
	a)	Introduction to gas absorption operation, equilibrium solubility of gases in liquids	01	1 & 3
	b)	Material balance for one component transferred in countercurrent flow and co current flow, countercurrent multistage operation, one component transferred	02	1 & 3
	c)	Numericals	04	1 & 6
	d)	Absorption with chemical reaction Different absorption operation equipments (plate tower, packed tower, venturiscrubber)	02	1 & 3

Unit- V

Teacher should facilitate learning of Crystallization & Drying Operation.

5.	Crystallization & Drying:		Lectures required	Reference No.
	a)	Introduction to crystallization, Growth and properties of crystals Effect of impurities in crystallization	01	2
	b)	Effect of temperature on solubility, Fractional crystallization, Caking & yield of crystals	01	2
	c)	Different type of crystallizers	01	2
	d)	Numericals	01	2 & 6
	e)	Introduction to drying operation, rate of drying, mechanism of moisture movement during drying	01	2
	f)	Drying equipments, different methods of drying	01	2
	g)	Numericals	02	2 & 6

References:

1 Coulson & Richardson Chemical Engineering (Vol. I), Butterworth-Heinmann (Elsevier) (Sixth Edition).
2 Coulson & Richardson Chemical Engineering (Vol. II), Butterworth-Heinmann (Elsevier) (Fifth Edition).
3 R.E.Treybal , Mass transfer operation ,McGraw Hill Book Company, (Third Edition).
4 Christie J.Geankoplis, Transport Processes & Unit Operations, Prentice Hall Inc.
5 Coulson & Richardson Chemical Engineering (Vol.IV), Butterworth-Heinmann (Elsevier).
6 Coulson & Richardson Chemical Engineering (Vol.V), Butterworth-Heinmann (Elsevier).

Industrial Economics & Management

Teacher, Paper setter and Examiner should follow the guidelines as given below.

Unit- I

Teacher should facilitate learning of Economics, Economic System and Demand Analysis.

1.	Economics, Economic System and Demand Analysis:		Lectures required	Reference No.
	a)	Economics, Nature & Scope of economics	02	1
	b)	Usefulness of Economics to engineering organizations, Economy: Types, Problems and Functioning	02	1 & 2
	c)	Basic Terms & Concepts used in Economics	01	1
	d)	Principal Economic system: Socialism, Capitalism, Mixed Economy	01	1
	e)	Utility analysis of Demand, Demand & Law of Demand, Elasticity of Demand	02	1 & 2

Unit- II

Teacher should facilitate learning of Factors of Production, Business Organizations, Market & Market Forms, and National Income.

2.	Factors of Production, Business Organizations and National Income:		Lectures required	Reference No.
	a)	Factor of Production, Land, Labor, Capital & Organization	01	1
	b)	Forms of Business Organizations	02	1 & 2
	c)	Laws of returns	01	1
	d)	Market & Market Forms, Price Determinations: Perfect & Imperfect Competitions	01	1
	e)	National Income: Concept, Factors & Measurement, Keynesian Model	03	1

Unit- III

Teacher should facilitate learning of Commercial Banks, Theories of Money, Sources of Finance, Management Concept, and Management by Objectives.

3.	Financial Institutions, Management Concept:		Lectures required	Reference No.
	a)	Types of Banks & Role of Banks in Economic Development	01	1
	b)	Theories of Money. Sources of Finance: Shares & Debentures & other Sources of Finance.	02	1 & 2
	c)	Management Concept: Difference & Relationship between Management, Administration.	01	2 & 3
	d)	Principles, Process, Functions, Levels & Types of Management.	02	2 & 3
	e)	Management by Objectives	02	2 & 3

Unit- IV

Teacher should facilitate learning of Marketing, Sales and Personnel Management.

4.	Marketing, Sales and Personnel Management:		Lectures required	Reference No.
	a)	Marketing Research and Techniques	01	2 & 3
	b)	Sales Management, Function of sales Manager, Salesman's quota	01	2 & 3
	c)	Marketing Management, Duties of Marketing Manager	01	2 & 3
	d)	Personnel Management: Manpower Planning, Recruitment	01	2 & 3
	e)	Selection & Training	01	2 & 3
	f)	Job Evaluation Methods, Merit Rating	02	2 & 3
	g)	Industrial Safety	01	2 & 3

Unit- V

Teacher should facilitate learning of Purchasing &Materials Management, Industrial Relations, and Communication Techniques.

5.	Purchasing &Materials Management, Industrial Relations, and Communication Techniques:		Lectures required	Reference No.
	a)	Purchasing Techniques and Purchasing Cycle	01	2 & 3
	b)	Materials Management its Functions, Importance of Materials Management	01	2 & 3
	c)	Leadership in Business and Qualities	01	2 & 3
	d)	Motivation	02	2 & 3
	e)	Industrial Relations, Industrial Disputes	01	2 & 3
	f)	Communication: Principles, Types, Characteristics and Role of Communication in Management	02	4

References:

1 Dewett & Varma, Elementary Economic Theory, S. Chand & Company Ltd New Delhi.
2 O.P.Khanna, Industrial Engineering & Management, Dhanpat Rai Publications (P) Ltd New Delhi.
3 Banga & Sharma, Industrial Engineering Science & Management, Khanna Publishers New Delhi.
4 C.R.Basu, Business Organisation and Management, Tata McGraw Hill Publishing Company Ltd. New Delhi.

Lab Process Heat Transfer

COURSE CONTENT

Teacher should facilitate learning of following lab experiments:

(Note: Any eight experiments from the following)

Experiments		Lab hours required
1	Determination of thermal conductivity of metals rod	02
2	To determine heat flux through composite walls	02
3	Determination of heat transfer coefficient in natural/ forced convection	02
4	Determination of temperature distribution, fin efficiency in natural and forced convection	02
5	Determination of emissivity of a test surface	02
6	Determination of Stefan Boltzmann constant	02
7	Determinations of log mean temperature difference and over all heat transfer coefficient of Parallel and counter flow heat exchanger	02
8	Heat transfer through lagged pipe	02
9	Study of heat transfer in evaporator	02
10	Study and calculate the efficiency of a fin in natural convection	02
11	To find out overall heat transfer coefficient by drop wise and film wise condensation	02

Reference for Practicals:

Designed Standard College Laboratory Manual and Instruction Manuals of the Laboratory Equipment Suppliers.

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student will be asked questions related to practical performed. Evaluation will be based on performance in the practical during semester and viva-voce.

Lab Instrumentation & Instrumental Analysis

COURSE CONTENT

Teacher should facilitate learning of following lab experiments:

(Note: Any eight experiments from the following)

Experiments		Lab hours required
1	To study the response of bimetallic thermometer	02
2	To study the response of thermocouple	02
3	To measure the pH of given solution	02
4	To measure the conductance of given solution	02
5	To investigate the conductometric titration of strong acid and strong base	02
6	To determine concentration of given solution by colorimeter	02
7	To study separation of components present in given mixture by thin layer chromatography	02
8	To study separation of components present in given sample by paper chromatography	02
9	To determine refractive index of liquids by Abbey's refractometer	02
10	To identify the given sample by FTIR	02

Reference for Practicals:

Designed Standard College Laboratory Manual and Instruction Manuals of the Laboratory Equipment Suppliers.

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Lab Mass Transfer-I

COURSE CONTENT

Teacher should facilitate learning of following lab experiments:

(Note: Any eight experiments from the following)

	Experiments	Lab hours required
1	Diffusion in Still Air: To estimate mass transfer coefficient for given system at room temperature	04
2	Liquid – Liquid Diffusion: To determine diffusion coefficient for given system as function of concentration	04
3	Solid – Liquid Diffusion: To determine mass transfer coefficient for dissolution of given system without chemical reaction	04
4	Solid in Air Diffusion: To calculate mass transfer coefficient for vaporization of given solid in air using packed bed	04
5	Wetted Wall Column: To determine mass transfer coefficient for air – water system	04
6	Cooling Tower: To determine volumetric mass transfer coefficient for air – water system	04
7	Absorption in Packed Column: To find mass transfer coefficient of given system	04
8	Crystallization: To determine percentage yield of crystallization without and with seeding	04
9	Natural Drying: To obtain drying curve for batch drying operation	04
10	Fluidized Bed Dryer: To determine the rate of drying and to obtain mass transfer coefficient for the given material	04

Reference for Practicals:

Designed Standard College Laboratory Manual and Instruction Manuals of the Laboratory Equipment Suppliers.

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student will be asked to perform any one practical out of 8. Evaluation will be based on performance in the practical during semester, paper work and viva-voce.

Lab Data Analysis & Interpretation

COURSE CONTENT

Teacher should facilitate learning of following lab experiments:

(Note: Any eight experiments from the following)

Experiments		Lab hours required
1	To design questionnaire	02
2	To write Analysis Report for the questionnaire	02
3	To prepare and write sample Industrial Reports/Seminar Reports/Case Studies	02
4	To write Literature review using Websites, Magazines, Books, Reports, Surveys, Journals, Research Papers, Research work on PhD etc.	02
5	To prepare and write sample Project Reports with references in standard format	02
6	To Prepare Excel Chart for Count (frequencies)	02
7	To Prepare Excel Chart for Percentage	02
8	To Prepare Excel Chart showing Mean, Mode, and Median	02
9	To Prepare Excel Chart for Range, Standard deviation	02
10	To Prepare Excel Chart showing Variance, Ranking	02

Reference for Practicals:

1. C.R. Kothari (2008), Research Methodology- Methods and Techniques, New Age International Publishers, New Delhi (2nd Revised edition).
2. S.C.Gupta (2007), Fundamentals of statistics, Himalaya Publishing House (6^{th} Revised & Enlarged edition)

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Industrial Training/EDP/Special Study

COURSE CONTENT

Teacher should facilitate learning of following real life working environment, new knowledge, skills, and current technologies.

Industrial Training	• Student shall undergo industrial training for a minimum period of **two weeks** during summer vacations between fourth semester and fifth semester. • The industry in which industrial training is taken should be a medium or large scale industry • The paper bound report on training must be submitted by the student in the beginning of Fifth semester along with a certificate from the company where the student took training. • Every student should write the report separately. • Institute / Department/T&P Cell have to assist the students for finding Industries for the training. • Students must take prior permission from Department before joining for Industrial Training.
EDP (Entrepreneurship Development Program)	• Student has to participate in Entrepreneurship Development Program for a minimum period of **One week** during summer vacations between fourth semester and fifth semester. • Every student must submit the paper bound report based on the program in the beginning of Fifth semester along with a certificate (Course / Program completion) from the program organizers. • Every student should write the report separately. • Institute / Department may arrange Entrepreneurship Development Program at their campus. • Students must take prior permission from Department before attending any Entrepreneurship Development Program.
Special Study	• Student has to submit name of three topics of his interest to the department. • Special study in a group shall not be allowed. • The three-member committee appointed by Head of Department shall allot one topic out of the three topics submitted by the student. • Every student must submit the paper bound report based on special study at the end of Fifth semester. • Department should allot guide to all such students, for monitoring their progress and guide them for literature survey / report writing etc. • Evaluation of special study shall be done based on presentation made by student, followed by brief question answer session.

Guide lines for ICA:

Assessment shall be based on the active participation of the students in the Industrial Training / EDP / Special study and based on knowledge / skill acquired by the student. The three-member committee appointed by Head of Department in consultation with the Principal shall assess the reports and award marks based on following:

(a) Report	10 marks.
(b) Presentation	10 marks.
(c) Viva-voce at the time of presentation	05 marks.
Total:	**25 marks.**

NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Third Year Chemical Engineering

Faculty of Engineering and Technology

Teacher and Examiner's Manual

SEM –VI

W.E.F 2014 – 2015

Process Equipment Design- II

Teacher, Paper setter and Examiner should follow the guidelines as given below.

Unit- I

Teacher should facilitate learning of Process Design of Heat Exchanger and Evaporator.

1.	Process Design of Heat Exchanger and Evaporator:		Lectures required	Reference No.
	a)	Process Design of Heat Exchanger: Introduction, Types of Heat Exchanger	01	2 & 3
	b)	Process Design of Shell and Tube Heat Exchanger	01	2 & 3
	c)	Numerical	02	2 & 3
	d)	Process Design of Evaporator: Introduction, Types of Evaporator	01	2
	e)	Methods of Feeding of Evaporator, Design of Calendria type Evaporator, Numerical	03	2 & 7

Unit- II

Teacher should facilitate learning of Process Design of Reaction Vessels and Crystallizer Design.

2.	Process Design of Reaction Vessels and Crystallizer Design:		Lectures required	Reference No.
	a)	Process Design of Reaction Vessels: Introduction, Materials of Construction, Agitation, Classification of Reaction Vessels and Heating Systems	01	2
	b)	Design of Reaction Vessel, Numerical	03	2 & 8
	c)	Crystallizer Design: Introduction and Types of Crystallizers	01	2 & 6
	d)	Design of crystallizers	01	2 & 6
	e)	Numerical	02	2 & 6

Unit- III

Teacher should facilitate learning of Process Design of Rotary Dryer and Design of Tall Vessels.

3.	Process Design of Rotary Dryer and Design of Tall Vessels:		Lectures required	Reference No.
	a)	Process Design of Rotary Dryer: Introduction and Types of Dryer	01	2 & 5
	b)	Design of Rotary Dryer, Numerical	03	2 & 5
	c)	Design of Tall Vessels: Introduction, The Axial Stresses Due To Dead Loads, The Axial Stresses Due To Pressure,	01	1 & 2
	d)	Longitudinal Bending Stresses due to Dynamic Loads, Design of Distillation (Tall) Column (Tower)	01	1 & 2
	e)	Numerical	02	1 & 2

Unit- IV

Teacher should facilitate learning of Design of Sieve Tray for Distillation Column and Design of Thick Walled High Pressure Vessel.

4.	Design of Sieve Tray for Distillation Column and Design of Thick Walled High Pressure Vessel:		Lectures required	Reference No.
	a)	Introduction of Sieve Tray for Distillation Column	01	1 & 4
	b)	Design of Sieve Tray for Distillation Column	01	1 & 4
	c)	Numerical	02	1 & 4
	d)	Introduction of Thick Walled High Pressure Vessel	01	2
	e)	Design of Thick Walled High Pressure Vessel	01	2
	f)	Numerical	02	2

Unit- V

Teacher should facilitate learning of Design of Bubble Cap Tray for Distillation Operation and Design of Turbine Agitator.

5.	Design of Bubble Cap Tray for Distillation Operation and Design of Turbine Agitator :		Lectures required	Reference No.
	a)	Introduction of Bubble Cap Tray for Distillation Operation	01	1 & 4
	b)	Design of Bubble Cap Tray for Distillation Operation	01	1 & 4
	c)	Numerical	02	1 & 4
	d)	Agitators: Introduction and Types of Agitators	01	2
	e)	Baffling and Power Requirements	01	2
	f)	Design of Turbine Agitator	02	2

References:

1 B.C. Bhattacharya, Introduction to Chemical Equipment Design (Mechanical Aspects), CBS Publisher and Distributors, New Delhi.
2 M.V.Joshi and V.V. Mahajani Process Equipment Design, Macmillan Publishers India Ltd. (Fourth Edition).
3 Coulson & Richardson Chemical Engineering (Vol. VI), Butterworth-Heinmann (Elsevier) (Sixth Edition).
4 R.E.Treybal, Mass Transfer Operations, McGraw Hill, New Delhi
5 G.K.Roy, Solved Problems In Chemical Engg., Khanna Publications, NewDelhi.
6 S.D. Dawande, Process Equipment Design (Vol. I & II), Denett & Co., Nagpur.
7 J.H.Perry, Chemical Engineer's Hand Book, McGrawhill, New Delhi.
8 Lloyed E.Brownell, Edwin H.Young, Process Equipment Design, John Wiley & Sons

Chemical Reaction Engineering-I

Teacher, Paper setter and Examiner should follow the guidelines as given below.

Unit- I

Teacher should facilitate learning of Chemical Reaction Engineering: Review of chemical reaction equilibrium

.1.	**Classification of Chemical Reaction, Rate of reaction, Order of reaction:**		**Lectures required**	**Reference No.**
	a)	Introduction to Chemical Reaction Engineering: Review of chemical reaction equilibrium	01	1
	b)	Classification of chemical reaction, rate of reaction, order and molecularity of reaction, rate constant	01	1
	c)	Temperature dependent term of rate equation, comparison of theories	02	1
	d)	Activation energy and temperature dependency	02	1
	e)	Rate of reaction predicted by theories, Reaction mechanism	02	1

Unit- II

Teacher should facilitate learning of Integral and differential method of analysis of data, Variable volume batch reactor

.

2.	**Interpretation of Kinetic Data for Batch Reactor:**		**Lectures required**	**Reference No.**
	a)	Collection & interpretation of kinetic data	01	1
	b)	Constant volume batch reactor Integral and differential method of analysis of data	03	1
	c)	Variable volume batch reactor, Integral and differential method of analysis of data	03	1
	d)	The search for rate equation	01	1

Unit- III

Teacher should facilitate learning of Recycle reactor and Autocatalytic reaction.

3.	**Ideal batch reactor, Mixed flow reactor, Plug flow reactor:**		**Lectures required**	**Reference No.**
	a)	Ideal batch reactor ,mixed flow reactor ,plug flow reactor	02	1 & 6
	b)	Space time and space velocity, holding time and space time for batch , mixed and plug flow reactors	02	1, 2 & 3
	c)	Comparison in mixed and plug flow reactors, Combined flow system	02	1 & 3
	d)	Recycle reactor	01	1
	e)	Autocatalytic reaction	01	1

Unit- IV

Teacher should facilitate learning of multiple reactions in parallel and series, adiabatic and non adiabatic.

4.	Multiple Reactions :		Lectures required	Reference No.
	a)	Introduction to multiple reactions: Reaction in parallel, Reaction in series	01	1
	b)	Series parallel reaction	02	1 & 3
	c)	Optimum temperature progression for single reaction	01	1
	d)	Isothermal, adiabatic, non adiabatic operation	02	1, 3, 4 & 5
	e)	Product distribution and temperature for multiple reactions	02	1, 3 & 7

Unit- V

Teacher should facilitate learning of Residence Time Distribution of non ideal flow

5.	Residence Time Distribution and Concept of Micro and Macro Mixing:		Lectures required	Reference No.
	a)	Residence time distribution of fluid in vessel	02	1, 3, 4 & 5
	b)	Conversion directly from tracer information	01	1, 4 & 5
	c)	Models for non-ideal flow	01	1
	d)	Dispersion models, Tank in series model	02	1
	e)	Concept of micro and macro mixing	02	1

References:

1. Octave Levenspiel, Chemical Reaction Engineering, John Wiley and Sons.
2. J.M. Smith, Chemical Engineering Kinetics, McGraw Hill
3. H.Scott Fogler, Elements of Chemical Reaction Engineering, Prentice Hall New Jersey.
4. Coulson & Richardson Chemical Engineering (Vol. III), Butterworth-Heinmann (Elsevier) (Sixth Edition).
5. Coulson & Richardson Chemical Engineering (Vol. V), Butterworth-Heinmann (Elsevier) (Sixth Edition).
6. S.D. Dawande, Principles of Reaction Engineering, Denett & Co., Nagpur.
7. Lanny D. Schimdt , Chemical Reaction Engineering, Oxford University Press.

Chemical Engineering Thermodynamics

Teacher, Paper setter and Examiner should follow the following guidelines.

Unit – I

Teacher should facilitate learning of fundamental concepts of laws of thermodynamics.

1.	Laws of Thermodynamics:		Lectures required	Reference No.
	a)	Introduction to the subject, The laws of Thermodynamics	01	1 & 2
	b)	Cyclic rule, Coefficient of Thermal Expansion, Compressibility Coefficient ,First Law of Thermodynamics : Basic Laws	02	1 & 2
	c)	Law of corresponding state, Heat Capacities, Enthalpy as a function of Temperature & Pressure,	02	1 & 2
	d)	Joule-Thomson Coefficient, Relation between C_p and C_v, Thermodynamic relations, Generalized Equation of State	02	1 & 2
	e)	Redlich-kwong equation of state, Soave-Redlich-Kwong equation of state	01	1 , 2 & 5

Unit- II

Teacher should facilitate learning of Entropy concept and entropy changes.

2.	Entropy Concept:		Lectures required	Reference No.
	a)	The Second Law of Thermodynamics, Mathematical Treatment of Entropy Concept	02	1 & 2
	b)	Combined form of First and Second Law of Thermodynamics	01	2
	c)	Thermodynamic Relations based on Second Law of Thermodynamics	03	1 , 2 , 5 & 6
	d)	Calculations of Entropy Changes, Third Law of Thermodynamics	02	1 & 2

Unit- III

Teacher should facilitate learning of Partial Molar Quantities and fugacity.

3.	Partial Molar Quantities and Fugacity:		Lectures required	Reference No.
	a)	Partial Molar Quantities: General Aspects, Determination of Partial Molar Volume and Enthalpy	02	1 & 2
	b)	Fugacity and Fugacity Coefficient, Fugacity coefficient through equation of state ,Phase equilibrium: General Aspects	02	1 & 2
	c)	Fugacity coefficient through virial coefficient correlation. Ideal solution: General Aspects	02	1 & 2
	d)	Gibbs-Duhem Equation, Gibbs-Duhem-Margules Equation, Application of Gibbs-Duhem Equation	02	1 , 2 & 6

Unit- IV

Teacher should facilitate learning of Vapour-Liquid Equilibria and its basic equations

4.	Vapour-Liquid Equilibrium:		Lectures required	Reference No.
	a)	Vapour-Liquid Equilibria (VLE): Basic equations for VLE, Thermodynamic consistency test of VLE data	02	1 & 2
	b)	Reduction of VLE data, Excess Gibbs free energy Model, Margules Equation & Van Laar Equation	02	1 & 2
	c)	Phase Equilibria for Single Component System: Gibbs-Helmholtz Equation	02	1 & 2
	d)	The Clapeyron Equation, Clausious-Clapeyron Equation, Application of Clapeyron Equation	02	1 & 2

Unit- V

Teacher should facilitate learning of Chemical Reaction Equilibria and Vant Hoff equation.

5.	Chemical Reaction Equilibria :		Lectures required	Reference No.
	a)	Chemical Reaction Equilibria: The criteria for chemical equilibrium, Equilibrium constant, Law of chemical equilibrium	03	1,3,4 & 5
	b)	Relations between equilibrium constant, Homogeneous gaseous equilibria, Temperature dependence of the equilibrium constant (The Van't Hoff Equation)	03	1,5 & 6
	c)	Integrated form of the Van't Hoff equation, Pressure dependence of the equilibrium constant	01	1& 5
	d)	Applications of Phase Equilibrium in Ideal Solutions: To construct pressure-composition and boiling point diagrams	01	1,3 & 5

References:

1. K.V. Narayanan, A Text book of Chemical Engineering Thermodynamic, Prentice Hall India Pvt. Ltd., New Delhi.
2. R.R.Rastogi and R.R.Mishra, An Introduction to Chemical Thermodynamics, Vikas Publishing House Pvt.Ltd, New Delhi.
3. B.G.Kyle, Chemical and Process Thermodynamics, Prentice Hall India Pvt. Ltd., New Delhi.
4. G.N. Pandey and J.C.Chaudhari, Chemical Engineering Thermodynamics, Khanna Publishers, Delhi.
5. J.M.Smith, H.C.Vanness, M.M.Abbott Introduction to Chemical Engineering Thermodynamics, 5^{th} edition, McGraw Hill International Edition.
6. Y.V.C. Rao, Chemical Engineering Thermodynamics, University Press (INDIA) Ltd., Orient Longman Ltd., Hyderabad.

Mass Transfer-II

Teacher, Paper setter and Examiner should follow the following guidelines.

Unit – I

Teacher should facilitate learning of distillation and vapor liquid equilibrium.

1.	Distillation and Types of Distillation:		Lectures required	Reference No.
	a)	Introduction to distillation process, Vapor liquid equilibrium	01	1 & 4
	b)	The methods of distillation (Binary mixture), differential , flash	02	1 & 4
	c)	Azeotropic, extractive, low pressure, steam distillation, batch rectification.	02	1 & 4
	d)	Condition for varying overflow in non- ideal system (Binary), Multi component mixture, The fractionating column	01	1 & 4
	e)	Continuous rectification for binary system, Equipments for Distillation	02	1 & 4

Unit- II

Teacher should facilitate learning of different types of columns for distillation.

2.	Design of Columns for Distillation:		Lectures required	Reference No.
	a)	Multistage (Tray) towers: Bubble cap trays, Sieve trays, Valve trays	01	1 & 4
	b)	Tray efficiencies, concept of reflux, minimum reflux ratio, optimum reflux, total reflux.	01	1 & 4
	c)	Lewis Sorrel, McCabe Thiele, and Ponchon Savarit method for multistage operations	03	1 & 4
	d)	Packed towers for distillation, Types of Packings	01	1 & 4
	e)	NTU, HTU, HETP concept and calculations	02	1 & 2

Unit- III

Teacher should facilitate learning of liquid-liquid extraction processes.

3.	Liquid-Liquid Extraction:		Lectures required	Reference No.
	a)	Introduction to extraction process, Liquid equilibria	01	1,2 & 3
	b)	Material balances for stage wise contact methods, Extraction with reflux	02	1,2 & 3
	c)	Fractional extraction	02	1 & 2
	d)	Stage contact and continuous contact type extractors	03	1 & 2

Unit- IV

Teacher should facilitate learning of adsorption, ion exchange and their applications.

4.	Adsorption and Ion exchange Operation:		Lectures required	Reference No.
	a)	Introduction to adsorption operation, Type of adsorption operation	01	1 &2
	b)	Nature of adsorbents, Adsorption equilibria, Adsorption of vapor, gas mixture and liquids, Material balances for stage wise for operation	03	1 &2
	c)	Continuous contact process for adsorption, Unsteady state fixed bed adsorption	01	1 &2
	d)	Principle of ion exchange operation, Equilibria for ion exchange operation	02	1 &2
	e)	Rate of ion exchange operation, Application of ion exchange operation	01	1 &2

Unit- V

Teacher should facilitate learning of leaching process, membrane separation processes.

5.	Leaching & Membrane Separation Processes :		Lectures required	Reference No.
	a)	Introduction to leaching operation, Mass Transfer in leaching operation	01	1 & 2
	b)	Calculation of stages for different processes, graphical method for calculation of no. of stages for counter current washing process	02	1 , 2 & 4
	c)	Equipments for leaching operation	02	1 & 2
	d)	Introduction to membrane separation process, Different Types of membrane separation process, (Ultrafiltration, Reverse Osmosis, Dialysis, Electro Dialysis, Pervaporation)	02	2
	e)	General membrane equation, Liquid membrane	01	2

References:

1 Coulson & Richardson Chemical Engineering (Vol. II), Butterworth-Heinmann (Elsevier) (Fifth Edition).
2 R.E.Treybal , Mass transfer operation ,McGraw Hill Book Company, (Third Edition).
3 Christie J.Geankoplis, Transport Processes & Unit Operations, Prentice Hall Inc.
4 Coulson & Richardson Chemical Engineering (Vol.V), Butterworth-Heinmann (Elsevier).

Process Engineering Economics & Costing

Teacher, Paper setter and Examiner should follow the following guidelines.

Unit – I

Teacher should facilitate learning of Status and Trends of Chemical Industry

1.	Status and Trends of Chemical Industry, Plant Capacity& Standardization :		Lectures required	Reference No.
	a)	Indian Chemical Industry, Current Status, Trends and Challenges ahead	02	1 & 5 *
	b)	Scale of Production	02	4
	c)	Selection of Plant Capacity, Plant Location : Factors involved, Selection of Plant Site	02	1, 2 & 3
	d)	Energy Gestation Period. Expansion, Diversification and Obsolescence	01	1
	e)	Scope for Standardization in Design and Production. Economics of Research and Development	01	1

*** Note:** For Part (a) Teacher, Paper setter and Examiner should take into account the latest development in Chemical Process Industry in addition to the references mentioned, by referring Journals, Magazines and Internet resource Material.

Unit- II

Teacher should facilitate learning of Cost Estimation and Capital Investment.

2.	Cost Estimation:		Lectures required	Reference No.
	a)	Cost: Prime Cost, Overhead Cost, Total Cost, Standard Cost & Variances	01	1, 2 & 3
	b)	Cost Estimation: Factors Affecting Investment and Production Cost	02	1 & 2
	c)	Capital Investment, Fixed Investment and Working Capital	02	1 & 2
	d)	Estimating Equipment Cost By 6 /10 Factor Rule. Method of Estimating Capital Investment	02	1 & 2
	e)	Different Costs Involved in Total Product Cost, Computer Automization in Costing	01	1 & 2

Unit- III

Teacher should facilitate learning of Interest and Investment Cost & Taxes and Insurances.

3.	Interest and Investment Cost & Taxes and Insurances:		Lectures required	Reference No.
	a)	Interest and Investment Cost, Simple and Compound Interest	01	1 & 2
	b)	Nominal and Effective Rates of Interest, Continuous Interest	01	1 & 2
	c)	Present Worth, Ordinary Annuity, Perpetuities and Capital Costs	02	1 & 2
	d)	Types of Taxes and Tax Returns	02	1 & 3
	e)	Types of Insurance and Legal Responsibility	02	1 & 3

Unit- IV

Teacher should facilitate learning of Types and Methods of Determination of Depreciation

4.	Depreciation:		Lectures required	Reference No.
	a)	Types of Depreciation	01	1, 2 & 3
	b)	Service Life, Salvage Value, Present Value	01	1, 2 & 3
	c)	Methods of Determining Depreciation	05	1, 2 & 3
	d)	Single Unit and Group Depreciation. Causes of Obsolescence and Inadequacy	01	1, 2 & 3

Unit- V

Teacher should facilitate learning of Profitability Evaluation and Break Even Analysis.

5.	Profitability Evaluation and Break Even Analysis:		Lectures required	Reference No.
	a)	Mathematical Methods of Profitability Evaluation	02	1 & 2
	b)	Cash Flow Diagram, Alternative Investment, Replacement: Types and Factors	02	1 & 2
	c)	Break Even Analysis	02	1, 2 & 3
	d)	Balance Sheet, Pricing Issue Method and Income Statement	02	1 & 3

References:

1. Max S. Peters, Klaus D. Timmerhaus, Ronald E. West, Plant Design and Economics for Chemical Engineers, McGraw Hill (Fifth Edition).
2. T.R. Banga and S.C.Sharma, Industrial Organization & Engineering Economics, Khanna Publishers, New Delhi (Twenty Fourth Edition).
3. O.P.Khanna, Industrial Engineering & Management, Dhanpat Rai Publications (P) Ltd. New Delhi (Revised Enlarged Edition).
4. Dewett & Varma, Elementary Economic Theory: S. Chand & Company Ltd New Delhi.
5. James Riley Couper, (2003), Process Engineering Economics, CRC Press (Taylor & Francis Group).

LAB Chemical Reaction Engineering-I

COURSE CONTENT

Teacher should facilitate learning following lab experiments:

(Note: Any eight experiments from the following)

Experiments		Lab hours required
1	To determine the reaction rate constant {k} for given reaction. (CSTR / BATCH / SEMIBATCH / PFR)	02
2	To determine the effect of temperature on reaction rate constant. (CSTR / BATCH / SEMIBATCH / PFR)	02
3	To determine the activation energy {E} for the given reaction. (CSTR / BATCH / SEMIBATCH / PFR)	02
4	To draw C [t], E [t] & F [t] curve and to calculate the mean residence time {tm} variance { σ^2 } and skewness { S^3 } for plug flow reactor	02
5	To draw C [t], E [t] and F [t] curve and to calculate the mean residence time {tm} variance { σ^2 } and skewness { S^3 } for packed bed reactor	02
6	To study the cascaded CSTR	02
7	To draw C [t], E [t] and F [t] curve and to calculate the mean residence time {tm} variance { σ^2 } and skewness {S^3} for Annular reactor	02
8	To study the kinetics in tubular flow reactor [coiled tube] for the given reaction	02

References for Practicals:

Designed Standard College Laboratory Manual and Instruction Manuals of the Laboratory Equipment Suppliers.

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student will be asked questions related to practical performed. Evaluation will be based on performance in the practical during semester and viva-voce.

LAB Mass Transfer-II

COURSE CONTENT

Teacher should facilitate learning following lab experiments:

(Note: Any eight experiments from the following)

Experiments		Lab hours required
1	To verify Rayleigh's equation for simple distillation	04
2	To plot the vapor liquid equilibrium curve for a binary mixture	04
3	Determination of HTU, HETP and NTU	04
4	To construct ternary diagram for given system	04
5	To study Tie Lines	04
6	To study and determine the efficiency of cross current liquid- liquid extraction.	04
7	To study Spray Column	04
8	To calculate efficiency of cross current leaching operation	04
9	To study adsorption of acetic acid on activated charcoal	04
10	To study Ion Exchange	04

References for Practicals:

Designed Standard College Laboratory Manual and Instruction Manuals of the Laboratory Equipment Suppliers.

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student may be asked questions based on the practicals performed during lab work. Evaluation will be based on practical and oral examination related to laboratory course.

Lab Entrepreneurship

COURSE CONTENT

Teacher should facilitate learning of following assignments:

(Note: Any eight assignments from the following)

Assignments		Lab hours required
1	To identify and define various elements essential for developing and leading a successful enterprise	02
2	Enlist the qualities entrepreneur posses to be successful businessman	02
3	How to select and what procedure is to be adopted for setting up an enterprise	02
4	With the help of schedule/questionnaire how to prepare a market survey report	02
5	What are the possible financial resources available for setting up an enterprise?	02
6	Preparation of feasibility report to set up a small scale enterprise	02
7	A report on various industry promotion schemes facilitated by State and Central government	02
8	A visit report to various State and Central Agencies involved in setting up an enterprise such as industrial development corporation, pollution control board etc.	02
9	A visit report by group of students to any enterprise of their interest	02
10	A case study defining what great managers do to sustain in ever changing world	02

References for Practicals:

1. Amar Bhide, (2000), The Origin and Evolution of New Business, Oxford University Press, New York.
2. C.R. Kothari (2008), Research Methodology- Methods and Techniques, New Age International Publishers, New Delhi (2nd revised edition).
3. Dr.Vasant Desai (2013), Entrepreneurial Development, Himalaya Publishing House, Mumbai.
4. O.P.Khanna, Industrial Engineering & Management, Dhanpat Rai Publications (P) Ltd.

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of assignments/report.

Minor Project

COURSE CONTENT

Teacher should facilitate learning of self study, enhance analytical ability, promote research oriented activity by developing ability of extracting the material from the different sources and writing comprehensively and exhaustive report on an allotted topic and ability to explore and present a topic in systematic manner.

Following should be considered:

1	Every student shall undertake the Minor Project in semester VI. It is expected that the broad area of major project shall be finalized by the student in the beginning of the VI semester and Minor project undertaken may be a part of Major Project
2	Each student shall work on an approved project, a group of 05 students (maximum) shall be allotted for the each minor project and same group may be continued for major project
3	Minor project may involve fabrication, design or investigation of a technical problem that may take design, experimental or analytical character or combine element of these areas. The project work shall involve sufficient work so that students get acquainted with different aspects of fabrication, design or analysis
4	Each group of students is required to maintain separate log book for documenting various activities of minor project
5	The three-member committee appointed by Head of the department shall be constituted for finalizing the topics of minor project. Maximum four minor project groups shall be assigned to one teaching staff

Guide lines for ICA: Assessment of the project for award of ICA marks

shall be done jointly by the guide and departmental committee as per the guidelines given in Table-A.

Assessment of Minor Project
Name of the Project: _____
Name of the Guide: _____
Table-A

SN	Exam Seat No	Name of Student	Project Selection	Documentation	Design /Simulation/Logic	PCB/hardware/programming	Result Verification	Presentation	Total
			5	10	10	10	10	5	50

Seminar-I

COURSE CONTENT

Teacher should facilitate learning of communication ability of an individual and to improve technical knowledge through study of specific topic. Teacher should also facilitate understanding ability, ability to listen, proper language, oral presentation skill amongst students.]

Following should be considered:

1	For Seminar-I every student will individually study a topic assigned to him / her and submit a report and shall deliver a short lecture / Seminar on the topic during the term
2	The three-member committee appointed by Head of the department shall be constituted for finalizing the topics of Seminar-I. Seminar shall be related state of the art topic of his choice approved by the committee
3	Seminar topic should not be repeated and registration of the same shall be done on first come first serve basis
4	Topic of Seminar shall be registered within a two week from commencement of VI Semester and shall be approved by the committee
5	Maximum six seminar supervision shall be allotted to each teacher
6	At the end of semester, student should submit the seminar report (paper bound copy)in following format: a. Size of report shall be of minimum 25 pages. b. Student should preferably refer minimum five reference books / magazines/standard research papers. c. Format of Report i. Introduction ii. Literature survey iii. Theory 1) Implementation 2) Methodology 3) Application 4) Advantages, Disadvantages iv. Future scope v. Conclusion

Guide lines for ICA: ICA shall be based on evaluation of student performance by a seminar presented by the student. Every student shall be required to present a seminar in presence of Panel of teachers constituted by the Head of Department in consultation with the Principal. The evaluation shall be based as per the guidelines given in Table- B

Title of Seminar: _____
Name of Guide: _____

Table-B

SN	Exam Seat No	Name of Student	Topic Selection	Literature survey	Report writing	Depth of understanding	Presentation	Total
			5	5	5	5	5	25