

University School of Chemical Technology
Guru Gobind Singh Indraprastha University

Syllabus of Examination

B.Tech/M.Tech Dual Degree (Chemical Engineering)

(3rd Semester)

(w.e.f. August 2004 Batch)

B.Tech/M.Tech Dual Degree (Chemical Engineering) (3rd Semester)

SCHEME OF EXAMINATION

B.TECH/M.TECH DUAL DEGREE (CHEMICAL ENGINEERING)

L	T	P	Credits
15	5	12	28

THIRD SEMESTER EXAMINATION

Code No.	Paper	L	T	P	Credits
<u>Theory Papers</u>					
99211 BA-211	Physical Chemistry	3	1	0	4
99213 BA-213	Applied Mathematics III	3	1	0	4
14201 CT-201	Chemical Process Calculations	3	1	0	4
14203 CT-203	Fluid Mechanics	3	1	0	4
14205 CT-205	Unit Operations-I	3	1	0	4
<u>Practical/Viva Voce</u>					
99261 BA-261	Physical Chemistry Lab	0	0	3	2
14251 CT-251	Unit Operation Lab-I	0	0	3	2
14271 CT-271	Workshop	0	0	3	2
15275 IT-275	Computer Programming Lab	0	0	3	2
Total		15	5	12	28

CT-201	Chemical Process Calculations	L	T	P	Credits
		3	1	0	4

Stoichiometric and composition relationship, behavior of ideal gases, gaseous mixtures, vapor pressure, humidity and humidity chart.

Units and dimensions, applications of laws of conservation of mass and energy to single and multistage process.

Material balance for (a) Non-reacting systems- recycle, bypass etc.
(b) Reacting systems- recycle, bypass, purging etc.

Energy balance for non reacting and reacting systems, flame temperature, adiabatic reaction temperature, combustion, heat capacity, heat of reaction etc.

Material and energy balances for unit operations and processes, integrated balances for manufacturing processes.

Books & References :

1. Stoichiometry, Bhatt V.I. and Vora S.M., Tata McGraw Hill, 3rd Ed., 1996.
2. Basic Principles of Calculations in Chemical Engineering, Himmelblau D.M., Prentice Hall, 6th Ed., 1999.
3. Elementary Principles of Chemical Processes, Felder R.M. and Rousseau R. W., John Wiley & sons, Inc., 3rd Ed., 2000.

CT-203 **Fluid Mechanics**

L	T	P	Credits
3	1	0	4

Fluid Statics : Pressure measurement, forces on submerged bodies.

Properties of fluid: Equation of continuity and motion, Bernoulli's Equation and its applications. Newtonian and non-Newtonian fluids, Laminar and Turbulent flows. Pressure drop calculations and friction factor.

Measurement and Control of Flowing Fluids: Principles and operation of variable head meter and variable area meter.

Fluid moving machineries such as pumps, blowers. Application and selection of valves.

Boundary layer flow: Flow past immersed bodies, drag and lift forces, motion of solids through a fluid.

Dimensional Analysis : Flow of Incompressible fluids: Laminar and turbulent flow in pipes, velocity distribution in pipes, frictional losses in pipes and fittings, Fanning Equation, Estimation of economic pipe diameter, derivation of Hagen - Poiseuille and $f=16/Re$ equations.

Agitation and mixing of liquids

Fluidization: Conditions of fluidization, aggregate and particulate fluidization, Ergun's and Kozeny Equation. Flow through packed and fluidized Beds

Flow of compressible fluid: Basic equations, Flow through ducts, venturimeter, convergent-divergent nozzle. Laval Nozzle, fanno flow.

Books & References :

1. Unit Operations of Chemical Engineering, McCabe W.L, Smith J.C. and Harriott P., McGraw Hill International Edition, Singapore, 5th Ed., 1993.
2. Chemical Engineering, Vol .1, Coulson J.M. and Richardson J.F, Butterworth Heinemann, Oxford 6th Ed., 1999.
3. Introduction to Chemical Engineering, Badger W.L. and Banchero J.T., Tata McGraw Hill, 1997
4. Unit Operations of Chemical Engineering, Vol .1, Chattopadhyaya, P, Khanna 2nd Ed., 1998
5. Fluid Mechanics, Douglas J. F., Gasiorek J.M., Swaffield J.A., Addison-Wesley Longman, 3rd Ed., 1995
6. Fluid Mechanics for Chemical Engineers, Nevers N. D., McGraw Hill, New York, 2nd Ed., 1991.

CT-205 **Unit Operations-I**

L	T	P	Credits
3	1	0	4

Size Reduction : Size reduction of solids, energy for size reduction, law's of crushing and grinding, work index, particle size distribution.

Mechanical Separation: Screening: stationary screens, Trommel and vibrating screens,

Filtration: plate and frame filter press, continuous rotary vacuum filter, filter aids etc;

Sedimentation: One dimensional motion of particles through fluid. Batch and continuous thickeners

Centrifuge: Tubular bowl centrifuge, disks centrifuge, and batch basket centrifuge. Cyclone separators, electrostatic and magnetic precipitator.

Conveying: Mechanical and pneumatic conveying system, storage and handling of materials, design and power requirement.

Crystallization: Theory of solubility and crystallization, phase diagram (temp - solubility relationship), population balance analysis, method of moments for rate expression. For volume area and length growth., crystal size distribution, Mixed suspension mixed product removal operation, programmed evaporative and cooling (rate expressions), most dominant size ideal classified bed, melt crystallization, process design of crystallizers and their operation, selection and specification of crystallizers like OSLO, Swenson Walker, agitated type etc, performance evaluation of crystallizers.

Books & References :

1. Unit Operations of Chemical Engineering, McCabe W.L Smith J.C. and Harriott P., McGraw Hill, Singapore, 5th Ed., 1993.
2. Chemical Engineering, Vol .1, Coulson J.M. and Richardson J.F, Butterworth Heinemann, Oxford 6th Ed., 1999.
3. Introduction to Chemical Engineering, Badger W.L. and Banchero J.T.,Tata McGraw Hill, 1997.
4. Unit Operations of Chemical Engineering Vol .1, Chattopadhyaya, P., Khanna Publishers, 2nd Ed., 1998.

CT-211 Chemical Engineering - 1 (For BT Students only)

L	T	P	Credits
3	1	0	4

Chemical Engineering discipline, structure and practice. **(4 Hours)**
Stoichiometry and chemical equations. Units, dimensions and conversions. Phase rule, Henry's law, Rault's law and their applications to gas-liquid and vapor-liquid systems.

Material balance for non-reacting and reacting systems, recycle and bypass. **(20 Hours)**
Heats of solution, mixing and reaction. Types of energy and first law of thermodynamics.
Energy balance for non-reacting and reacting systems. Calculation of flame temperature and adiabatic reaction temperature.

Properties of fluids & fluid statics. Mechanics energy balance. **(10 Hours)**
Flow of incompressible fluids: laminar and turbulent flows, velocity distribution in pipes, pressure drop in pipes and fittings.

Stokes law and its applications.
Flow in packed beds. **(6 Hours)**
Flow measurement : Orifice & Venturi meter. Pumps and their characteristics.

Books & Reference :

1. Unit operations of Chemical Engineering, McCabe W.L., Smith J.C. and Harriott P., McGraw Hill International Edition, Singapore, 5th Ed., 1993.
2. Fluid Mechanics, Douglas J.F. Gasiorek J.M., Swatfield J.A. Addison- Wesley Longman 3rd Ed. 1995.
3. Basic Principles of calculations in Chemical Engineering, Himmelblau D.M., Prentice Hall. 6th Ed., 1999
4. Elementary Principles of Chemical Processes. Felder R.M. and Rousseau R.W., John Wiley & Sons, Inc., 3rd Ed., 2000.
5. Chemical Engineering, Vol.1, Coulson J.M. and Richardson J.F, Butterworth Heinemann, Oxford 6th Ed., 1999.
6. Fluid Mechanics for chemical engineers, Nerves N.D. Mc Graw Hill, New York, 2nd Ed. 1991
7. Unit Operation of chemical engineering., Vol.1, Chattopadhyay Khanna 2nd Ed., 1998.
8. Chemical Process Principles; O.A. Hougen, K.M Watson, R.A Ragatz CBS Publishers & Distributors, 1995.

CT-251 Unit Operation Lab-I

L	T	P	Credits
0	0	3	2

1. Studies on crystallization
2. Experiment based on Sedimentation
3. Experiment on Leaf Filter
4. Experiment on Rotary Vacuum Filter.
5. Experiment on Plate & Frame Filter Press.
6. Experiment on Screen Separation.
7. Experiment on Size reduction by Jaw Crusher.
8. Experiment on Size reduction by Grinder
9. Solid particle separation by cyclone separator
10. Studies on pneumatic conveying system

CT-271 Workshop

L	T	P	Credits
0	0	3	2

Working of lathe, shaper, milling and drilling machines, power hacksaw, shearing machine and grinding wheel.

Simple turning, threading, drilling, boring and knurling operations on a lathe.

Use of arc welding and gas welding in making different types of joints.

Sheet metal work practice.

Glass Blowing.

Hands on training on chemical engineering equipment like pumps, valves, compressor, blower, heat exchanger etc.

Books & References:

1. Workshop Technology, Part I, II & III, Chapman, W.A.J., CBS publishers and distributors, 5th Ed., 1996.
2. Manufacturing Processes, Amstead B.H, Ostwald P.F., and Begeman M.L., John Wiley Sons, Inc., New York, 8th Ed., 1986.
3. Workshop Technology, Vol I, II and III, Chandola S.P., Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1998.
1. Elements of Workshop Technology, Vol I & II., Hajra Choudury S.K., Bose S.K., Hajra Choudury A.K. and Roy N., Media Promoters and Publishers Pvt. Ltd., Mumbai, 7th Ed., 1984