Faculty of Engineering and Technology

P.K.University

Shivpuri (MP)

Evaluation Scheme & Syllabus

M.Tech. in Chemical Engineering

(II Semester)

(Effective from session 2025-26)

EVALUATION SCHEME

M.Tech –CHEMICAL ENGINEERING (2nd SEM)

STUDY AND EVALUATION SCHEME FOR M.TECH. IN CHEMICAL ENGINEERING
YEAR-1st/SEMESTER-II

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	
MADVACH201	Advances in Fluidization Engg.	3	1	0	4	30	-	30	70	-	70	100
MCHEMCH202	Chemical Process Design	3	0	0	3	30	-	30	70	-	70	100
MADVACH203	Advanced Transport Phenomena	3	1	0	4	30	-	30	70	-	70	100
MINDUCH204	Industrial Waste Management	3	0	0	3	30	-	30	70	-	70	100
MADVACH205	Advanced Food Process Engineering	3	0	0	3	30	-	30	70	-	70	100
MAIRPCH206	Air Pollution Control Equipment Design	3	0	0	3	30	-	30	70	-	70	100
MSOFTCH207	Software Laboratory	0	0	2	1	-	25	25	-	25	25	50
Total		18	0	2	21	180	25	205	420	25	445	650

Department of Chemical Engineering
(Faculty of Engineering and Technology)
P.K. University, Shivpuri (MP
I Year II Semester

L	T	P
3	1	0

MADVACH201:
ADVANCES IN FLUIDIZATION ENGINEERING COURSE

Applications of fluidized beds: Introduction, Industrial application of fluidized beds, Physical operations and reactions.

Fluidization and analysis of different phases: Gross behavior of fluidized beds. Bubbles in dense beds. The emulsion phase in dense bubbling beds. Flow pattern of gas through fluidized beds.

Heat and Mass transfer in fluidized bed systems: Mass and heat transfer between fluid and solid. Gas conversion in bubbling beds. Heat transfer between fluidized bed and surfaces.

Elutriation and entrainment: TD and also distribution of solid in a fluidized bed.

Circulation systems.

Design of fluidized bed systems: design of fluidization columns for physical operations, catalytic and non- catalytic reactions, three phase fluidization.

TEXT BOOK:

1. *Diazo Kunji and O. Levenspiel, "Fluidization Engg". 2nd Ed., Butterworth Heinemann, 1991.*

REFERENCE:

1. *J. F. Davidson and Harrison, "Fluidization", 10th Ed, Academic Press, London, 1994.*

2. *Jackson, R., "The Dynamics of Fluidized Particles," Cambridge University Press, New York (2000).*

3. *Fan, L.-S. and C. Zhu, Principles of Gas-Solid Flows, Cambridge University Press, New York (1998).*

Department of Chemical Engineering
(Faculty of Engineering and Technology)
P.K. University, Shivpuri (MP
I Year II Semester

L	T	P
3	0	0

MCHEMCH202
CHEMICAL PROCESS DESIGN

Design and sizing of Shell and Tube Heat exchangers with types and arrangements of fluids, plate type heat exchanger, Condensers -vertical and Horizontal.

Design and sizing of Single and Multiple effect Evaporators-Short tube, long tube etc.

Design of storage tank and supports: horizontal storage tank, Design of Saddle, Skirt, and Lug supports

Design of Reaction vessel with and without cooling coil, Normal and High Pressure vessel, Design and sizing of mass transfer equipments: Design of distillation column, Multi-component distillation with reboiler, Absorption tower both plate as well as packed type, cooling tower and extraction columns Design and sizing of drier, and Crystallizer.

Design and sizing of phase separation equipment- filter press, Centrifuge, Cyclone (Hydro as well as air).

All the above design should be taught in a process Integration approach with special the material and energy conservation

Aspen Plus lab type course: Property method and model descriptions, Property calculation method and Routes, Petroleum component characterization method Property parameter estimation and simulation of different process equipments using Software

TEXT BOOKS:

1. *K.Q.Kern Process Heat transfer, McGraw-Hill,1965*
2. *Coulson and Richardson Chemical Engineering Vol.VI, Pergamon Press,1983*
3. *S.B.Thakore and B.I.Bhatt Introduction to Process Engineering and Design, McGraw-Hill, 2009*
4. *Couper, "Chemical process equipment design*

REFERENCES:

1. *Perry Chemical Engineer's Hand book by Perry, McGraw-Hill,2009*
2. *McCabe and Smith Unit operation of Chemical Engineering, McGraw-Hill, 2008*
3. *Christie John Geankopolis Transport process and Separation Process, Fourth Edition, PHI, 2004.*
4. *Aspen Manual*

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

I Year II Semester

MADVACH203

L	T	P
3	1	0

ADVANCED TRANSPORT PHENOMENA

Momentum Transport:

Introduction to concepts and definitions, Newtonian and non-Newtonian Fluid Models, Review of Shell balance method and Equations of changes for fluid flow problems (Flow over flat plate, though pipes, packed bed and fluidized beds)

Turbulent Flow - Equation of changes, phenomenological theories, Turbulent flow in closed conduits and analysis of different velocity distributions, Boundary layer theory: Equation of changes, Blasius Exact solution method, von karman Integral momentum method, Boundary layer separation.

Energy Transport:

Application of Shell balance and Equations of changes for temperature distributions in heat flow problems Steady state conduction, Combination of heat transfer resistance,

Different method of analysis for Multidimensional Steady and Unsteady state heat conduction, Convection heat transfer co-efficient, Heat transfer during Laminar and Turbulent flow in closed conduits-,

Mass Transport

Application of Shell balance method and Equations of changes for mass transfer problems, Concentration distributions for isothermal and non-isothermal mixtures, Multi component systems, with more than one one independent variable and in turbulent flow Convective mass transfer and correlation, interphase mass transfer, Macroscopic balance for multi component system, Mass transfer with chemical reactions,

Dimensional analysis in fluid dynamics, convection heat transfer, Boiling and Condensation heat transfer, Heat transfer in Liquid metals, Empirical correlation for high Prandtl Number of fluids, Analogy between momentum and heat transfer,

TEXT BOOKS:

R. Byron Bird, Warren E. Stewart and Edwin N. Lightfoot, "Transport Phenomena", Revised second Edition, John Wiley & Sons, 2007

REFERENCES:

JamesWelty, Charles E. Wicks and Wilson, Gregory L Rorrer, "Fundamentals of Momentum, Heat and Mass transfer", 5th Edition, 2008.

C. O.Bennet and J. O. Meyers, "Momemtum, Heat and Mass transfer" McGraw Hill, 1995.

J.P. Holman, "Heat Transfer", 8th Edition, McGraw Hill, New York, 1997

H. Schlichting, Boundary-Layer Theory, 7th edition, McGraw-Hill, Inc,

Department of Chemical Engineering
(Faculty of Engineering and Technology)
P.K. University, Shivpuri (MP
I Year II Semester

L	T	P
3	0	0

MINDUCH204: INDUSTRIAL WASTE MANAGEMENT

Water Pollutants, Effects, Monitoring and Quality standards: Pollution of water and soil, effect of pollutants on environment and health, monitoring water pollution, water pollution laws and minimum national standards, monitoring, compliance with standards, Latest norms for effluent treatment.

Water Pollution Sources, Analysis and Methods of control: Water pollution sources and classification of water pollutants - Wastewater sampling and analysis. Treatment of water-pollution: BOD, COD of wastewater and its reduction – Fundamentals of Anaerobic digestion and Aerobic digestion.

Wastewater Treatment Plant Design: Physical unit operations: Screening, Flow equalization, sedimentation etc., Chemical Unit Processes: chemical precipitation, dis-infection, colour removal by adsorption Biological unit processes: Aerobic suspended - growth treatment processes, aerobic attached-growth treatment processes, anaerobic suspended - growth treatment processes, anaerobic attached-growth treatment processes.

Advanced Wastewater and Water Treatment: Carbon adsorption - Ion exchange - Membrane processes - Nutrient (nitrogen and phosphorus) removal - Design ofplant for treatment and disposal of sludge

Solids Waste and Landfill Management: Sources and classification - methods of solid waste disposal - Composting (natural) - Accelerated composting with industrial sludge - Landfill technology - Methods adopted for municipal solid waste - Toxic-waste management, Incineration of industrial waste, Design aspects, economics.

Hazardous Waste Management and Risk Assessment: Types of hazardous Wastes-Health effects - Nuclear fission and radioactive waste treatment and disposal methods. Risk assessment

TEXT BOOKS: **1.** C.S. Rao, "Environmental Pollution Control Engineering", Wiley 2nd Edition, New Age International Publishers, 2006.

2 S.P. Mahajan, "Pollution Control in Process Industries", Tata McGraw Hill, New Delhi, 1985

REFERENCES:

1. P. Sincero and G.A. Sincero, Environmental Engineering: A Design Approach Prentice Hall of India pvt Ltd, N.Delhi.1996

2. Tchbanoglous and F.L. Burton, Metcalf and Eddy's Wastewater Treatment-Disposal And Reuse (Third Ed.), TMH publishing Co Ltd, N. Delhi. (1996)

Department of Chemical Engineering
(Faculty of Engineering and Technology)
P.K. University, Shivpuri (MP)
I Year II Semester

L	T	P
3	0	0

MADVACH205: ADVANCED FOOD PROCESS ENGINEERING

Food Process Engineering - Fundamentals: Raw material and the process-Geometric, Functional and Growth properties of the raw material, Mechanization and the raw material, cleaning - contaminants in food raw materials, function of cleaning and cleaning methods, sorting and Grading of Foods.

Unit Operations in Food Processing: Fluid flow, thermal process calculations, refrigeration, evaporation and dehydration operations to food processing. Heat processing of foods - modes of heat transfer involved in heat processing of foods.

Food Canning Technology: Fundamentals of food canning technology, Heat sterilization of canned food, containers - metal, glass and flexible packaging, Canning procedures for fruits, vegetables, meats, poultry and marine produces.

Separation And Mixing Process In Food Industries: Conversion operations. Size reduction and screening of solids mixing and emulsification, filtration and membrane separation, centrifugation, crystallization, extraction.

Food Biotechnology: Food Biotechnology. Dairy and cereal products.

Beverages and food ingredients. High fructose corn syrup. Single cell protein.

TEXT BOOK:

1. *R.T. Toledo, "Fundamentals of Food Process Engineering", AVI Publishing Co., New York, 1980.*
2.

REFERENCES:

1. *J.M. Jackson & B.M. Shinn, "Fundamentals of Food Canning Technology", AVI Publishing Co., New York, 1978.*
2. *J.G. Bernnan, J. R .Butters, N.D. Cowell & A. E. V. Lilley, "Food Engineering Operations", 2nd Edn., Applied Science, New York, 1976.*

Department of Chemical Engineering
(Faculty of Engineering and Technology)
P.K. University, Shivpuri (MP)
I Year I Semester

L	T	P
3	0	0

MAIRPCH206: AIR POLLUTION CONTROL EQUIPMENT DESIGN

Air Pollutant Sources, Effects and Clean Air Acts: Pollution of air: Sources and effects of air pollutants on physical environment and living systems, Monitoring air pollution, Air pollution Laws and Minimum national standards.

Air Pollutant Formation, Dipersion, Analysis: Formation of pollutants through large-scale combustion of fossil fuels, mineral processing, automobiles in urban areas and at source minimisation of release - Meteorological aspects of air pollutant dispersion. Chemical reactions in a contaminated atmosphere, urban air pollution, acid rain Air sampling and measurement, Analysis of air pollutants

Air Pollution Control Methods for Particulates Removal: Control Methods - Source Correction methods - Particulate emission control: Dry techniques industrial dust collectors, cyclone and multiclone separators, bag filters, electrostatic precipitators, relative merits and demerits, choice of equipments, design aspects economics. Wet techniques wet dust collection, wet cyclone, empty scrubber, column (packed) scrubber, ventury scrubber, suitability, merits and demerits, design aspects and economics.

Control of Specific Gaseous Pollutants: Cleaning of Gaseous effluents - Control of sulphur dioxide emission by various methods - Control of nitrogen oxides in combustion products - Control of release of carbon monoxide and hydrocarbons to the atmosphere.

Noise Pollution and Control: Sound pressure, Power and Intensity - Measures of Noise- Outdoor noise propagation- Indoor Noise propagation- Noise Control

TEXT BOOKS:

1. Y.B.G. Verma, H. Brauer," Air Pollution Control Equipments", Springer, Verlag Berlin,1981.
2. M.N. Rao and H.V.N. Rao, "Air Pollution", Tata McGraw Hill, New Delhi, 1993.

REFERENCES:

1. Rao C.S. "Environmental Pollution Control Engineering," 2nd Edition, New Age International Publishers, 2006.

A. P. Sincero and G.A. Sincero Environmental Engineering: A Design Approach, Prentice Hall of India pvt Ltd, N.Delhi.1996

Department of Chemical Engineering
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P.K. University, Shivpuri (MP)
I Year II Semester

L	T	P
0	0	2

MSOFTCH207: SOFTWARE LABORATORY

Experiments Simulation of steady state and Dynamic processes using ASPEN PLUS. Simulation of mass transfer processes using ANSYS. Solving linear and non-linear algebraic equations, matrix operations, differential equations, land parameter estimation by linear and non-linear regression methods and MATLAB