

Scheme & Syllabus of
UNDERGRADUATE DEGREE COURSE

B.Tech. VII & VIII Semester

Chemical Engineering



Rajasthan Technical University, Kota
Effective from session: 2020-21



RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Scheme & Syllabus

IV Year- VII & VIII Semester: B. Tech. (Chemical Engineering)

Teaching & Examination Scheme

B. Tech.: Chemical Engineering

4thYear – VII Semester

| THEORY | | | | | | | | | | | |
|-----------------------|----------|---------|---|------------------|---|---|---------|-----|-----|-------|-----|
| SN | Category | Course | | Contact hrs/week | | | Marks | | | | Cr |
| | | Code | Title | L | T | P | Exm Hrs | IA | ETE | Total | |
| | | | | | | | | | | | |
| 1 | PCC | 7CH4-01 | Transport Phenomena | 3 | 0 | 0 | 3 | 30 | 120 | 150 | 3 |
| 2 | OE | | Open Elective I | 3 | 0 | 0 | 3 | 30 | 120 | 150 | 3 |
| | | | Sub Total | 06 | 0 | 0 | | 60 | 240 | 300 | 6 |
| PRACTICAL & SESSIONAL | | | | | | | | | | | |
| 3 | PCC | 7CH4-21 | Transport Phenomena | 0 | 0 | 2 | | 30 | 20 | 50 | 1 |
| 4 | | 7CH4-22 | Energy Resources Utilisation | 0 | 0 | 2 | | 30 | 20 | 50 | |
| 5 | | 7CH4-23 | Process Design and Techno-Feasible Studies | 0 | 0 | 4 | | 60 | 40 | 100 | |
| 6 | PSIT | 7CH7-30 | Industrial Training | 1 | 0 | 0 | | | | 125 | 2.5 |
| 7 | | 7CH7-40 | Seminar | 2 | 0 | 0 | | | | 100 | 2 |
| 8 | SODE CA | 7CH8-00 | Social Outreach, Discipline & Extra Curricular Activities | | | | | | | 25 | 0.5 |
| | | | Sub- Total | 3 | | 8 | | 120 | 80 | 450 | 9 |
| | | | TOTAL OF VII SEMEESTER | 9 | 0 | 8 | | 180 | 320 | 750 | 15 |

L: Lecture, **T:** Tutorial, **P:** Practical, **Cr:** Credits

ETE: End Term Exam, **IA:** Internal Assessment

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Rajasthan Technical University, Kota



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IV Year- VII & VIII Semester: B. Tech. (Chemical Engineering)

Teaching & Examination Scheme

B. Tech.: Chemical Engineering

4th Year – VIII Semester

| THEORY | | | | | | | | | | | |
|--------------------------------|----------|---------|---|------------------|---|---|---------|-----|-----|-------|------|
| SN | Category | Course | | Contact hrs/week | | | Marks | | | | Cr |
| | | Code | Title | L | T | P | Exm Hrs | IA | ETE | Total | |
| | | | | | | | | | | | |
| 1 | PCC | 8CH4-01 | Process Modelling and Simulation | 3 | 0 | 0 | 3 | 30 | 120 | 150 | 3 |
| 2 | OE | | Open Elective II | 3 | 0 | 0 | 3 | 30 | 120 | 150 | 3 |
| Sub Total | | | | 6 | 0 | 0 | | 60 | 240 | 300 | 6 |
| PRACTICAL & SESSIONAL | | | | | | | | | | | |
| 3 | PCC | 8CH4-21 | Process Modelling and Simulation | 0 | 0 | 2 | | 30 | 20 | 50 | 1 |
| 4 | | 8CH4-22 | Comprehensive Study of Chemical Engineering | 0 | 0 | 2 | | 30 | 20 | 50 | 1 |
| 5 | PSIT | 8CH7-50 | Project | 3 | 0 | 0 | | | | | 7 |
| 6 | SODE CA | 8CH8-00 | Social Outreach, Discipline & Extra Curricular Activities | 0 | 0 | 0 | | 0 | 0 | 25 | 0.5 |
| Sub- Total | | | | 3 | | 4 | | 60 | 40 | 125 | 9.5 |
| TOTAL OF VIII SEMEESTER | | | | 9 | 0 | 4 | | 120 | 280 | 425 | 15.5 |

L: Lecture, **T:** Tutorial, **P:** Practical, **Cr:** Credits

ETE: End Term Exam, **IA:** Internal Assessment

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| List of Open Electives for Chemical Engineering | | | |
|--|---|---------------------------|---|
| Subject Code | Title | Subject Code | Title |
| Open Elective - I | | Open Elective - II | |
| 7AG6-60.1 | Human Engineering and Safety | 8AG6-60.1 | Energy Management |
| 7AG6-60.2 | Environmental Engineering and Disaster Management | 8AG6-60.2 | Waste and By-product Utilization |
| 7AN6-60.1 | Aircraft Avionic System | 8AN6-60.1 | Finite Element Methods |
| 7AN6-60.2 | Non-Destructive Testing | 8AN6-60.2 | Factor of Human Interactions |
| 7CR6-60.1 | Introduction to Ceramic Science & Technology | 8CR6-60.1 | Electrical and Electronic Ceramics |
| 7CR6-60.2 | Plant, Equipment and Furnace Design | 8CR6-60.2 | Biomaterials |
| 7CE6-60.1 | Environmental Impact Analysis | 8CE6-60.1 | Composite Materials |
| 7CE6-60.2 | Disaster Management | 8CE6-60.2 | Fire and Safety Engineering |
| 7CS6-60.1 | Quality Management/ISO 9000 | 8CS6-60.1 | Big Data Analytics |
| 7CS6-60.2 | Cyber Security | 8CS6-60.2 | IPR, Copyright and Cyber Law of India |
| 7EE6-60.1 | Electrical Machines and Drives | 8EE6-60.1 | Energy Audit and Demand side Management |
| 7EE6-60.2 | Power Generation Sources. | 8EE6-60.2 | Soft Computing |
| 7EC6-60.1 | Principle of Electronic communication | 8EC6-60.1 | Industrial and Biomedical applications of RF Energy |
| 7EC6-60.2 | Micro and Smart System Technology | 8EC6-60.2 | Robotics and control |
| 7ME6-60.1 | Finite Element Analysis | 8ME6-60.1 | Operations Research |
| 7ME6-60.2 | Quality Management | 8ME6-60.2 | Simulation Modeling and Analysis |
| 7MI6-60.1 | Rock Engineering | 8MI6-60.1 | Experimental Stress Analysis |
| 7MI6-60.2 | Mineral Processing | 8MI6-60.2 | Maintenance Management |
| 7PE6-60.1 | Pipeline Engineering | 8PE6-60.1 | Unconventional Hydrocarbon Resources |
| 7PE6-60.2 | Water Pollution control Engineering | 8PE6-60.2 | Energy Management & Policy |
| 7TT6-60.1 | Technical Textiles | 8TT6-60.1 | Material and Human Resource Management |
| 7TT6-60.2 | Garment Manufacturing Technology | 8TT6-60.2 | Disaster Management |

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IV Year- VII & VIII Semester: B. Tech. (Chemical Engineering)

7CH4-01: Transport Phenomena

Credit: 3

Max. Marks: 150(IA:30, ETE:120)

3L+0T+0P

End Term Exam: 3 Hours

| SN | Contents | Hours |
|----|---|-----------|
| 1 | Introduction: Objective, scope and outcome of the course. | 1 |
| 2 | Similarity in momentum, heat and mass-transport - Newton's laws of viscosity. Fourier's laws of conduction and Fick's laws of diffusion, Flux-transport property relationships. Estimation of transport properties measurement and correlations, velocity distribution in Laminar flow of falling film. | 9 |
| 3 | Flow over an inclined plane, a circular tube an annulus and between two parallel plates. Shell balance approach for developing equations of change for momentum, heat and mass transport. | 10 |
| 4 | Transport equations in turbulent flow and equations for turbulent fluxes. Velocity, Temperature and concentration profiles for laminar and turbulent flow conditions. Temperature and concentration profiles for conductive and convective transport in solids and fluids. | 10 |
| 5 | Macroscopic momentum and heat balance equations, Kinetic energy calculations, Constant area and variable area flow problems. Flow through bends, time determination for emptying of vessels. | 10 |
| | Total | 40 |



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Scheme & Syllabus

IV Year- VII & VIII Semester: B. Tech. (Chemical Engineering)

7CH4-21: Transport Phenomena

Credit: 1
OL+0T+2P

Max. Marks: 50(IA:30, ETE:20)

Contents

1. Study of momentum transport problems with shell balance approach.
2. Study of heat transport problems with shell balance approach.
3. Study of mass transport problems with shell balance approach.
4. Development of equations for turbulent fluxes. Velocity, Temperature and concentration profiles for laminar and turbulent flow conditions.
5. Development of transport equations in turbulent flow.
6. Solution of problems related to constant area and variable area flow problems.

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IV Year- VII & VIII Semester: B. Tech. (Chemical Engineering)

7CH4-22: Energy Resources Utilisation

Credit: 1
OL+OT+2P

Max. Marks: 50(IA:30, ETE:20)

Contents

1. Basic concepts of demand, supply and pricing; price and output determination under perfect competition, derivation of the supply function, price and output determination under monopoly, oligopoly, and monopolistic competition.
2. Energy and society: Social, economic, political and environmental dimensions of energy.
3. Major types and sources of energy at the global and at the national level.
4. Reserves and resources of petroleum, coal and nuclear minerals: Globally and in India.
5. Other resources of energy: Hydroelectric power, solar energy, wind, wave, and biomass based energy.
6. Energy sources and power generation: Thermal, nuclear, hydroelectric, solar, wind and wave; relative merits and demerits including conversion efficiency, generation cost and environmental impact, clean coal initiatives.
7. Power transmission and distribution.
8. Carbon sequestration, coal gasification, CBM, Shale gas, gas hydrates: current status and future prospects.
9. Solar energy, hydrogen energy, and fuel cells: current status and future prospects.
10. Carbon credits and its impact on hydrocarbon business.
11. International oil markets, developments of Indian oil industry.
12. NELP (New Exploration Licensing Policy), Mines rules and regulations.
13. Pipelines: Current status and future prospects.
14. LNG, CNG and other forms of natural gas: global and Indian scenario.
15. Global energy politics.

7CH4-23: Process Design and Techno-Feasible Studies

7CH7-30: Industrial Training

7CH7-40: Seminar

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IV Year- VII & VIII Semester: B. Tech. (Chemical Engineering)

7CH8-00: Social Outreach, Discipline & Extra Curricular Activities

8CH4-01: Process Modelling and Simulation

Credit: 3
3L+0T+0P

Max. Marks: 150(IA:30, ETE:120)
End Term Exam: 3 Hours

| SN | Contents | Hours |
|----|---|-----------|
| 1 | Introduction: Objective, scope and outcome of the course. | 1 |
| 2 | The role of analysis: Chemical engineering problems, basic concepts of analysis; the analysis process, simple example of estimating an order, source of the model equations. Conservation equations, constitutive equations, control volumes, dimensional analysis, system of units, dimensional consistency in mathematical descriptions, dimensional analysis and Constitutive relationships, final observations. | 9 |
| 3 | Non-Reacting Liquid Systems: Introduction, equation of continuity, simple mass balance, application of the model equations, component mass balances. Model behavior: Steady state behavior, un-steady state behavior, density assumption, numerical integration methods of ordinary differential equation. | 10 |
| 4 | Reacting Liquid Systems: Introduction, basic model equations for a tank-type reactor, reaction rate, batch reactor, pseudo first-order reactions, reversible reactions, multiple reactions. Consecutive reactions, parallel reactions, complex reactions, constant density assumption, order and stoichiometry. | 10 |
| 5 | Treatment of experimental data: Introduction, criteria for Best Fit, Best Slope-I, Best straight line. Fitting a quadratic, simulation examples of gravity fluid flow, heat and mass transfer. Dynamic modelling of simple processes, sequential, simultaneous modular and equation oriented approaches. Computer programming of various iterative convergence methods such as Newton- Raphson, false position, Muller methods. | 10 |
| | Total | 40 |

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8CH6-13: Process Modelling and Simulation

Credit: 1
OL+OT+2P

Max. Marks: 50(IA:30, ETE:20)

Contents

1. Simulation of gravity flow tank by Euler Method
2. Simulation of gravity flow tank by Range Kutta Method
3. Simulation of three CSTR in series by Range Kutta method
4. Simulation of three CSTR in series by Euler method
5. Simulation of three CSTR in series with feedback -loop by Euler method
6. Modelling a batch reactor-verification of 1st and 2nd order rate kinetics.
7. Counter current double pipe heat exchanger modelling-data analysis by iterative methods
8. Simulation of a distillation column-binary systems, equi-molal overflow, constant relative, volatility.

8CH4-22: Comprehensive Study of Chemical Engineering

8CH7-50: Project

8CH8-00: Social Outreach, Discipline & Extra Curricular Activities

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