IPS ACADEMY INDORE

INSTITUTE OF ENGINEERING &SCIENCE

(AN AUTONOMUS INSTITUTE BY UGC)

DEPARTMENT OF CHEMICAL ENGINEERING

SYLLABYS FOR POST GRADUATE PROGRAM

M. Tech. III Semester

Chemical Engineering

IPS Academy, Indore, Institute of Engineering & Science

(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)

Scheme Based on AICTE Flexible Curricula

III Semester **Master of Technology (M. Tech.) [Chemical Engineering]**

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical						
				End Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Term work / Lab Work & Sessional		L	T	P	
1.	PSEC-MTCH301	PSEC	Program Specific Elective Course-IV	60	25	15	-	-	100	3	0	0	3
2.	LLC-MTCH301	LLC	Liberal Learning Course	60	25	15	-	-	100	1	0	0	1
3.	SBC-MTCH301	SBC	Dissertation Phase-I				120	80	200	0	0	20	10
			Total	**120**	**50**	**30**	**120**	**80**	**400**	**4**	**0**	**20**	**14**

Program Specific Elective Course-IV	**Liberal Learning Course**
Data Base for Process Plant Design	Business (Management, Entrepreneurship, etc)
Fluidization Engineering	Agriculture (Landscaping, Farming, etc.)
Process Intensification	Personality Development
Modern Analytical Techniques	Defense (Study about Functioning of Armed Forces)

1 Hr Lecture =1 Credit ,1 Hr Tutorial =1 Credit, 2 Hr Practical =1 Credit

Course Code	Semester	Course Title	Load	Credit
PSEC-MTCH301(A)	III	Program Specific Elective Course-IV Data Base for Process Plant Design	L-3, T-0, P-0	3

Course objective-To impart knowledge about design principles of various Process equipment.

Course content-

MODULE 1: Shell and Tube Heat Exchanger Design: 1-2 parallel –counter flow: Shell and Tube Exchanger, Flow arrangements for increased heat recovery, Calculations for Process conditions

MODULE 2: Multiple Effect Chemical Evaporation: Calculations of Chemical Evaporators, Solution of industrial problems: concentration of cane sugar liquors – forward feed, Evaporation of paper pulp waste liquors – backward feed, caustic soda concentration – forced circulation evaporators.

MODULE 3: Vaporizers and Reboilers: Vaporizing processes, Reboiler arrangements, Classification of vaporizing exchangers, Heat flux and temperature difference Limitations, Relation between maximum flux and maximum film coefficient,

MODULE 4: Towers: Introduction, Contacting Devices, Choice between Packed Columns and Plate columns, Tower Packings, Choice of plate types, Transfer unit calculations, Column diameter. Packed Towers: Introduction, Type and Size of Packings, Flooding, Pressure Drop, Foam, Holdup, Degree of Wetting, Column Diameter, Height of Packing,

MODULE 5: Introduction, Sieve Trays: Tower Diameter, Plate Spacing, Entrainment, Weepage, Tray Layout, Valve trays: Flooding and Entrainment, Tray Spacing, Foaming Tray type, Tray diameter and Lay out, Hydraulic Parameters.

Text/Reference Book-

1. Process Heat Transfer by D.Q.Kern, Mc Graw Hill Co., 1997.

2. Process Plant Design by Backhurst and Harker Amercian ElservierPub.Co., Heinmann

Chemical Engineering Series, 1973.

3. Process Equipment Design by M.V.Joshi, McMillan India,1996.

4. Coulson and Richardson Chemical Engineering Volume 6 Pergamon Press.

Course Code	Semester	Course Title	Load	Credit
PSEC-MTCH301(B)	III	Program Specific Elective Course-IV Fluidization Engineering	L-3, T-0, P-0	3

Course objective-To study the fluidization phenomena, fluidized bed regimes and models.

Course content-

MODULE 1: Fluidization phenomenon, Liquid-like behavior of a fluidized bed

MODULE 2: Physical operations, Synthesis reaction, Cracking of hydrocarbons, Combustion, Incineration, and gasification.

MODULE 3: Distributors, Gas jets in fluidized beds, Pressure drop in fixed beds, Geldart classification of particles, Gas fluidization with and without entrainment, Mapping of fluidization regimes.

MODULE 4: Dense beds, bubbling fluidized beds, Entrainment from fluidized beds, High velocity fluidization, Solids mixing, segregation, and staging, Gas dispersion and interchange in bubbling beds, Heat and mass transfer, Industrial applications.

MODULE 5: CSTR model, Two region model, Kunii-Levenspiel model.

Text/Reference Book-

1. Kunii, D., Levenspiel, O. and Robert, E., (1991) Fluidization Engineering, Butterworth-Heinemann.
2. Coulson, J.M., and Richardson, J.F., (2002) Chemical Engineering, Vol. 2, Asian Books Private Limited.

Course Code	Semester	Course Title	Load	Credit
PSEC-MTCH301(C)	III	Program Specific Elective Course-IV Process Intensification	L-3, T-0, P-0	3

Process Intensification

Course objective-Understanding of the concept of Process Intensification and its application to a range of processes e.g. heat and mass transfer, separation processes in chemical industry.

Course content-

MODULE 1: Introduction: Techniques of process intensification (PI) applications, philosophy and opportunities of process intensification, main benefits from process intensification, process intensifying equipment, process intensification toolbox.

MODULE 2: Process intensification through micro reaction technology: Effect of miniaturization on unit operations and reactions, implementation of micro reaction technology, from basic properties to technical design rules.

MODULE 3: Combined chemical reactor heat exchangers and reactor separators: Principles of operation; applications, reactive absorption, reactive distillation, applications of RD processes, reactive extraction case studies: Absorption of NOx Coke Gas Purification.

MODULE 4: Compact heat exchangers: Classification of compact heat exchangers, plate heat exchangers, spiral heat exchangers, flow pattern, heat transfer and pressure drop,

MODULE 5: Enhanced fields: Energy based intensifications, sono-chemistry, basics of cavitation, cavitation reactors, flow over a rotating surface, hydrodynamic cavitation applications.

Text/Reference Book-

1. Stankiewicz, A. and Moulijn, (Eds.), Reengineering the Chemical Process Plants, Process Intensification, Marcel Dekker, 2003.
2. Reay D., Ramshaw C., Harvey A., Process Intensification, Butterworth Heinemann, 2008.
3. KameliaBoodhoo (Editor), Adam Harvey (Editor), Process Intensification Technologies for Green Chemistry: Engineering Solutions for Sustainable Chemical Processing, Wiley, 2013.
4. Segovia-Hernández, Juan Gabriel, Bonilla-Petriciolet, Adrián (Eds.) Process Intensification in Chemical Engineering Design Optimization and Control, Springer, 2016.
5. Reay, Ramshaw, Harvey, Process Intensification, Engineering for Efficiency, Sustainability and Flexibility, Butterworth-Heinemann, 2013.

Course Code	Semester	Course Title	Load	Credit
PSEC-MTCH301(D)	III	Program Specific Elective Course-IV Modern Analytical Techniques	L-3, T-0, P-0	3

Course objective-The course is designed to impart the knowledge in quantitive and qualitative analysis with state-of-the-art analytical equipment's.

Course content-

MODULE 1- Introduction to chromatography and classification of chromatographic methods based on the mechanism of separation.

MODULE 2- Gas chromatography: Introduction, fundamentals, instrumentation, columns: preparation and operation, detection, dramatization,

MODULE 3- UV-Visible spectroscopy: Introduction, electromagnetic spectrum, absorbance laws and limitations, instrumentation-design and working principle, chromophore concept, auxochromes, applications of UV-Visible spectroscopy, IR spectroscopy: Basic principles, FT-IR, theory and applications

MODULE 4- Mass spectroscopy: Theory, ionization techniques: electron impact ionization, chemical ionization.

MODULE 5- NMR: Theory, instrumentation, chemical shift, shielding and deshielding effects,

Text/Reference Book-

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.
4. Practical Pharmaceutical Chemistry – Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi, 1997.
5. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.
6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis - Modern Methods – Part B - J W Munson, Vol 11, Marcel. Dekker Series
8. Spectroscopy of Organic Compounds, 2nd edn., P.S/Kalsi, Wiley estern Ltd., Delhi.
9. Textbook of Pharmaceutical Analysis, KA.Connors, 3rd Edition, John Wiley & Sons, 1982.
10. Textbook of Pharmaceutical Analysis, KA.Connors, 3rd Edition, John Wiley & Sons, 1982.

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