IPS Academy

Institute of Engineering & Science

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

Scheme & Syllabus Based on AICTE Flexible Curricula

B. Tech, Chemical Engineering Department

Semester VI (Third Year)

For admitted in July 2022 (*w.e.f. July, 2024*)

S.No.	Course Type	Course Code	Course Title	Hrs./ Week			Credits
				L	T	P	
1	PCC	CH12	Chemical Reaction Engineering-II	3	1	-	3
2	PCC	CH 13	Chemical Process Control	3	1	-	3
3	PCC	CH 14	Process Equipment Design-I	3	1	-	3
4	PEC	CH 02	Professional Elective-II	3	1	-	3
5	HSMC	HS06	Humanities and Social Science Open Course -II	2	1	-	2
6	LC	CH 13(P)	Chemical Process Control	-	-	2	1
7	LC	CH 02(P)	Professional Elective-II	-	-	2	1
8	SBC	CH 03(P)	Design Studio-II	-	-	2	2
9	LLC	LLC03	Liberal Learning Course-III	-	-	2	1
10	MLC	MLC04	Intellectual Property Rights	1	-	-	Audit
11	PROJ	CH 02	Internship-*To be completed anytime during Fifth/Sixth semester (Minimum 15Days/90Hrs.)Its evaluation/credit to be added in Seventh Semester.*				
						Total Credits	19

❖ **Professional Elective Courses-II**

(A) Chemical Process Modeling & Simulation
(B) Biochemical Engineering
(C) Environmental Pollution and Control

❖ **Humanities and Social Sciences Open Courses-II**

(A) Industrial Psychology
(B) Personnel Psychology
(C) Engineering Economics
(D) Finance for Engineers
(E) Stress Management
(F) Business Communication

- **Skill Based Courses**
  Simulation Lab-II

- **Liberal learning Course -III**
  (A) Sociology
  (B) Sanskrit
  (C) Graphic Design
  (D) Animation
  (E) Corporate Culture
  (F) Interior Design

Course Code	Semester	Course Title	Load	Credit
PCC-CH12	VI	Chemical Reaction Engineering-II	3L:1T:0P(04 hrs)	Credits:03

Prerequisite Course: Chemical Reaction Engineering-I

Course Objective: To provide the knowledge of Heterogeneous Catalysis & Reactor Design.

MODULE 1: **(07 hrs)**
Heterogeneous processes: Classification of catalysts, Preparation of catalysts, Promoters and Inhibitors, poisoning, General mechanism of catalytic reactions, kinetics of catalyst deactivation.

MODULE 2: **(08 hrs)**
Global reaction rate, External transport processes and their effects on heterogeneous reactions, Effect of external resistance on selectivity, effectiveness factors, Effect of intra-phase transport, Thiele Modulus.

MODULE 3: **(09 hrs)**
Design of Heterogeneous catalytic reactors: fixed bad reactor, Fluidized bed reactors, Gas liquid reaction on solid catalysts in slurry reactor.

MODULE 4: **(08 hrs)**
Models for fluid - solid non-catalytic reactions, controlling mechanisms, Diffusion through gas film controls. Diffusion through ash layer controls.

MODULE 5: **(07 hrs)**
Gas-liquid reactions and liquid-liquid reaction, Rate equation based on film theory, Rate equation for mass transfer and reaction.

Course Outcome:
CO1: Ability to understand mechanism of catalytic reactions.
CO2: Ability to understand External Diffusion and Internal diffusion in porous catalyst.
CO3: Ability to design catalytic reactor, Slurry Reactors, Trickle bed reactors fixed bed and fluidized bed reactors.
CO4: Ability to develop model for fluid solid non catalytic reactions.
CO5: Ability to understand Gas-Liquid Reactions and Liquid- Liquid Reaction based on film theory.

Text/Reference Book:
1. Fogler, H. S., “Elements of Chemical Reaction Engineering,” 3rd ed., Prentice-Hall of India, Delhi, 2003.
2. Levenspiel, O., “Chemical Reaction Engineering,” 3rd ed., John Wiley, 1999.
3. Smith, J. M., “Chemical Engineering Kinetics,” 3rd ed., McGraw-Hill, 1981.
4. Carberry, J. J., “Catalytic Reaction Engineering,” McGraw-Hill, 1976.
5. Levenspiel, O., “The Chemical Reactor Omnibook,” OSU Bookstores, Corvallis Oregon, 1996.

Course Code	Semester	Course Title	Load	Credit
PCC-CH13	VI	Chemical Process Control	3L:1T:0P (04 hrs)	Credits:03

Prerequisite Course: Mathematics-II

Course Objective

The objective this course enables the students to know about control methods and make the students knowledgeable in various types of measuring instruments used in chemical process industries.

MODULE 1: **(07 hrs)**

Construction and characteristics of final control elements such as Proportional, Integral, PD, PID controllers, pneumatic control valve, principles and construction of pneumatic and electronic controllers.

MODULE 2: **(07 hrs)**

Process instrumentation diagrams and symbols, process instrumentation for process equipments such as Distillation column Absorption column, Heat Exchanger, Reactors, Evaporators, fluid storage vessels.

MODULE 3: **(08 hrs)**

Laplace Transform, Linear open loop system, first order system and their transient response. Dynamic response of a pure capacitive process, Transportation lag, Dynamic response of a first order lag system, Block diagram reduction.

MODULE 4: **(09 hrs)**

Second order system and their transient response. Interacting and non-interacting system. Linear closed loop system, block diagram of closed loop transfer function, controllers, transient response of closed loop system, Inverse response.

MODULE 5: **(09 hrs)**

Stability concept, Routh stability criterion, relative stability, Hurwitz stability criterion, Nyquist's stability criterion. Root locus technique, introduction to frequency response, Bode diagram, Bode stability criterion, gain and phase margins, Ziegler Nichols controller setting, Cascade control system.

Course Outcomes:

CO1: Ability to understand the behavior of PID controller.
CO2: Ability to determine the step response for interacting and non interacting system.
CO3: Ability to understand the characteristic of control valve.
CO4: Ability to calibrating curve for thermocouple.
CO5: Ability to understand the stability of the process.

Text/Reference Book:

1. Coughnower & Koppel – Process System Analysis and Control- McGraw Hill, New York.
2. D. P. Eckman – Automatics Process Control – McGraw Hill, New York.
3. Peter Harriot – Process Control – McGraw Hill, New York. 4. J. J. Nagrath & M. Gopal; Control System Engineering.

Course Code	Semester	Course Title	Load	Credit
PCC-CH14	VI	Process Equipment Design-I	3L:1T:0P (04 hrs)	Credits:03

Prerequisite Course: Engineering Mechanics

Course Objective

The objective of this course is to acquire basic understanding of design parameter, complete knowledge of design procedures for commonly used process equipment and their attachments (e.g. internal and external pressure vessels, tall vessels, high pressure vessels, supports etc.), and different types of equipment testing methods.

MODULE 1: **(08 hrs)**

Mechanics of materials- Stress- Strain relationships of elastic materials subjected to tensile, compressive and shear forces, Elastic and plastic deformation, General design considerations; Design of shell, bottom plates, self supported, and column supported roofs, wind girder, nozzles and other accessories.

MODULE 2: **(09 hrs)**

Unfired pressure vessel- Pressure vessel codes, classification of pressure vessels, Design of cylindrical and spherical shells under internal and external pressures; Selection and design of flat plate, tor-spherical, ellipsoidal, and conical closures, compensations of openings. High pressure Vessels: Stress analysis of thick walled cylindrical shell.

MODULE 3: **(11 hrs)**

Tall vertical & horizontal vessels-Pressure, dead weight, wind, earthquake and eccentric loads and induced stresses; combined stresses, Shell design of skirt supported vessels. Vessel supports; Design of skirt, lug, and saddle supports.

MODULE 4: **(09 hrs)**

Bolted Flanges- Types of Flanges, and selection, Gaskets, Design of non- standard flanges, specifications of standard flanges. Fabrication of Equipment; major fabrication steps; welding, non-destructive tests of welded joints, inspection and testing, vessel lining, materials used in fabrication of some selected chemical industries.

Course outcome-

CO1: Ability to understand basic concepts of equipment design
CO2: Ability to understand design of cylindrical and spherical shells under internal and external pressures.
CO3: To provide knowledge about design of tall vertical & horizontal vessels.
CO4: To provide knowledge about design of flanges.

Text/Reference Book:

1. Brownell, N.E and Young, H.E; Process Equipment Design; John Wiley
2. Bhattacharya, B.C; Introduction of Chemical Equipment Design; CBS Publishers, Delhi.
3. Perry RH; Hand book of Chemical Engg; Mc Graw Hill Pub
4. I.S.: 2825-1969 – Code For Unfired Pressure Vessels.

Course Code	Semester	Course Title	Load	Credit
PEC-CH02(A)	VI	Chemical Process Modeling & Simulation	3L:1T:0P (04hrs)	Credits:03

Prerequisite: Chemical reaction engineering, mass transfer operation, heat transfer, thermodynamics.

Course Objective: To study Modeling and simulation of the chemical processes.

MODULE 1: **(08 hrs)**

Introduction to modeling, systematic approach to model building, conservation equations, constitutive equations, classification of models. Conservation principles, Advantages, limitations and application of simulation.

MODULE 2: **(10 hrs)**

Non-Reacting Liquid Systems: equation of continuity, application of the model equations, component mass balances, model behavior: steady state behavior, un-steady state behavior, Reacting Liquid Systems: Development of steady state and dynamic lumped and distributed parameter models based on first principles, Development of model of CSTR, Batch reactor, parallel and series reaction, pseudo first-order reactions, reversible reactions, consecutive reaction.

MODULE 3: **(08 hrs)**

Treatment of experimental data: Introduction, criteria for Best Fit, Best Slope-I, Best, Slope-II, Best straight line, fitting a quadratic, simulation examples of gravity fluid flow, Monte-Carlo simulation

MODULE 4: **(07 hrs)**

Development of model of Heat transfer equipment, Batch and continuous Distillation sequential, simultaneous modular and equation oriented approaches, partitioning and tearing.

MODULE 5: **(07 hrs)**

Computer programming of various iterative convergence methods such as Newton-Raphson, False position, Wegstein, Muller methods.

Course Outcomes:

CO1: Evaluate chemical engineering problems & basic concepts of model equations.
CO2: Ability to get knowledge about model development for Non-reacting and reacting Liquid systems.
CO3: Analyze the experimental data using Best Fit, Best Slope method.
CO4: Application of dynamic modeling of simple processes, modular and equation oriented approaches, tearing of algorithm.
CO5: Study and apply various iterative convergence methods.

Text/ Reference Book:

1. Russell TWF; Introduction to Chemical Engineering Analysis -John Wiley & Sons
2. Luyben W.L; Process Modeling, Simulation And Control For Chemical Engineers; TMH
3. Jana ; Chemical process modeling and computer simulation; PHI Learning.

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Course Code	Semester	Course Title	Load	Credit
PEC-CH02(B)	VI	Biochemical Engineering	3L:1T:0P(04 hrs)	Credits:03

Prerequisite(s): Chemical Reaction Engineering, Physical Chemistry, Mass transfer operations

Module 1: **(07 hrs)**
Introduction to Microbilogy and Bio-Chemical Engineering: Role of chemical engineers in biotechnology, Aspects of microbiology, cell theory structure of microbial cells, classification of microorganism, Essential chemicals of life lipids, Sugars and Polysaccharides, RNA and DNA, Amino acids and proteins.

Module 2: **(09 hrs)**
Metabolism and Energetic: Assimilatory and dissimilatory process, metabolic mechanism of the cells; Biochemical Kinetics: Simple enzyme kinetics with one or two substrates, Mechanism of Enzyme action, inhibition and regulation, modulation of enzymatic activity, enzyme reactions in heterogeneous systems, immobilization of enzyme.

Module 3: **(06 hrs)**
Microbial growth: Kinetics of microbial growth, Growth cycle, phases for Batch cultivation, mathematical modeling of batch growth, products synthesis Kinetics, overall kinetics and thermal death kinetics of cells and spores.

Module 4: **(09 hrs)**
Unit Operations in Biochemical Process: Agitation and aeration, gas liquid mass transfer, determination of oxygen transfer rates, determination of Kga and KLa scaling of mass transfer equipment, heat balance and heat transfer correlation for biochemical systems, sterilization, filtration and drying.

Module 5: **(09 hrs)**
Design and Analysis of Bio-Reactors: Classification and characterization of different bioreactors, batch and continuous reactors, tubular, CSTR and tower reactors, aerobic and anaerobic fermentation-process, design and operation of typical aerobic and anaerobic fermentation processes, manufacture of microbial products e.g. antibiotics alcohol/ wine etc; use of whole cells for industrial processes.

Course Outcomes:
After completion of this course, the students are able to:
CO1: Understand fundamental concept of biochemical engineering, cell theory structure of microbial cell, essential chemicals of life-lipids, sugars, proteins etc.
CO2: Derive expression for biochemical kinetics, enzyme reactions in heterogeneous system
CO3: Understand growth cycle, phases for batch cultivation and develop mathematical model of batch growth.
CO4: Understand and analyze unit operations in biochemical process
CO5: Design and analyze bioreactors, fermentation process

Text/Reference Book:
1. J. E. Bailey and D. F. Ollis, Biochemical Engineering Fundamentals, McGraw Hill
3. Shuler, Kargi; Bioprocess Engineering basic concepts.; PHI Learning
4. Inamdar S.T , Biochemical Engineering – Principles and Concepts A
5. Rao ; Introduction to Biochemical Engineering; TMH

Course Code	Semester	Course Title	Load	Credit
PEC-CH02(C)	VI	Environmental pollution and control	3L:1T:0P(04 hrs)	Credits:03

Module 1: **(07 hrs)**

Environmental Pollution: Concept of pollution, causes of environmental pollution, Environmental problems due to pollution, concept of Development, Major conflicts of Development and Environment, Mining and Environment.

Module 2: **(08 hrs)**

Air Pollution: Sources and effect of air pollution, classification of air pollutants, emission standard of air pollution. Meteorological condition influencing air pollution, Chemical inversion, principle, working principle of control equipment for particulate emission and gaseous pollutants like cyclone separator, gravity settling chamber, multi-tray settling chamber, bag filter, scrubber, E.S.P.

Module 3: **(09 hrs)**

Water Pollution: Sources and effect of water pollution, water born diseases, classification of water pollutants, physical, chemical and bacteriological analysis of water; pollution laws and limits, effluent standards;, working principle of waste water and industrial effluent treatment plants (physiochemical and biological)

Module 4: **(09 hrs)**

Advance Waste water treatment: Advanced oxidation process; photolysis and photocatalysis, sonolysis, electrochemical oxidation technologies, Fenton-based processes and ozone-based processes: Membrane Technology; Principles of Membrane processes; Types and uses of membranes; Recent development in membranes; Types and uses of modules; Washing procedures, Membrane bioreactors; Pervaporation and its applications; Reverse Osmosis, Ultrafiltration and Microfiltration and their applications; Dialysis and Electrodialysis and their applications; Others.

Module 5: **(07 hrs)**

Pollution due to solid waste and Noise : Sources and effects of solid waste and Nature of domestic, municipal, agricultural, industrial, Hospital, Nuclear Wastes; collection, treatment and disposal of solids waste; waste recovery system, solid waste management; Sources and effects of noise pollution noise pollution, noise measurement and control; noise mitigation measures.

Course Outcomes

CO1: Ability to understand the concept of pollution and their effect on human, plants and animals.
CO2: Knowledge about source and effect of air pollution and their solutions.
CO3: Understanding about source and effect of water pollution and their solutions.
CO4: Ability to design modern technique for waste water treatment.
CO5:Ability to understand solid waste and noise pollution.

Text/Reference Book:

1. Rao C S; Environmental Pollution Control Engineering; New Age India Ltd.
2. Mahajan S P; Pollution Control in Process Industries
3. Canter Lary; Environmental Impact Assessment; TMG
4. Keily; Environmental Engineering; TMG
5. Miller GT Jr; Environmental sciences-working with earth; Cegage Pub.

Course Code	Semester	Course Title	Load	Credit
SBC-CH03	VI	Design Studio- II	0L:0T:2P (04 hrs)	Credits:02

Simulation Study of Various Chemical Process with the help of Software : ChemCAD

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Course Code	Semester	Course Title	Load	Credit
HSMC-HS06 (A)	VI	Industrial Psychology	2L:1T:0P (03 hrs)	Credits:02

Course Objective: The objective of this course is to develop an understanding of the origin and potential of Industrial Psychology and human behaviour in students.

Course Contents:

MODULE I

Introduction to Industrial Psychology: Definition, Origin, and scope of Industrial Psychology, Principles of Industrial Psychology, Major field in industrial psychology, Prominent roles of Industrial Psychologist, , Influence of industrialization on human behaviour, Research Methods in Industrial psychology.

MODULE II

Group Dynamics and Leadership: Group dynamics Concepts, Group, teams and team work, Theories and styles of leaderships, Conflict and Conflict Resolution.

MODULE III

Job satisfaction and Work Motivation: Definition and meaning of Job Satisfaction, Effects of job satisfaction on work outcomes, Industrial conditions, Definition of motives and nature of work motivation, Theories of motivation

MODULE IV

Performance Review- Job analysis and Appraisal and Job evaluation, Measurement of Job Performance, Performance Appraisal Process, Team Appraisals and the Future of Performance Appraisals; Legal Concerns in Employee Performance Appraisals, Placement and Training of Employees

MODULE V

Work Environment: Physical and psychological barrier, accidents and safety protocol, Emotional wellbeing, work life balance, Job analysis, Work schedule, Fatigue, monotony, growth and benefits.

Course Outcomes:

1. CO 1: Students will learn the basic attributes of Personality.
2. CO 2: Students will learn the basic attributes of industry and management.
3. CO 3: Students will develop knowledge about group dynamics and leadership styles.
4. CO 4: Students will learn to deal with dynamics of diverse workplace, conflict and professional proficiency.
5. CO 5: Students will develop knowledge about task dynamics, accidents and safety measures.

Text Books:

1. Miner J.B.(1992) Industrial / Organizational Psychology. New York: McGraw Hill
2. Daniel Katz and Robert L Kahn (1978). The Social psychology of Organizations, 2nd edition. Wiley
3. Arnold and John (2016) Work Psychology: Understanding Human Behaviour in the Work Place.6th Edition. Trans Atlantic Publications, Inc.
4. Cooper C.L. and Locke E.A. (2000). Industrial and Organizational Psychology: Linking Theory with Practice. Wiley

5. Blum and Naylor (1982). Industrial Psychology: Its Theoretical and Social Foundations. CBS Publication.

Suggested Readings:

1. Gisbert Pascal,(1972). Fundamentals of Industrial Sociology. New Delhi Tata McGraw Hill
2. Mamoria C.B. and Mamoria S.(2022) Dynamics of Industrial Relations in India. 13th Edition. Himalayan Publishing House
3. Conte J.M. and Landy F.J.(2018) Work in the 21st century. 6th Edition. Wiley
4. Adrian Furnham (2008). Personality and Intelligence at Work. Routledge
5. John Chandler (2016) Identity at Work. Routledge
6. Craig C. (2008). Work Motivation in Organizational Behaviour. Taylor and Francis
7. Wendy Hollway (1991).Work psychology and Organizational behaviour. Sage Publications ltd.

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Course Code	Semester	Course Title	Load	Credit
HSMC-HS06 (B)	VI	Engineering Psychology	2L:1T:0P (03 hrs)	Credits:02

Course Objective: The objective of this course is to enable students to acknowledge and comprehend human factor in work settings, and learn to deal with work, people and human emotions effectively.

Course Contents:

MODULE 1

Introduction to Psychology: Definition, Origin, and scope of Psychology, Brain and Behaviour, Cognition and intelligence, Motor factors, Problem Solving (Algorithm and Heuristics), Decision making, Self awareness and Locus of control

MODULE 2

Introduction to engineering Psychology: Definition, Origin, and scope of engineering Psychology, process of socialization, need theory and Influence of socialization on human behaviour,

MODULE 3

Perception: Sensation and perception, working conditions, conflict, and conflict resolutions, Team dynamics, Workspace and equipment, Human-Computer interaction.

MODULE 4

Design and psychology: Physical and psychological framework of human behaviour and engineering products, Vibration and Motion Sickness, Visual environment, Acoustic environment, Thermal environment ,Research Methods in Engineering Psychology, Anthropometrics, Statistical analysis.

MODULE 5

Work Environment: Factors influencing technology and performance, boredom, fatigue, work life balance, Human workload, Health hazard assessment (accidents and safety protocol), Accident analysis.

Course Outcomes

6. CO 1: Students will learn to observe and acknowledge self, others and society in holistic framework
7. CO 2: Students will develop knowledge to create sustainable environment that protects psychological need.
8. CO 3: Students will develop better understanding of machine with relation to psychological needs of human.
9. CO 4: Students will develop knowledge to design better ergonomic products in alignment with emotional comfort.
10. CO 5: Students will develop ability to imply psychological dimension in advancement of technology.

Text books:

1. Christopher D. Wickens, Justin G. Hollands, William S. Helton, Simon Banbury (1999). Engineering Psychology and Human Performance (Third Edition), Pearson.
2. Bridger, R. (2017). Introduction to human factors and ergonomics. CRC Press
3. Neil Martin G.(2008).Psychology a Beginners Guide. Oneworld Publication
4. Payne, S.(1996).Psychology and Cognitive Technologies. The Psychologist.

Suggested Readings:

1. Don Haris and Wen-Chin Li (2021). Engineering psychology and Cognitive Ergonomics, Springer Cham

2. Francis Dusro, Patricia DeLucia (2010).” Engineering Psychology”, The Corsini Encyclopedia of Psychology, vol.2.John Wiley and Sons.
3. Shackel, B.(1996). Ergonomics: Scope, Contribution and Future Possibilities. The Psychologist.
4. Card, S.K. , Moran, T.P. ,& Newell, A. (1983). The Psychology of Human-Computer interaction. Hillsdale, New Jersey.
5. Oborne, D.J.(1982).Ergonomics at Work. Wiley: Chichester.
6. Reason, J (1990) Human Error. Cambridge university press.

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Course Code	Semester	Course Title	Load	Credit
HSMC-HS06 (E)	VI	Stress Management	2L:1T:0P (03 hrs)	Credits:02

Course Objectives:
The objective of this course is to enable students to understand and learn how to use various techniques and determine the most appropriate method to aid in managing reaction to stress.

Course Contents:
MODULE-I
Introduction to Stress
Introduction to stress: Meaning, Definition, Eustress and Distress, Types of stress: Acute stress, Episodic Acute stress and chronic stress, Signs and Symptoms

MODULE –II
Causes of Stress
Psychological, Social, Environmental, Academic, Family and Work stress, Adaptive and Maladaptive Behavior, Individual and Cultural Differences

MODULE - III
Consequences of Stress:
(i) Physiological Impact of stress -Autonomic Nervous System Changes, Changes in Brain, General adaptive syndrome (GAD), Quality of sleep, Diet and Health effects (ii) Psychological Impact of stress - Impaired Mental functions, Poor memory (iii) Social Impact of stress - Stressful Life Events, Social support and health

MODULE – IV
Coping with Stress:
Understanding your stress level, Role of Personality Pattern, Self Esteem, Locus of Control, Role of Thoughts Beliefs and Emotions Coping Mechanisms: - Coping Mechanisms: Appraisal focus Use of Audio and Video Aids , Cultural Activities, Autogenic Training, Biofeedback, Relaxation, Yoga and Meditation Emotional focused and Problem focused , 'Fight or Flight' Response, Stress warning signals

MODULE –V
Project based learning:
Project report on Stress Management (Students will prepare and submit a report under the guidance of the mentors)

Course Outcomes:
1. Co1- To make students acquainted with fundamentals of Stress management for the purpose of improving everyday functioning.
2. CO2-Students will learn various sources of stress like psychological, Social, Environmental, Academic, Family and work for the smooth functioning of day to day life.
3. CO3-To enable study of stress as a subjective experience and to enable practical approach with measurable levels of stress.
4. CO4-To provide understanding of stress whether it can be positive or negative and ways to deal with it.
5. CO5- Students will be able to learn through practical based approach.

Text Books:

1. Greenberg, J. S. (2017). Comprehensive Stress Management (14th edition). New York: McGraw Hill.
2. Roy, Sumita. (2005) Managing Stress: Handle, Control, Prevent Sterling Publisher
3. Davis M. (2000) *The Relaxation and Stress Reduction Work Book*, New Harbinger inc.
4. Simmons M., Daw W. (1994) *Stress, Anxiety, Depression: a Practical Workbook*, Winslow Press.
5. Tyler M. (1999) *Stress Management Training for Trainers Handbook*, Living with Stress Ltd
6. Udai, Y. (2015). Yogasan aur pranayam. New Delhi: N.S. Publications

Reference Books:

1. Cooper K. (1991) *Overcoming Hypertension*, Bantam Books.
2. Hambly K., Muir A. (1997) *Stress Management in Primary Care*, Butterworth Heinemann.
3. Jones H. (1997) *I'm too Busy to be Stressed*, Hodder and Stoughton
4. Payne R. (1995) *Relaxation Techniques: a Practical Handbook for Healthcare Professionals*, Churchill Livingstone.
5. Steinmetz J. (1980) *Managing Stress Before it Manages You*, Bull Publishing.

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Course Code	Semester	Course Title	Load	Credit
HSMC-HS06 (F)	VI	Business Communication	2L:1T:0P (03 hrs)	Credits:02

Course Objectives:
The course is designed to hone the communication skills of the students and enable them to be an integral part of the corporate world by providing an overview of prerequisites to business communication.

Course Contents:
MODULE-I
Communication: It's Interpretation
Basics of Communication: Process, Components and Factors of Communication. Types of Communication, Global Aspects, Ethical Aspects, Legal Aspects, Gender Communication, Communication in Organization, Communication during crisis

MODULE-II
Communication Core:
Communication Skills for Team and Leadership Effectiveness: Managerial Communication, Organizational Communication, Persuasive Communication, Negotiation Skills, Intercultural Communication Competence

MODULE- III
Communication and Digitalization:
Email, Phone calls, Video conferencing, Types of instant messaging: SMS, Business Blogs, Facebook, Instagram, Twitter, Linkedin, Snapchat, Telegram and Web chats

MODULE- IV
Business Correspondence:
Writing Skills in business and public administration in India: Effective writing, Job Application, Bio Data, Curriculum Vitae, Resume, Notice, Agenda & Minutes of meetings, Memorandum

MODULE–V
Presentation Skills:
Elements of Presentation, Tips for Effective Presentation, Practice and Perform **(**Presentation prepared by the students will be evaluated)

Course Outcomes:
1. To develop knowledge, skills, and judgment around human communication that facilitates their ability to work collaboratively professionally.
2. To develop an ability to understand the different types of communication and demonstrate an ability to better understand and adapt to others and their behaviors
3. To apply changes to distinguish mass communication and media in the digital era.
4. To apply to draft effective business correspondence with brevity and clarity to maintain healthy business relationship.
5. To learn to demonstrate students verbal and non-verbal communication ability through presentations.

Text Books:

1. Professional Communication by Aruna Koneru, Tata McGraw-Hill Publishing Company Limited, New Delhi,2005
2. Effective Technical Communication by M. Ashraf Rizvi, Tata McGraw-Hill Publishing Company Limited, New Delhi,2005
3. Communication Skill for Engineers and Scientist by Sangeeta Sharma and Vinod Mishra, PHI Learning, New Delhi, 2015
4. Business Communication by Dr. V.G. Sadh, Thakur Publications, Lucknow,2013
5. Business Correspondence and Report Writing by R.C. Sharma and Krishna Mohan, Tata McGraw-Hill Publishing Company Limited, New Delhi,2008

Reference Books:

1. Bonet, Diana. The Business of Listening: Third Edition. New Delhi: Viva Books, 2004.
2. Bovee, Courtland L, John V. Thill & Barbara E. Schatzman. Business Communication Today: Tenth Edition. New Jersey: Prentice Hall, 2010
3. Guffey, Mary Ellen. Essentials of Business Writing. Ohio: SouthWestern College Pubg., 2000.
4. Hughes, Shirley. Professional Presentations: A Practical Guide to the Preparation and Performance of Successful Business Presentations. Sydney: McGraw-Hill, 1990
5. Monippally, Matthukutty, M. Business Communication Strategies. New Delhi: Tata McGraw-Hill Publishing Company Ltd., 2001.

Course Code	Semester	Course Title	Load	Credit
LC-CH13	VI	Chemical Process Control	0L:0T:2P (04 hrs)	Credits:01

List of Experiment (Pl. expand it):

1. To study the characteristics of control valves (linear, quick opening, etc)
2. To study the dynamics of liquid level systems of non-interacting and interacting types.
3. To study the response of mercury in glass thermometer with and without a thermowell.
4. To study the characteristics of an electronic PID controller.
5. To study the characteristics of a current to pneumatic converter.
6. To study the effectiveness of computer control of a distillation column.
7. To study the effectiveness of a computer control of a heat exchanger.
8. To study to effectiveness of a computer control of a chemical reactor
9. To study to dynamics of a pressure tanks.
10. To calibrate an air purged liquid level indicator.

Note: Each student should perform at least eight experiments out of the above list.

Course Code	Semester	Course Title	Load	Credit
LC-CH02(A)	VI	Chemical Process Modeling & Simulation	0L:0T:2P (04hrs)	Credits:01

List of Experiments:

1. Process dynamics experiments like flow of incompressible fluids at a variable flow rate.
2. Dynamics of a tank draining through an orifice in the bottom. Differential equation formulation and verification with the experimental data.
3. Mass balance in a tank filling at certain rate and emptying at another rate. Rectangular and wedge-shaped tank and incompressible fluid.
4. Modeling a batch reactor-verification of 151 and 2nd order rate kinetics.
5. Counter current double pipe heat exchanger modeling-data analysis by iterative methods.
6. Simulation of a distillation column-binary systems, equi-molal overflow, constant relative, volatility.
7. Input-Output response study in non-ideal flow reactors.
8. Simulation of a perfectly mixed reactor with heat transfer. Derivation of a mathematical model and solving for study state heat transfer.

Course Code	**Semester**	**Course Title**	**Load**	**Credit**
LC-CH02(B)	VI	Biochemical Engineering	0L:0T:2P (04hrs)	Credits:01

List of Experiments (Please Expand It)

1. To carry out the isolation and identification of microorganism from a soil sample.
2. To examine & study effectiveness of various techniques for preserving microorganism
3. To study the kinetics of ethanol fermentation.
4. To determine the kinetic constants l.1max and Km for the growth of microorganisms.
5. To identify bacterial species using Gram staining tests.
6. To determine the biochemical oxygen demand of the given wastewater sample.
7. To determine the chemical oxygen demand of the given wastewater sample.
8. To determine the dissolved oxygen content of the given sample by Winkler method.
9. To determine the reducing sugar in the given fermentation medium.
10. To determine the protein in the given fermentation medium.
11. To determine the total sugar content in the given fermentation medium.
12. To study the kinetics of methane fermentation.
13. To study the kinetics of an enzyme catalyzed reaction.
14. To study the activity of enzymes in free and immobilized States.
15. To study the activity of whole cell enzymes in free and immobilized States.

Note: Each student should perform at least eight experiments out of the above list.

Course Code	Semester	Course Title	Load	Credit
LC-CH02(C)	VI	Environmental Pollution and Control	0L:0T:2P (04hrs)	Credits:01

List of Experiments (Please Expand it):

1. To determine the BOD of a given water Sample.
2. To determine the D O of a given water Sample.
3. To determine the COD of a given water Sample.
4. To determine the ph value of a given water Sample.
5. To determine the Chlorides in a given water Sample.
6. To determine the Acidity in a given water Sample.
7. To determine the Alkalinity in a given water Sample.
8. To determine the Total Hardness in a given water Sample.
9. To determine the Turbidity of a given water Sample.
10. To determine the Aerobic Microbial colony count.
11. To determine the Total dissolve solid of a given sample

Note: Each student should perform at least eight experiments out of the above list.