SCHEME

OF

STUDIES AND EXAMINATIONS
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Teaching Schedule</th>
<th>Marks of Class work</th>
<th>Examination Marks</th>
<th>Total</th>
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<th>Duration of Exam</th>
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<td>ADVANCED TRANSPORT PHENOMENA</td>
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<td>4</td>
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<td>APPLIED MATHEMATICS IN CHEMICAL ENGINEERING</td>
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<td>23</td>
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**NOTE:**

1. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
2. Electronics gadgets including Cellular phones are not allowed in the examination.
## DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY, MURTHAL (SONEPAT) SCHEME OF STUDIES & EXAMINATIONS M. Tech. 1st YEAR (SEMESTER - II) (CHEMICAL ENGINEERING)
Credit Based Scheme w.e.f. 2012-13

<table>
<thead>
<tr>
<th>S. No</th>
<th>Course No.</th>
<th>Course Title</th>
<th>Teaching Schedule</th>
<th>Marks of Class work</th>
<th>Examination Marks</th>
<th>Total Credit</th>
<th>Duration of Exam</th>
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<td>Theory</td>
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<td>1</td>
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<td>ADVANCED HEAT TRANSFER</td>
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<td>ELECTIVE-I</td>
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**Elective-I:**
1. CHE554B: PETROLEUM ENGINEERING
2. CHE556B: FLUIDIZATION ENGINEERING.

**Elective-II:**
1. CHE560B: CHEMICAL PROCESS INTEGRATION
2. CHE562B: RENEWABLE ENERGY TECHNOLOGIES.

**Note:**
1. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
2. Electronics gadgets including Cellular phones are not allowed in the examination.
3. The choice of the students for any elective shall not be a binding for the department to offer, if the department does not have expertise. The minimum strength of the students should be 08 to run an elective course.
### DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY, MURTHAL (SONEPAT)
### SCHEME OF STUDIES & EXAMINATIONS
#### M. Tech. 2nd YEAR (SEMESTER – III) (CHEMICAL ENGINEERING)
Credit Based Scheme w.e.f. 2013-14

<table>
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<td>ELECTIVE III</td>
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<td>21</td>
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<td>225</td>
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**Elective-III:**
1. CHE651B: POLYMER SCIENCE AND ENGINEERING
2. CHE653B: FUEL CELL TECHNOLOGIES.
3. CHE655B: INDUSTRIAL RISK AND SAFETY MANAGEMENT.

**Note:**
1. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
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3. The choice of the students for any elective shall not be a binding for the department to offer, if the department does not have expertise. The minimum strength of the students should be 08 to run an elective course.
## DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY, MURTHAL (SONEPAT)
### SCHEME OF STUDIES & EXAMINATIONS
#### M. Tech. 2nd YEAR (SEMESTER – IV) (CHEMICAL ENGINEERING)
Credit Based Scheme w.e.f. 2013-14

<table>
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<th>Examination Marks</th>
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<td>DISSERTATION</td>
<td>- 20</td>
<td>50</td>
<td>- 100</td>
<td>150</td>
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**TOTAL**

- 20

- 100

- 150

- 20
SYLLABUS

UNIT-II: Series of isothermal constant hold up CSTRs, Gravity flow tank, CSTRs with variable hold ups, Heated tanks, Gas phase pressurized CSTR, Isothermal and non-isothermal CSTRs systems. Single and Multi-component vaporizers. Numerical and software simulation techniques. Interval Halving, False position Newton Raphson Methods etc., Numerical integration, Euler’s method

UNIT-III: Reaction systems: Batch reactor, Reactor with mass transfer, Ideal and non-ideal binary Distillation Column, Batch Distillation with hold up, pH systems, Development of models for multistage processes, absorption column, multi stage counter current extraction and liquid liquid extraction

UNIT-IV: Semi batch reactor, Mixing Process, Adsorption systems, heat exchangers and evaporators, cooling towers, fluid catalytic cracking, Trickle bed reactor, Bioreactor, Interacting and Non-interacting tanks, stirred tank heaters

TEXT / REFERENCE BOOKS:
5. Chemical Engineering Dynamics: E.J. Dunn- V.C.H.

NOTE:
1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.
<table>
<thead>
<tr>
<th>UNIT</th>
<th>CONTENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Momentum mass and energy balance equations; Equations of change for isothermal systems; Velocity distributions in flow systems; Interphase transport in isothermal Systems; Microscopic and macroscopic balance.</td>
</tr>
<tr>
<td>II</td>
<td>Theories of turbulence- phenomenological and statistical; Turbulent transfer processes in single and multiphase systems; Temperature distribution in turbulent flow; Concentration fluctuation and time smoothed concentration; Turbulent mixing with first and second order reactions.</td>
</tr>
<tr>
<td>III</td>
<td>Boundary layer theory; Steady state transport in boundary layers; Taylor dispersion in laminar tube flow.</td>
</tr>
<tr>
<td>IV</td>
<td>Interphase transport in non-isothermal systems. Equation of change for entropy; Application of generalized Maxwell – Stephan’s equations; Mass transport across selectively permeable membrane and porous media.</td>
</tr>
</tbody>
</table>

**TEXT/REFERENCE BOOKS:**

**NOTE:**
1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
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TEXT/REFERENCE BOOKS:

NOTE:
1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.
UNIT-I: Introduction to numerical computations in chemical engineering: General introduction to the subject of numerical analysis, Representing numbers, Polynomial curve fit by least squares method and its application to chemical processes. Newton's divided difference interpolation, Forward differences with equally space base points, Bisection method for one variable, Fixed point iteration for one variable, Newton's method for one variable, Secant method for one variable, Regula Falsi for one variable.


TEXT / REFERENCE BOOKS:

NOTE:
1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
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### CHE 509B : ADVANCED CHEMICAL REACTION ENGINEERING
#### M. Tech. Semester - I (Chemical Engineering)

<table>
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<td>4 - 4</td>
<td>25 Marks</td>
<td>75 Marks</td>
<td>100 Marks</td>
<td>3 Hours</td>
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</table>

**UNIT-I:** Kinetics of Heterogeneous Reactions - Rate controlling steps, Langmuir-Hinshelwood kinetics. External Diffusion Effects in Heterogeneous Reactions; Mass Transfer limited reactions in packed beds, Modeling diffusion with and without reaction; Non catalytic fluid-solid reaction- Shrinking and Unreacted Core Model.

**UNIT-II:** Internal Transport Processes in Porous Catalysts - Intra pellet mass transfer, Evaluation of effectiveness factor, Mass transfer with reaction in packed bed.

**UNIT-III:** Design of Heterogeneous Catalytic Reactors- Isothermal and adiabatic fixed bed reactors, Non-isothermal and non adiabatic fixed bed reactors. Slurry reactor model, Trickle bed reactor model.

**UNIT-IV:** Non-Ideal Flow-Residence Time Distribution, Dispersion Model, Tanks-in-Series Model, Mixing concepts, Segregated Flow Model.

**TEXT / REFERENCE BOOKS:**
2. Elements of Chemical Reaction Engineering, H. Scott Fogler-PHI
3. Chemical Reaction Engineering, O. Levenspiel - Willey Student Edition

**NOTE:**
1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.
Modeling and Simulation of Chemical Engineering Systems like:

1. Stirred tanks with/without heating jackets
2. Reaction systems
3. CSTR’s isothermal and non-isothermal
4. Flash calculations
5. Multi-component distillation column
6. Batch distillation with constant and variable reflux
7. Batch distillation with holdup
8. Multistage absorption
9. Multistage adsorption
10. Extraction and leaching

Software such as Aspen Plus/Chem-CAD, MATLAB, C++ etc. may be used in modeling above problems.

NOTE:

1. The students will be required to perform the 08 experiments/exercises from the above list and any other two experiments designed by the department based on the theory course (CHE511B : Modeling And Simulation).
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.
UNIT-I: Closed-Loop Systems-First and Higher order systems, response to various inputs. Linear Closed-Loop Systems. Controllers and Final Control Elements. Control Valve – Valve Sizing, Valve Characteristics

UNIT-II: Stability and Frequency response-Routh Hurwitz method, Root locus method, Frequency response, design of control system, Bode diagrams, Bode stability criterion, Zigler-Nichols and Cohen-Coon tuning methods, Process Identification

UNIT-III: Advanced Control Systems-Feedback control of systems with Large Dead Time, Feed-forward and Ratio Control, Adaptive and Inferential Control Systems.


TEXT / REFERENCE BOOKS:
2. Chemical Process Control, G. Stephanopulos-PHI

NOTE:
1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
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CHE504B : ADVANCED SEPARATION PROCESSES
M. Tech. Semester - II (Chemical Engineering)

Class Work : 25 Marks
Examination : 75 Marks
Total : 100 Marks
Duration of Examination : 3 Hours

UNIT-I: Membrane separation-Characterization of membranes; transport through porous and non-porous membranes;

UNIT-II: Reverse osmosis, electro dialysis, gas permeation; pervaporation, concentration, pressure, electrically and thermally driven membrane processes; membrane reactors; polarization; fouling; modules; energy requirements.

UNIT-III: Adsorptive separation-Definition; types of adsorption; adsorbent types, their preparation and properties; adsorption isotherms and their importance; equipment types for commercial processes; mathematical modeling with suitable initial and boundary conditions for different cases such as thermal swing, pressure swing and moving bed adsorption; chromatography.

UNIT-IV: Other techniques-Reactive distillation; supercritical fluid extraction; surfactant based separations; cryogenic separation; ionic separation.

TEXT / REFERENCE BOOKS:
7. Supercritical Fluid Extraction by M A McHugh, V J Krukonis; Butterworth.

NOTE:
1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.
UNIT-I: Analysis of convective heat transfer- Convective heat transfer, boundary layer fundamentals, conservation of mass, momentum & energy for laminar & flow over a flat plate, boundary layer equations & similarity parameters, dimensional analysis, integral equations of the laminar boundary layer, analysis between momentum & heat transfer over a flat surface; turbulent flow & turbulent boundary layers analysis, analysis for turbulent flow over a flat surface.

UNIT-II: Heat transfer by natural convection - Temperature a velocity distribution in thermal boundary layers, governing equations of mass, momentum & energy for natural convection past vertical plane surface, approximate integral boundary layer analysis for natural convection, working correlations for various shapes, natural convection from finned surface, natural convection in enclosed spaces, mixed free & forced convection.

UNIT-III: Forced convection inside tubes & ducts- Analysis of laminar forced convection in long tube, correlations for laminar forced correction, analogy between heat & momentum transfer in turbulent flow, working correlations for turbulent forced convection, forced convection in non-circular sections. Forced convection over exterior surfaces: Flow over bluff bodies, local heat transfer coefficient distribution around cylinders, effect of various parameters on local heat transfer coefficient, heat transfer from tube bundles in cross flow, heat transfer from non-circular sections.

UNIT-IV: Heat transfer- heat transfer in fixed bed, heat transfer in fluidized bed, heat transfer in cyclone heat exchanger. Heat transfer by combined conduction, convection & radiation: Thermocouple lead error in surface temperature measurements, heat transfer from radiating fins, flat plate solar collector, the heat pipe.

TEXT / REFERENCE BOOKS:

NOTE:
1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.
UNIT-I: Scope and Purpose of Refining: Global and Indian refining scenario, Petroleum refining industry in India practice and prospects, An overview of the entire spectrum of the refinery products, refinery configuration development, Physical-chemical characteristics of Petroleum and Petroleum products. Refinery Feedstock: Nature and effect of different types of refinery feedstock and their impurities on refinery configuration and operation.

UNIT-II: Refinery Distillation Processes: Desalting and Stabilization of crude, Process description of typical simple distillation, Fractional distillation, crude oil distillation, vacuum distillation etc. Degree of separation (5-95 gap) and degree of difficulty of separation (At 50), Packie charts, ASTM, TBP and EFV Distillation. Refinery Gas Processing - Process description of typical light ends unit, acid gas removal using gas treating processes.


UNIT-IV: Two Phase Oil and Gas Separation equipment - Types, their description, vessel sizing. Theory of separation and separator design. Three Phase Oil Gas and Water Separators: Types of separators, their description. Various control and vessel internals, theory and sizing of three phase separator. LACT units.

TEXT/REFERENCE BOOKS:

NOTE:
1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.
UNIT-I: Introduction-Fluidization phenomenon, behaviour of fluidized beds and industrial applications

UNIT-II: Packed Bed-Flow of fluids, Darcy’s law and permeability, specific surface and voidage, general expressions for flow through beds, Carman–Kozeny equations, Molecular flow, Packing, Pressure drop


TEXT / REFERENCE BOOKS:

NOTE:
1 In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2 The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
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UNIT-II: Combined heat & Power Integration, Heat engines & Thermal Pinch Diagram, Heat Pumps & Thermal Pinch diagram, cogeneration targeting

UNIT-III: Mass integration strategies, Targeting for minimum discharge waste & minimum purchase of fresh material,

UNIT-IV: Synthesis Mass Exchange Networks, Graphical & Algebraic approach to the targeting of Mass Exchange Networks, Mathematical techniques for the synthesis of Mass & Heat exchange network

TEXT / REFERENCE BOOKS:

NOTE:
1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.


TEXT / REFERENCE BOOKS:
1. Dr R K Singhal," Non-conventional energy sources", S K Kataria & Sons, Darya Ganj, New Delhi
2. D S Chauhan, S K Srivastava, "Non Conventional energy resources", New Age International (P) limited.

NOTE:
1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.
List of Experiments:
1. Pressure control system trainer.
2. Temperature control system trainer.
3. Level control system trainer.
4. Flow control system trainer.
5. Ratio control system trainer.
6. Analysis of Valve.
7. Interacting and Non-Interacting System
8. Multi-process control system Trainer
9. Cascade Control System
10. PLC Trainer

Note:
1. The students will be required to perform the 08 experiments/exercises from the above list and any other two experiments designed by the department based on the theory course (CHE 502B: Advanced Process Dynamics And Control).
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.
CHE514B : SEMINAR-I
M. Tech. Semester - II (Chemical Engineering)

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<td></td>
<td>2</td>
<td>50 Marks</td>
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The objectives of the course remain:

- To learn how to carry out literature search
- To learn the art of technical report writing
- To learn the art of verbal communication with the help of modern presentation techniques

A student will select a topic in emerging areas of Engineering & Technology and will carry out the task under the supervision of a teacher assigned by the department. He/She will give a seminar talk on the same before a committee constituted by the Chairperson of the department. The committee should comprise of 2 or 3 faculty members from different specializations. The teacher(s) associated in the committee will each be assigned 2 hours teaching load per week. However supervision of seminar topic will be in addition to regular teaching load.
CHE601B : OPTIMIZATION OF CHEMICAL PROCESSES
M. Tech. Semester - III (Chemical Engineering)

<table>
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<th>Duration of Examination</th>
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UNIT-I: Introduction to optimization-Formulation of objective function, basic concepts- functions, regions, necessary and sufficient conditions for an extremum of an unconstrained function. One dimensional search-Scanning and bracketing; Newton, Quasi-Newton and secant method, Region elimination method; polynomial approximation methods.


UNIT-III: Linear Programming-Formulation of LP problem, graphical solution of LP Problem, Simplex Method, Duality in Linear programming, two phase method

UNIT-IV: Non-Linear Programming with constraints- Necessary and sufficiency conditions for a local extremum, quadratic programming, successive quadratic programming, Generalized reduced gradient (GRG) method Novel techniques for optimization- Simulated Annealing, Genetic Algorithm, Differential Evolution etc. Use of MS Excel and MAT LAb is advised for solving problems

TEXT/REFERENCE BOOKS:

NOTE:
1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.
UNIT-I: Inter relationship between energy and pollution, Global warming, ozone layer depletion, effect of change in climate on ecosystem and world economy.

UNIT-II: Sources & effects of air pollution on human beings & plant life, Air Sampling, Meteorological aspects of air pollution problems, inversion, plumes and behavior of plumes and different atmospheric stability conditions. Air pollution Control technologies: settling chambers, cyclones, electrostatic precipitator, bag filter and wet scrubbers, Design and efficiencies, Combustion generated pollution, vehicles emission control, air pollution legislation and regulations.

UNIT-III: Water Pollution: types of water pollutants, sources and effects of water pollutants, waste water characteristics (BOD, DO, COD etc.) effluent standards. Treatment methods, Primary methods: screening, sedimentation, filtration etc. Secondary method: Biological treatments Activated sludge process, Trickling filters, Tertiary treatments such as ozonisation, adsorption, disinfection etc. Sludge treatment and disposal methods, water pollution legislation and regulations.


TEXT BOOKS

REFERENCE BOOKS
4. “Waste Water System engineering” H W Parker; Prentice Hall of India

NOTE:
1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.
The primary objective of this course is to develop in student the capacity for analysis & judgment and the ability to carry out independent investigation in design/development through a dissertation work involving creativity, innovation and ingenuity. The work must start with comprehensive literature search and critical appreciation thereof so as to select research problem the student wishes to work on.

Each student will carry out independent dissertation under the supervision of some teacher(s) who will be called Supervisor(s). In no case more than two supervisors can be associated with one dissertation work. The dissertation involving design/fabrication testing/computer simulation/case studies etc. which commences in the III semester will be completed in IV Semester. The evaluation of the dissertation phase-I besides approval of the dissertation topic of the students will be done by a committee of three members constituted as under:

Chairperson of Department : Chairperson
M.Tech. Coordinator/Senior faculty : Member Secretary
Respective dissertation supervisor : Member

The student will be required to submit two copies of his/her report to the department for record (one copy each for the department and participating teacher).

The project coordinator will be assigned the project load of maximum of 2 hours per week including his own guiding load of one hour. However, the guiding teacher will be assigned maximum of one period of teaching load irrespective of number of students/groups under him/her.
UNIT-I: Introduction to polymer science-Classification of polymers, polymer structure, molecular weight, chemical structure and thermal transitions. The synthesis of high polymers: Step growth polymerization, chain growth polymerization, polymerization techniques, reactions of synthetic polymers, special topics in polymer synthesis, chemical structure determination.


TEXT / REFERENCE BOOKS:

NOTE:
1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.
### CHE653B : FUEL CELL TECHNOLOGIES (ELECTIVE-III)

M. Tech. Semester - III (Chemical Engineering)

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**UNIT-I:** Fuel cell- Introduction; types of fuel cells; advantages and disadvantages. Thermodynamics- Work potential; electrode potential; reversible voltage; thermodynamic efficiency. Electrochemical reaction kinetics- Reaction rate; Exchange current density; Galvani potential; Butler-Volmer equation; Tafel equation.

**UNIT-II:** Charge transport- Forces for charge transport; voltage loss due to charge transport; transport resistances; electrolytes.

**UNIT-III:** Mass transport- Diffusive transport; convective transport; flow structure design. Modeling- Flux balance; governing equations.

**UNIT-IV:** Fuel cell characterization: In-situ technique: current-voltage measurement, electrochemical impedance spectroscopy, cyclic voltametry; Ex-situ technique: porosity determination, BET surface area determination, gas permeability, structure and chemical determination.

**TEXT / REFERENCE BOOKS:**
2. Fuel Cell Systems Explained by J Larminie, A Dicks; Wiley.

**NOTE:**
1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.
CHE655B : INDUSTRIAL RISK AND SAFETY MANAGEMENT (ELECTIVE-III)
M. Tech. Semester - III (Chemical Engineering)

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UNIT-II: Hazards in work places- Nature and type of Work places, Types of hazards, hazards due to improper housekeeping, hazards due to fire in multi floor industries and buildings, guidelines and safe methods in above situations. Workers' exposures to hazardous chemicals, TLVs of Chemicals, Physical and Chemical properties of chemicals leading to accidents like fire explosion ingestion and inhalation, pollution in work place due to hazardous, dust, fumes and vapors, guidelines and safety methods in chemical handling, storage entry to confined space.

UNIT-III: Hazards in industries like fertilizer, heavy chemicals, petroleum, pulp and paper, tanneries, dies, paints, pesticides, glass and ceramics, dairy and sugar industries, guidelines for safeguarding personnel and safeguarding against water, land and air pollution in the above industries.


TEXT / REFERENCE BOOKS:

NOTE:
1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.
CHE609B : ENVIRONMENTAL ENGINEERING LAB
M. Tech. Semester - III (Chemical Engineering)

L T P Credits | Class Work | Examination | Total | Duration of Examination
- - 3 1.5 | 40 Marks | 60 Marks | 100 Marks | 3 Hours

List of Experiments / Exercises:

1. Determination of Dissolved oxygen
2. Determination of BOD
3. Determination of COD
4. Determination of Acidity
5. Determination of Alkalinity
6. Determination of Total Hardness
7. Determination of Dissolved Solids
8. Determination of Volatile matter
9. Determination of Sulphates
10. Determination of Chlorides
11. Determination of Heavy metals (using Spectrophotometer )
12. Stack Gas Analysis – NOX, SOX, COX, SPM

NOTE:

1. The students will be required to perform the 08 experiments/exercises from the above list and any other two experiments designed by the department based on the theory course (CHE603B : Environmental Engineering And Waste Management).

2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.

3. Electronics gadgets including Cellular phones are not allowed in the examination.
CHE61B : SEMINAR-II
M. Tech. Semester - III (Chemical Engineering)

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<td>2</td>
<td>2</td>
<td>50 Marks</td>
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The objectives of the course remain:

- To learn how to carry out literature search
- To learn the art of technical report writing
- To learn the art of verbal communication with the help of modern presentation techniques

A student will select a topic in emerging areas of Engineering & Technology and will carry out the task under the supervision of a teacher assigned by the department. He/ She will give a seminar talk on the same before a committee constituted by the Chairperson of the department. The committee should comprise of 2 or 3 faculty members from different specializations. The teacher(s) associated in the committee will each be assigned 2 hours teaching load per week. However supervision of seminar topic will be in addition to regular teaching load.
The Dissertation started in IIIrd Semester will be completed in IV Semester and will be evaluated in the following manner.

**Internal Assessment**
Internal Assessment (Class work evaluation) will be effected as per ordinance through interim report, presentation and discussion thereon by the following committee of three members.

- Chairperson of Department: Chairperson
- M.Tech. Coordinator/Sr. Faculty: Member Secretary
- Respective dissertation Supervisor: Member

**External Assessment**
Final dissertation will be assessed by a panel of examiners consisting of the following

- Chairperson of Department: Chairperson
- Respective Supervisor(s): Member(s)
- External expert: To be appointed by the University

**NOTE:**
2. The External Expert must be from the respective area of specialization. The Chairperson & M. Tech Co-ordinator with mutual consultation will divide the submitted dissertations into groups depending upon the area of specialization and will recommend the list of experts for each group separately to the V C for selecting the examiners with the note that an external expert should be assigned a maximum of FIVE dissertations for evaluation.
3. The student will be required to submit THREE copies of his/her report to the M.Tech. Co-ordinator for record and processing.
4. The project coordinator will be assigned the project load of maximum of 2 hours per week including his own guiding load of one hour. However, the guiding teacher will be assigned maximum of one period of teaching load irrespective of number of students/groups under him/her.