Chemical and Materials Engineering Department

History:

King Abdulaziz University-Rabigh founded the Department of Chemical and Materials Engineering in 2010 and became operational in 2011.

Department Requirements

In order to qualify for a B.Sc. degree in Chemical and Materials Engineering:

- A student must successfully complete 155 credit hours with an overall GPA of 2.75 out of 5 or better while satisfying the curriculum requirements of his program of specialization.
- Each student is also required to complete one summer training of 10 weeks in industry under the supervision of a faculty member.
- The typical study period is five years (10 semesters) and the credit units are distributed as follows:
- University Requirements 26
- Faculty Requirements 44
- Program Compulsory Requirements 68
- Program Elective Requirements 11
- Free Courses (from outside Faculty) 6

Compulsory courses:

| Course | Course title | credit | Communication | Distribution of | prerequisites | | | |
|--|---|------------------|-------------------------|-----------------------------------|------------------------|--|--|--|
| code and | | hours | hours | communication hours | | | | |
| number | | | | (lecture, Lab, | | | | |
| | | | | Exercises) | | | | |
| CHEN | Intro to | | | | | | | |
| 201 | Chemical | 3 | 4 | (3 • •1) | CHEM 281 | | | |
| 201 | Engineering | | | | | | | |
| CHEN 201 In | ntro to Chemical Eng | gineering | 1 | | | | | |
| Broad definit | ions of Chemical Engi | ineering, intro | oduction to chemical er | lgineering calculations, material | balances in processes | | | |
| vapor-liquid e | equilibrium, partial sat | uration and h | umidity, computer app | lications. | compressionity charts, | | | |
| CHEN | Chemical Eng | 2 | 4 | (2 1) | | | | |
| 202 | Thermodynamics | 3 | 4 | (3 · ·1) | CHEM 240 | | | |
| CHEN 202 C | Chemical Eng Therm | odynamics | | | | | | |
| Introduction t | o thermodynamics con | ncepts, first la | w of thermodynamics, | Mass and energy balances in clo | osed and open systems, | | | |
| volumetric pr | roperties of pure flui | ds, heat effe | ects, humidity charts, | second law of thermodynamic | s, entropy, Computer | | | |
| CHEN | Materials | blems, powe | | | | | | |
| 210 | Science and Eng | 3 | 5 | (2 • 2 • 1) | CHEM 110 | | | |
| CHEN 210 N | CHEN 210 Materials Science and Eng | | | | | | | |
| Classification | Classification of engineering materials. Atomic and molecular bonding. Properties and microstructure. Elastic and plastic | | | | | | | |
| behavior. Or | der in solids, phase | s and solid- | solutions, crystal ge | ometry, disorder in solids, at | comic movement and | | | |
| rearrangemen | t, phase diagrams, so | olid-state tra | nsformations. Applicat | ions of metals, ceramics, poly | mers and composites. | | | |
| Service stabil | ity, corrosion and faile | are. Involves | laboratory experiments | and practices | | | | |
| CHEN 211 | Polymer Science | 2 | 4 | (1 • 2 • 1) | CHEM 231 | | | |
| 211 and Eng CHEN 211 Polymer Science and Eng | | | | | | | | |
| Classification of polymeric materials, calculation of molar mass and molar mass distribution, poly-merization reactions, | | | | | | | | |
| kinetics of p | olymerization reaction | ons, compos | ites materials, polyme | er processing, mechanical and | physical properties, | | | |
| commercial p | olymer, laboratory ex | periments | | | | | | |
| CHEN | Fluid and | 3 | 4 | (1, 2, 1) | MATH 204, CHEN | | | |
| 231 | Particle | | | $(1 \cdot 2 \cdot 1)$ | 201 | | | |
| | Mechanics | ļ <u>.</u> | | | | | | |
| CHEN 231 Fluid and Particle Mechanics Eluid static mass balance momentum balance onergy balance on finite and differential systems, laminer and turbulant flow | | | | | | | | |
| in pipes, fluid flow in porous media, boundary laver theory. fluid flow. flow behavior. flow applications | | | | | | | | |
| CHEN | Thermodynamics | 3 | 4 | (1, 2 , 1) | CHEN 210 | | | |
| 301 | of Materials | | | (1 • 2 • 1) | | | | |
| CHEN 301 Thermodynamics of Materials | | | | | | | | |
| Helmholtz free energy and Gibbs free energy, energy-property relationships, Thermal equilibria, Ellingham diagrams, 1st and | | | | | | | | |
| 2nd order transformations, equilibrium constant, Fugacity and Chemical activity, Equilibrium constant and its variation with temperature. Vent Hoff equation, Gibbs Dubam relationship. Thermodynamics of equilibrium Chemical Equilibrium Discovery | | | | | | | | |
| Diagrams | vant Horr equation, | GIDDS-Duhe | m relationship, Therm | ouynamics of solutions, Typic | ai Equilibrium Phase | | | |
| CHEN | Electrochem and | 2 | 4 | | CHEM 240 | | | |
| 311 | Corrosion Eng | _ | Ŧ | (1 • 2 • 1) | | | | |
| CHEN 311 E | Clectrochem and Cor | rosion Eng | | | | | | |

| Electrochemical mechanisms, corrosion kinetics, polarization and corrosion rates, passivity. Methods of testing corrosion of | | | | | | | | |
|---|---|-----------------|---------------------------|----------------------------------|--------------------------|--|--|--|
| iron and stee | iron and steel and the effects of various parameters. Pourbaix diagrams. Effect of stresses on corrosion, (stress corrosion | | | | | | | |
| cracking, cold | l working, hydrogen ci | racking, etc.). | Corrosion control techn | nologies, corrosion of some eng | ineering alloys. Design | | | |
| of simple pro | cesses. | | | | | | | |
| CHEN | Chemical | | | | MATH 204 CHEN | | | |
| 321 | Reaction | 3 | 4 | (3 · ·1) | 201 | | | |
| | Engineering | | | | 201 | | | |
| CHEN 321 Chemical Reaction Engineering | | | | | | | | |
| The course is | intended to develop t | he student' s | ability to understand m | nole balances, conversion and re | eactor sizing, rate laws | | | |
| and stoichiom | netry for single and mu | iltiple reactio | ns and its applications t | o steady-state no isothermal rea | ctor design. Collection | | | |
| and analysis of rate data and catalysis and catalytic reactor | | | | | | | | |
| CHEN | Mass Transfer | | | | | | | |
| 331 | | 3 | 4 | $(3 \cdot - \cdot 1)$ | CHEN 231 | | | |
| CHEN 331 M | Iass Transfer | | | | | | | |
| Fundamentals | s of mass transfer proc | cesses. The c | ontrol volume approach | to the mass transfer processes. | , differential equations | | | |
| of mass trans | fer. Steady and unstea | dy –state mo | lecular diffusion. Natur | al and forced convection mass | transfer. Mass transfer | | | |
| theories. Cor | vective mass transfe | r correlation | s. Analysis of chemic | cal engineering operations inv | olving mass transfer. | | | |
| Simultaneous | heat and mass transfe | r; mass trans | fer accompanied by che | emical reaction. | C | | | |
| CHEN | Heat Transfer | _ | | | | | | |
| 332 | | 3 | 4 | (3 · ·1) | CHEN 201 | | | |
| CHEN 332 H | leat Transfer | | | | | | | |
| Modes of he | at transfer, steady and | l un-steady-s | tate conduction in diff | erent co-ordinates, convective | heat transfer with and | | | |
| without phase | e change, correlations | for forced a | nd natural convection. | analogy between momentum a | and heat transfer, heat | | | |
| transfer applie | cations. | 101 101000 | | | | | | |
| CHEN | Separation | | | | | | | |
| 333 | Processes | 3 | 5 | (2 • 2 • 1) | CHEN 201 | | | |
| 555 CHEN 333 S | anaration Processes | | | | | | | |
| Phase equilibrium, continuous contact and stage wise processes: fractional distillation gas absorption and liquid-liquid | | | | | | | | |
| extraction processes involves laboratory experiments and practices | | | | | | | | |
| CHEN Process Dynamic | | | | | | | | |
| CHEN 241 | Process Dynamic | 2 | 3 | (1 • 2 •) | CHEN 321 | | | |
| 341 | and Control I | <u> </u> | | | | | | |
| UHEN 541 Process Dynamic and Control I Methametical modeling of process control transfer functions, dynamic behavior of charginal processory for the l | | | | | | | | |
| Mathematical modeling of process control, transfer functions, dynamic behavior of chemical processes, feedback control, | | | | | | | | |
| dynamic behavior of closed-loop systems, stability analysis, frequency response analysis, controller design and tuning, | | | | | | | | |
| introduction to computer control, laboratory and simulations applications | | | | | | | | |
| CHEN | Numerical | | | | | | | |
| 342 | Methods in | 3 | 4 | (3 • • 1) | MATH 204 | | | |
| Chem Eng | | | | | | | | |
| CHEN 342 Numerical Methods in Chem Eng | | | | | | | | |
| This course deals with Linear, non-linear equations, systems of equations. Jacobi, Gauss-Seidel, SOR. LU decomposition, | | | | | | | | |
| Newton-Raph | son, bisection and | Wegstein's n | nethod - convergence | acceleration; zeros of , poly | nomials; interpolating | | | |
| polynomial; f | inite difference metho | ds; numerical | differentiation, Newton | n-Coates and Gaussian quadratu | re. Solution of ODE's; | | | |
| the shooting r | nethod; numerical sol | ution of react | ion network equations; | solution of transient heat and m | ass transfer models | | | |
| CHEN | Summer | 2 | 1 | $(\langle A \rangle)$ | Complete 110 CU | | | |
| 390 | Training | 2 | + | () | Complete 110 CO | | | |
| CHEN 390 Summer Training Course | | | | | | | | |
| 10 weeks of | 10 weeks of training in industry under the supervision of a faculty member. Students have to submit a report about their | | | | | | | |
| achievements during training in addition to any other requirements assigned by the department | | | | | | | | |
| CHEN | Unit Operations | 0 | 4 | (A) | OLIEN 222 | | | |
| 431 | Lab | 2 | 4 | (• 4 •) | CHEN 333 | | | |

| Introduction, Laboratory Safety Rules, Familiarization with Experiments, Studies in Fluid Flow, The Study of Heat Exchanges, Experimental study of mass transfer, Modern separations techniques, and reaction engineering, Emphasis is on open-ended laboratory projects with electronic instrumentation; Experimental design with analytical, numerical, and statistical analysis of data.CHEN 441Process Dynamic and Control II23(1 · 2 ·)CHEN 341CHEN 441 Process Dynamic and Control IIReview of feedback control, cascade control, Ratio, override, selective, feed-forward, and multivariable process control, Dynamic simulation of control systems using SIMULINK and other commercial software packages, Instrumentation, design case studies, tuning case studiesCHEN Modeling and 34(3 · (1)CHEN 333CHEN Modeling and SimulationThis course is designed to give a chemical engineering student the ability to solve system of algebraic- differential equations. The course will develop student ability's to drive system models and simulated digitally, simulation computer packages, aspen, Hysys, chemcadCHEN 431CHEN 321, CHEN 333CHEN 451 Plant Design 49934(3 · (1)CHEN 321, CHEN 333CHEN 49 Sectior of the design, locations and layout of chemical process plant, operability, controllability reliability and safety requirement of the design, cost estimation, utilization of simulation and design packagesCHEN 333CHEN 451 Plant Design 49934(2 · 4 ·)CHEN 333CHEN 499 Project (9th and 10th Semester)64(2 | CHEN 431 Unit Operations Lab | | | | | | |
|--|--|--------------------------|-----------------|---------------------------|-----------------------------------|---------------------------|--|
| Experimental study of mass transfer, Modern separations techniques, and reaction engineering, Emphasis is on open-ended laboratory projects with electronic instrumentation; Experimental design with analytical, numerical, and statistical analysis of data.CHEN 441Process Dynamic and Control II23(1 · 2 ·)CHEN 341CHEN 441 Process Dynamic and Control II23(1 · 2 ·)CHEN 341CHEN 441 Process Dynamic and Control IIReview of feedback control, cascade control, Ratio, override, selective, feed-forward, and multivariable process control, Dynamic simulation of control systems using SIMULINK and other commercial software packages, Instrumentation, design case studies.CHEN 420CHEN 442 442Modeling and Simulation34(3 · - · 1)CHEN 333CHEN 442 142Modeling and Simulation34(3 · - · 1)CHEN 333CHEN 442 Hodeling and SimulationThis course will develop student ability's to drive system models and simulate digitally, simulation computer packages, aspen, Hysys, chemcatCHEN 321, CHEN 333CHEN 451 Plant Design 45134(3 · - · 1)CHEN 321, CHEN 333CHEN 451 Plant Design 49934(2 · 4 ·)CHEN 333CHEN 495 9Project (9th and 1664(2 · 4 ·)CHEN 333CHEN 495 Senior Project (9th and 16th Semester)64(2 · 4 ·)CHEN 333 | Introduction, | Laboratory Safety Rul | es, Familiariz | ation with Experiments | , Studies in Fluid Flow, The Stu | dy of Heat Exchanges, | |
| laboratory projects with electronic instrumentation; Experimental design with analytical, numerical, and statistical analysis of data.CHEN 441Process Dynamic and Control II23(1 · 2 ·)CHEN 341CHEN 441 Process Dynamic and Control II Review of feedback control, cascade control, Ratio, override, selective, feed-forward, and multivariable process control, Dynamic simulation of control systems using SIMULINK and other commercial software packages, Instrumentation, design case studies;Modeling and 34(3 · ·1)CHEN 333CHEN 442 Modeling and 3 4424(3 · ·1)CHEN 333CHEN 442 Modeling and SimulationThis course is designed to give a chemical engineering student the ability to solve system of algebraic- urle velop student ability's to drive system models and simulate digitally, simulation computer packages, aspen, Hysys, chemcatCHEN 321, CHEN 333CHEN 451Plant Design 34(3 · ·1)CHEN 321, CHEN 333CHEN 451 Plant Design 451B.Sc. Senior 499Project (9th and 16th Semester)Genes velocities of the design, locations and layout of chemical process plant, operability, controllability reliability and safety requirement of the design, cost estimation, utilization of simulation and design packagesCHEN 495 Senior 499Project (9th and 16A(2 · 4 ·)CHEN 495 Senior 2 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · 0 · | Experimental | study of mass transfe | r, Modern se | parations techniques, a | nd reaction engineering, Emph | asis is on open-ended | |
| data.CHEN 441Process Dynamic and Control II23 $(1 \cdot 2 \cdots)$ CHEN 341CHEN 441 Process Dynamic and Control IIReview of feedback control, cascade control, Ratio, override, selective, feed-forward, and multivariable process control, Dynamic simulation of control systems using SIMULINK and other commercial software packages, Instrumentation, design case studies.CHEN 441 Process Dynamic and Control IIReview of feedback control, cascade control, Ratio, override, selective, feed-forward, and multivariable process control, Dynamic simulation of control systems using SIMULINK and other commercial software packages, Instrumentation, design case studies.CHEN 40CHEN 442 Modeling and SimulationA 422SimulationThis course is designed to give a chemical engineering student the ability to solve system of algebraic- differential equations. The course will develop student ability's to drive system models and simulate digitally, simulation computer packages, aspen, Hysys, chem-cadCHEN 451 Plant Design 451A (3 · ·1)CHEN 451 Plant Design 3CHEN 451 Plant Design Chemical and pertochemical process blatt design, locations and layout of chemical process plant, operability, controllability reliability and safety requirement of the design, cost estimation, utilization of simulation and design packagesCHEN 499Project (9th and 409Project (9th and 409Project (9th and 409Pro | laboratory pro | jects with electronic i | nstrumentatio | on; Experimental design | n with analytical, numerical, and | l statistical analysis of | |
| CHEN 441Process Dynamic and Control II23(1 · 2 · -)CHEN 341CHEN 441CHEN 441Review of Geotrop systems using SUULINK and other control systems using SUULINK and other control systems using SUULINK and other control systems using and case studies;Dynamic site control, cascade control, Ratio, override, selective, feed-forward, and multivariable process control, Dynamic site case studies;CHEN 441Modeling and 44234(3 · - · 1)CHEN 333CHEN 442 Modeling and SimulationThis course is designed to give a chemical engineering student the ability to solve system of algebraic- differential equations. The course will develop student ability is to drive system models and simulation control systems process, aspen, Hysys, chemical34(3 · - · 1)CHEN 321, CHEN 333CHEN 451CHEN 451Forectemical processes plant design, locations and layout of chemical process plant, optimality, controllability reliability and structure new colspan="4">Section of simulation and design packages, new colspan="4">CHEN 451CHEN 451CHEN 451CHEN 451CHEN 451Chemical processes plant design, locations and layout of chemical process plant, optimality, controllability reliability and structure review, project design, locations and layout of simulation and design packages, plant, optimality, controllability reliability and structure review, project design, locations and layout of simulation and design packages, plant, optimality, controllabil | data. | | | | | | |
| 441and Control II23(1 * 2 * - 1)CHEN 341CHEN 441 Process Dynamic and Control IIReview of feedback control, cascade control, Ratio, override, selective, feed-forward, and multivariable process control, Dynamic simulation of control systems using SIMULINK and other commercial software packages, Instrumentation, design case studies, tuning case studiesCHENModeling and 44234(3 · - · 1)CHEN 333CHEN 442 Modeling and SimulationThis course is designed to give a chemical engineering student the ability to solve system of algebraic- differential equations. The course will develop student ability's to drive system models and simulated digitally, simulation computer packages, aspen, Hysys, chemcatCHEN 451 Plant Design 3334(3 · - · 1)CHEN 321, CHEN 333CHEN 451 Plant Design 451B.Sc. Senior 49934(2 · 4 ·)CHEN 333CHEN 459 EvolutionB.Sc. Senior 49964(2 · 4 ·)CHEN 333CHEN 499 Senior ProjectCHEN 499 Senior Project | CHEN | Process Dynamic | C | 2 | $(1, 2, \ldots)$ | CHEN 241 | |
| CHEN 441 Process Dynamic and Control IIReview of feedback control, cascade control, Ratio, override, selective, feed-forward, and multivariable process control, Dynamic simulation of control systems using SIMULINK and other commercial software packages, Instrumentation, design case studiesCHENModeling and 4423GHEN 442 Modeling and Simulation34This course is designed to give a chemical engineering student the ability to solve system of algebraic- differential equations. The course will develop student ability's to drive system models and simulate digitally, simulation computer packages, aspen, Hysys, chemcadCHEN 451 Plant Design 45134(3 · - · 1)CHEN 451 Plant Design Chemical and petrochemical processes plant design, locations and layout of chemical process plant, operability, controllability reliability and safety requirement of the design, cost estimation, utilization of simulation and design packagesCHEN 499B.Sc. Senior Project (9th and 10th Semester)64(2 · 4 ·)CHEN 499 Senior Project Selection of topic, literature review, project design planning, arranging for data collection and experimental work, interim | 441 | and Control II | 2 | 5 | (1 • 2 •) | CHEN 541 | |
| Review of feedback control, cascade control, Ratio, override, selective, feed-forward, and multivariable process control, Dynamic simulation of control systems using SIMULINK and other commercial software packages, Instrumentation, design case studies.CHENModeling and Simulation34(3 · - · 1)CHEN 333CHEN 442Modeling and Simulation34(3 · - · 1)CHEN 333CHEN 442 Modeling and SimulationThis course is designed to give a chemical engineering student the ability to solve system of algebraic- differential equations. The course will develop student ability's to drive system models and simulate digitally, simulation computer packages, aspen, Hysys, chemcadCHEN 321, CHEN 321, CHEN 333CHEN 451Plant Design 45134(3 · - · 1)CHEN 321, CHEN 333CHEN 451 Plant Design 45134(2 · 4 ·)CHEN 333CHEN 499B.Sc. Senior 10th Semester)64(2 · 4 ·)CHEN 333CHEN 499 Senior ProjectSelection of topic, literature review, project design planning, arranging for data collection and experimental work, interim | CHEN 441 P | rocess Dynamic and | Control II | | | | |
| Dynamic simulation of control systems using SIMULINK and other commercial software packages, Instrumentation, design case studies, tuning case studiesCHENModeling and Simulation34 $(3 \cdot - \cdot 1)$ CHEN 333CHEN 442 Modeling and SimulationThis course is designed to give a chemical engineering student the ability to solve system of algebraic- differential equations. The course will develop student ability's to drive system models and simulate digitally, simulation computer packages, aspen, Hysys, chemcadCHEN 8Plant Design 3334 $(3 \cdot - \cdot 1)$ CHEN 321, CHEN 333CHEN 451 Plant Design 45134 $(3 \cdot - \cdot 1)$ CHEN 321, CHEN 333333CHEN 451 Plant Design 45134 $(3 \cdot - \cdot 1)$ CHEN 321, CHEN 333CHEN 451 Plant Design 45134 $(2 \cdot 4 \cdot - \cdot)$ CHEN 333CHEN 19 Besign 49964 $(2 \cdot 4 \cdot - \cdot)$ CHEN 333CHEN 499 SeniorCHEN 499 Senior ProjectSelection of topic, literature review, project design planning, arranging for data collection and experimental work, interim | Review of fee | dback control, cascad | e control, Rat | tio, override, selective, | feed-forward, and multivariable | process control, | |
| case studiesCHEN 442Modeling and Simulation34 $(3 \cdot - \cdot 1)$ CHEN 333CHEN 442 Modeling and SimulationThis course is designed to give a chemical engineering student the ability to solve system of algebraic- differential equations. The course will develop student ability's to drive system models and simulation computer packages, aspen, Hysys, chem-catCHEN 321, CHEN 333CHEN 451Plant Design 45134 $(3 \cdot - \cdot 1)$ CHEN 321, CHEN 333CHEN 451 Plant Design CHEN 451 Plant Design teilability and petrochemical processes plant design, locations and layout of chemical process plant, operability, controllability reliability and petrochemical processes plant design, locations and layout of chemical process plant, operability, controllability reliability and petrochemical processes plant design, locations and layout of chemical process plant, operability, controllability reliability and petrochemical processes plant design, locations and layout of chemical process plant, operability, controllability reliability and petrochemical processes plant design, locations and layout of chemical process plant, operability, controllability reliability and petrochemical processes plant design, locations and layout of chemical process plant, operability, controllability reliability and petrochemical processes plant design, approximation, utilization of simulation and design parametersCHEN 499B.Sc. Senior 10th Semester)64(2 · 4 ·)CHEN 333CHEN 499 Evitor ProjectSelection of two period design planning, arranging for data collection and experimentation work, interim | Dynamic simu | ulation of control syste | ems using SII | MULINK and other cor | nmercial software packages, Ins | trumentation, design | |
| CHEN 442Modeling and Simulation34 $(3 \cdot - \cdot 1)$ CHEN 333CHEN 442 Modeling and SimulationThis course is designed to give a chemical engineering student the ability to solve system of algebraic- differential equations. The course will develop student ability's to drive system models and simulate digitally, simulation computer packages, aspen, Hysys, chemcadCHEN Plant Design 451A(3 · ·1)CHEN 321, CHEN 333CHEN 451 Plant Design 451Chemical and petrochemical processes plant design, locations and layout of chemical process plant, operability, controllability reliability and safety requirement of the design, cost estimation, utilization of simulation and design packagesCHEN 499Project (9th and 10th Semester)CHEN 499 Senior ProjectSelection of topic, literature review, project design planning, arranging for data collection and experimental work, interim | case studies, t | uning case studies | | | | | |
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| CHEN 442 Modeling and SimulationThis course is designed to give a chemical engineering student the ability to solve system of algebraic- differential equations. The course will develop student ability's to drive system models and simulate digitally, simulation computer packages, aspen, Hysys, chemcadCHEN 451Plant Design 334(3 · ·1)CHEN 321, CHEN 333CHEN 451 Plant Design Chemical and petrochemical processes plant design, locations and layout of chemical process plant, operability, controllability reliability and safety requirement of the design, cost estimation, utilization of simulation and design packagesCHEN 499B.Sc. Senior Project (9th and 10th Semester)64(2 · 4 ·)CHEN 333CHEN 499 Senior ProjectSelection of topic, literature review, project design planning, arranging for data collection and experimental work, interim | 442 | Simulation | 3 | 4 | (3 · ·1) | CHEN 555 | |
| This course is designed to give a chemical engineering student the ability to solve system of algebraic- differential equations. The course will develop student ability's to drive system models and simulate digitally, simulation computer packages, aspen, Hysys, chemcadCHENPlant Design 45134 $(3 \cdot - \cdot 1)$ CHEN 321, CHEN 333CHEN 451 Plant Design Chemical and petrochemical processes plant design, locations and layout of chemical process plant, operability, controllability reliability and safety requirement of the design, cost estimation, utilization of simulation and design packagesCHEN 333CHENB.Sc. Senior 10th Semester)4 $(2 \cdot 4 \cdot -)$ CHEN 333CHEN 499 Senior Project64 $(2 \cdot 4 \cdot -)$ CHEN 333 | CHEN 442 N | Iodeling and Simulat | tion | | | | |
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| Hysys, chemcadPlant Design 334(3 · - · 1)CHEN 321, CHEN 33345134(3 · - · 1)333CHEN 451 Plant DesignChemical and petrochemical processes plant design, locations and layout of chemical process plant, operability, controllability reliability and safety requirement of the design, cost estimation, utilization of simulation and design packagesCHENB.Sc. Senior 4994(2 · 4 ·)CHEN 333CHEN 499 Enjoit (9th and 10th Semester)64(2 · 4 ·)CHEN 333CHEN 499 Enjoit (9th and 10th Semester)CHEN 499 Enjoit (9th and 10th Semester) | The course wi | ill develop student abi | lity's to drive | e system models and sin | nulate digitally, simulation com | puter packages, aspen, | |
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| 45154(5 (1))333CHEN 451 Plant DesignChemical and petrochemical processes plant design, locations and layout of chemical process plant, operability, controllability reliability and safety requirement of the design, cost estimation, utilization of simulation and design packagesCHENB.Sc. Senior4(2 · 4 ·)CHEN 333499Project (9th and 10th Semester)64(2 · 4 ·)CHEN 333CHEN 499 Senior ProjectSelection of topic, literature review, project design planning, arranging for data collection and experimental work, interim | CHEN | Plant Design | 2 | 4 | (2 1) | CHEN 321, CHEN | |
| CHEN 451 Plant Design Chemical and petrochemical processes plant design, locations and layout of chemical process plant, operability, controllability reliability and safety requirement of the design, cost estimation, utilization of simulation and design packages CHEN B.Sc. Senior A CHEN 333 499 Project (9th and 6 4 (2 · 4 ·) CHEN 333 10th Semester) Interview, project design planning, arranging for data collection and experimental work, interim | 451 | | 3 | 4 | (3 · ·1) | 333 | |
| Chemical and petrochemical processes plant design, locations and layout of chemical process plant, operability, controllability reliability and safety requirement of the design, cost estimation, utilization of simulation and design packages CHEN B.Sc. Senior Image: CHEN 499 Project (9th and 6) CHEN 49 CHEN 333 10th Semester) Image: CHEN 499 CHEN 499 CHEN 499 CHEN 499 CHEN 499 CHEN 499 Senior Project Selection of topic, literature review, project design planning, arranging for data collection and experimental work, interim | CHEN 451 Plant Design | | | | | | |
| reliability and safety requirement of the design, cost estimation, utilization of simulation and design packages CHEN B.Sc. Senior 499 Project (9th and 6 4 (2 · 4 ·) CHEN 333 10th Semester) 10th Semester) CHEN 499 CHEN 499 CHEN 499 Selection of topic, literature review, project design planning, arranging for data collection and experimental work, interim | Chemical and petrochemical processes plant design, locations and layout of chemical process plant, operability, controllability | | | | | | |
| CHEN B.Sc. Senior A CHEN CHEN 333 499 Project (9th and 10th Semester) 6 4 (2 · 4 ·) CHEN 333 10th Semester) 10th Semester) CHEN 499 CHEN 499 CHEN 499 CHEN 499 Selection of topic, literature review, project design planning, arranging for data collection and experimental work, interim | reliability and safety requirement of the design, cost estimation, utilization of simulation and design packages | | | | | | |
| 499 Project (9th and 6 4 (2 · 4 ·) CHEN 333 10th Semester) Image: CHEN 499 Senior Project CHEN 499 Senior Project Selection of topic, literature review, project design planning, arranging for data collection and experimental work, interim | CHEN | B.Sc. Senior | | | | | |
| 10th Semester)10th Semester)CHEN 499 Senior ProjectSelection of topic, literature review, project design planning, arranging for data collection and experimental work, interim | 499 | Project (9th and | 6 | 4 | (2 • 4 •) | CHEN 333 | |
| CHEN 499 Senior Project Selection of topic, literature review, project design planning, arranging for data collection and experimental work, interim | | 10th Semester) | | | | | |
| Selection of topic, literature review, project design planning, arranging for data collection and experimental work, interim | CHEN 499 Senior Project | | | | | | |
| | Selection of topic, literature review, project design planning, arranging for data collection and experimental work, interim | | | | | | |
| report, experimental work and data collection or field study (if any), data processing analysis and results, preparation of a | | | | | | | |
| first draft of the final report, presentation of the project. | | | | | | | |
| Total 52 78 (40,24,14) | | | | | | | |

Courses Description:

1- CHEN 201 Intro to Chemical Engineering

Broad definitions of Chemical Engineering, introduction to chemical engineering calculations, material balances in processes with and without chemical reactions, recycle by-pass and purge calculations, critical properties and compressibility charts, vapor-liquid equilibrium, partial saturation and humidity, computer applications.

2- CHEN 202 Chemical Eng Thermodynamics

Introduction to thermodynamics concepts, first law of thermodynamics, Mass and energy balances in closed and open systems, volumetric properties of pure fluids, heat effects, humidity charts, second law of thermodynamics, entropy, Computer applications to thermodynamics problems, power cycles

3- CHEN 210 Materials Science and Eng

Classification of engineering materials. Atomic and molecular bonding. Properties and microstructure. Elastic and plastic behavior. Order in solids, phases and solid-

solutions, crystal geometry, disorder in solids, atomic movement and rearrangement, phase diagrams, solid-state transformations. Applications of metals, ceramics, polymers and composites. Service stability, corrosion and failure. Involves laboratory experiments and practices

4- CHEN 211 Polymer Science and Eng

Classification of polymeric materials, calculation of molar mass and molar mass distribution, poly-merization reactions, kinetics of polymerization reactions, composites materials, polymer processing, mechanical and physical properties, commercial polymer, laboratory experiments

5- CHEN 231 Fluid and Particle Mechanics

Fluid static, mass balance, momentum balance, energy balance on finite and differential systems, laminar and turbulent flow in pipes, fluid flow in porous media, boundary layer theory, fluid flow, flow behavior, flow applications

6- CHEN 301 Thermodynamics of Materials

Helmholtz free energy and Gibbs free energy, energy-property relationships, Thermal equilibria, Ellingham diagrams, 1st and 2nd order transformations, equilibrium constant, Fugacity and Chemical activity, Equilibrium constant and its variation with temperature, Vant Hoff equation, Gibbs-Duhem relationship, Thermodynamics of solutions, Typical Equilibrium Phase Diagrams.

7- CHEN 311 Electrochem and Corrosion Eng

Electrochemical mechanisms, corrosion kinetics, polarization and corrosion rates, passivity. Methods of testing corrosion of iron and steel and the effects of various parameters. Pourbaix diagrams. Effect of stresses on corrosion, (stress corrosion cracking, cold working, hydrogen cracking, etc.). Corrosion control technologies, corrosion of some engineering alloys. Design of simple processes.

8- CHEN 321 Chemical Reaction Engineering

The course is intended to develop the student's ability to understand mole balances, conversion and reactor sizing, rate laws and stoichiometry for single and multiple reactions and its applications to steady-state no isothermal reactor design. Collection and analysis of rate data and catalysis and catalytic reactor

9- CHEN 331 Mass Transfer

Fundamentals of mass transfer processes. The control volume approach to the mass transfer processes, differential equations of mass transfer. Steady and unsteady –state molecular diffusion. Natural and forced convection mass transfer. Mass transfer theories. Convective mass transfer correlations. Analysis of chemical engineering operations involving mass transfer. Simultaneous heat and mass transfer; mass transfer accompanied by chemical reaction.

10- CHEN 332 Heat Transfer

Modes of heat transfer, steady and un-steady-state conduction in different co-ordinates, convective heat transfer with and without phase change, correlations for forced and natural convection, analogy between momentum and heat transfer, heat transfer applications.

11- CHEN 333 Separation Processes

Phase equilibrium, continuous contact and stage wise processes; fractional distillation, gas absorption and liquid-liquid extraction processes, involves laboratory experiments and practices

12- CHEN 341 Process Dynamic and Control I

Mathematical modeling of process control, transfer functions, dynamic behavior of chemical processes, feedback control, dynamic behavior of closed-loop systems, stability analysis, frequency response analysis, controller design and tuning, introduction to computer control, laboratory and simulations applications

13- CHEN 342 Numerical Methods in Chem Eng

This course deals with Linear, non-linear equations, systems of equations. Jacobi, Gauss-Seidel, SOR. LU decomposition, Newton-Raphson, bisection and Wegstein's method - convergence acceleration; zeros of , polynomials; interpolating polynomial; finite difference methods; numerical differentiation, Newton-Coates and Gaussian quadrature. Solution of ODE's; the shooting method; numerical solution of reaction network equations; solution of transient heat and mass transfer models

14- CHEN 390 Summer Training Course

10 weeks of training in industry under the supervision of a faculty member. Students have to submit a report about their achievements during training in addition to any other requirements assigned by the department

15- CHEN 431 Unit Operations Lab

Introduction, Laboratory Safety Rules, Familiarization with Experiments, Studies in Fluid Flow, The Study of Heat Exchanges, Experimental study of mass transfer, Modern separations techniques, and reaction engineering, Emphasis is on open-ended laboratory projects with electronic instrumentation; Experimental design with analytical, numerical, and statistical analysis of data.

16- CHEN 441 Process Dynamic and Control II

Review of feedback control, cascade control, Ratio, override, selective, feed-forward, and multivariable process control, Dynamic simulation of control systems using SIMULINK and other commercial software packages, Instrumentation, design case studies, tuning case studies

17- CHEN 442 Modeling and Simulation

This course is designed to give a chemical engineering student the ability to solve system of algebraic- differential equations. The course will develop student ability's to drive system models and simulate digitally, simulation computer packages, aspen, Hysys, chem.-cad.

18- CHEN 451 Plant Design

Chemical and petrochemical processes plant design, locations and layout of chemical process plant, operability, controllability reliability and safety requirement of the design, cost estimation, utilization of simulation and design packages

19- CHEN 499 Senior Project

Selection of topic, literature review, project design planning, arranging for data collection and experimental work, interim report, experimental work and data collection or field study (if any), data processing analysis and results, preparation of a first draft of the final report, presentation of the project.

<u>Compulsory Courses outside the department:</u>

| Course | Course title | credit | Communication | Distribution of | prerequisites | | |
|---|--|----------------|---------------------------|--------------------------------------|--------------------------|--|--|
| code and | | hours | hours | communication hours | | | |
| number | | | | (lecture, Lab, | | | |
| | | | | Exercises) | | | |
| EEN 100 | Electrical Circuits I | 3 | 6 | (2: 2: 2) | PHYS 202 | | |
| EEN 100: E | Clectrical Circuits | | | | | | |
| Electric quan | ntities and circuit eler | nents; Kirchł | noff's laws; Mesh and | node analyses; Sinusoidal stead | ly-state analysis using | | |
| phasors; Net | work theorem and trai | stormations. | Three-phase circuits. | | | | |
| MEN 130 | Basic Workshop | l | 4 | (• 2•2) | | | |
| MEN 130 B | asic Workshop I | | | | | | |
| Introduction | to principles of proc | luction, Engi | neering materials, Mea | surements, Standards Specifica | tions, Foundry, Metal | | |
| forming (for | ging, extrusion, draw | ing, press w | ork, rolling, wire draw | ring), Sheet metal work, Weldi | ng, metal cutting and | | |
| machine tool | s (sawing, drilling, tur | ning, milling, | shaping, slotting, grind | ing), Fitting, Industrial safety, Pr | roduction management | | |
| and production | on planning. | | | | | | |
| MEN 225 | Engineering Mechanics | 3 | 4 | (3:: 13) | PHYS 281 | | |
| MEN 225 E | ngineering Mechanic | S | | | | | |
| General Prin | ciples of Statics; Force | e Vectors (2D | & 3D); Equilibrium of | a Particle (2D & 3D); Force Sys | stem Resultants (2D & | | |
| 3D): Equilib | rium of a Rigid Body | (2D): Cente | r of Gravity and centro | oid of a Body. Mass moment o | f inertia. Rotation and | | |
| translation | 5D), Equinoritation of a Rigid Body (2D), center of Gravity and centroid of a Body, Mass moment of inertia, Rotation and | | | | | | |
| translation of a rigid body in the plane, General plane motion, Displacement, velocity, and acceleration of rigid bodies, | | | | | | | |
| Equations of motion for a rigid body, | | | | | | | |
| CHEM | Principles of | 4 | 6 | $(2, 2, \ldots)$ | CHEM 110 | | |
| 231 | Organic Chem I | | Ŭ | (3, 3,) | CHEWIIIO | | |
| | | | | | | | |
| GUEN | Phys Chem for | | | | | | |
| CHEM | Non Chem | 4 | 4 | (3, 3,) | CHEM 281 | | |
| 240 | Maiors | | | | | | |
| CHEN 240 Phys Chem for Non Chem Majors | | | | | | | |
| Explores experimental and theoretical principles of chemistry including gases, liquids, solids, Zeroth law of thermodynamics, | | | | | | | |
| First law of thermos-dynamics, second law of thermodynamics, chemical equilibrium, phase equilibrium, Electrochemical | | | | | | | |
| equilibrium, quantum theory, atomic structure and spectroscopy basics, Chemical kinetics in liquid and gas phases, Chemical | | | | | | | |
| potential, che | emical potential, Macı | omolecules, i | ntroduction to solid stat | te chemistry, Surface dynamics | | | |
| IEN 401 | Intro to | 1 | 3 | $(1, \dots, 2)$ | IEN 202 | | |
| IEN 481 | Entrepreneurship | 1 | 5 | (1' - (2)) | IEN 202 | | |
| IEN 481 Introduction to Entrepreneurship | | | | | | | |
| Overview of the entrepreneurial process from an engineering perspective. Idea generation, planning, financing, marketing, | | | | | | | |
| protecting, s | taffing, leading, grow | ing, and harv | vesting. Basic framewor | rk for understanding the proces | s of entrepreneurship, | | |
| principles of | management and rela | ted technique | s in decision making, p | lanning, marketing, and financia | al control. Exercises in | | |
| practical ideas about launching own enterprises. Classroom lectures are combined | | | | | | | |
| | Total 16 29 (12,10,7) | | | | | | |

List of selective courses for Chemical and Materials Engineering Department:

| Course | Course title | credit | Communication | Distribution of | prerequisites | | | | |
|---|--|------------------|----------------------------|-------------------------------------|-------------------------|--|--|--|--|
| number | | nours | nours | communication nours | | | | | |
| number | | | | (lecture, Lab, | | | | | |
| | Exercises) | | | | | | | | |
| CHEN 411 | Materials Selection | 4 | 7 | (2 • 4 • 1) | CHEN 210 | | | | |
| CHEN 411 | CHEN 411 Materials Selection | | | | | | | | |
| Selection crit | teria for metals, allog | ys, ceramics a | nd plastics, mechanical | behavior, corrosion and oxidation | n resistance at ambient | | | | |
| and elevated | temperatures, mate | rials for mari | ne environments, oil p | roduction and transport, refiner | es, petrochemical and | | | | |
| desalination | desalination industries, refractory materials. Computer applications, and economic considerations, laboratory experiments | | | | | | | | |
| CHEN | Composite | 3 | 5 | (2 • 2 • 1) | CHEN 210 | | | | |
| 412 CHEN 412 | Materials | s | | | | | | | |
| Role of inte | erfaces processes a | nd production | of polymer matrix c | omposites metal matrix compo | osites ceramic matrix | | | | |
| composites. | design aspects of co | omposites base | es structures, applicatio | n and properties of composite m | aterials, production of | | | | |
| glass fiber ar | nd carbon fiber com | osites, Titaniu | im bases composite ma | terials. | anonais, procacción or | | | | |
| CHEN | Mat Structure | 2 | 5 | (2 . 2 . 1) | CUEN 210 | | | | |
| 413 | and Failure Anal | 3 | 5 | (2,2,1) | CHEN 210 | | | | |
| CHEN 413 N | Materials Structure | and Failure | Analysis | | | | | | |
| Structural cl | haracterization, qua | ntitative and | l qualitative analysis, | thermal analysis, differential c | alorimetry, molecular | | | | |
| spectroscopy | , engineering aspect | s of failure and | d failure analysis, failur | e modes, characterization of fract | ured surface, chemical | | | | |
| analysis, fail | ure prevention and | histories, mec | hanical and metallurgic | cal causes of failures, creep failu | res, corrosion induced | | | | |
| failure, pittin | g as stress concentra | ation. | | | | | | | |
| CHEN | Mat and | 4 | 5 | $(2 \land 4 \land 1)$ | CHEN 211 | | | | |
| 414 | Character | 4 | 0 | (2:4:1) | CHEN 211 | | | | |
| CHEN 414 | CHEN 414 Mat and Nanomat Character | | | | | | | | |
| Nano fabricated computed devices, bio molecular devices and molecular electronics, integrated micro systems and MEMS, | | | | | | | | | |
| molecular ma | molecular manufacturing and nano robots, material engineering processes applied to electro-active polymers, micro-nano scale | | | | | | | | |
| instrumentati | ion measuring | | | | | | | | |
| CHEN | Biomaterials | 3 | 7 | (2, 2, 1) | CHEN 210 CHEN | | | | |
| 415 | Diomateriais | 5 | | (2 · 2 · 1) | 211 | | | | |
| CHEN 415 Biomaterials | | | | | | | | | |
| Classification of biomaterials, classes of materials used in medicine, biomaterials surfaces, practical aspects of biomaterials, | | | | | | | | | |
| CHEN | Extractive | aeriais, applic | | | | | | | |
| 416 | Metallurgy | 3 | 5 | $(2 \cdot 2 \cdot 1)$ | CHEN 210 | | | | |
| CHEN 416 Extractive Metallurgy | | | | | | | | | |
| Major operations in the iron and steel-making industry; direct reduction processes, blast furnaces, converter and electric-arc | | | | | | | | | |
| steel-making and steel refining methods; electro slag (ESR) and vacuum induction refining (VIR). Bauxite production. Electro- | | | | | | | | | |
| thermal redu | ction of cryolite to p | produce comm | ercial aluminum. Produ | action of TiO2. Extractive metall | urgy of titanium. Gold | | | | |
| extraction. Continuous casting. | | | | | | | | | |
| CHEN | Water and | | 5 | | | | | | |
| 452 | Wastewater | 4 | 5 | $(2 \cdot 4 \cdot 1)$ | CHEN 333 | | | | |
| CHEN 452 V | I reatment | ator Trootmo | nt | | | | | | |
| Wastewater introduction. Wastewater charac-teristics. Technologies in wastewater treatment wastewater constituents | | | | | | | | | |
| wastewater introduction, wastewater charac-tensities, recimologies in wastewater treatment, wastewater constituents, wastewater constituents, | | | | | | | | | |

| analysis and selection of wastewater flow rates, Physical unit operations, chemical unit processes, biological treatment, | | | | | | | | |
|--|---|------------------|---------------------------|-------------------------------------|--------------------------|--|--|--|
| advanced wastewater treatment, water reuse | | | | | | | | |
| CHEN 454 | Water Desalination | 3 | 5 | (2 • 2 • 1) | CHEN 332 | | | |
| CHEN 454 | Water Desalination | | | | | | | |
| Resources for | Resources for water, composition of sea water, introduction to desalination, desalination processes, single effect evaporation. | | | | | | | |
| evaporators, single effect thermal vapor compression, single effect mechanical vapor compression, multiple effect evaporation | | | | | | | | |
| CHEN | Safety in Chem | 2 | 4 | $(2, \ldots, 1)$ | CHEN 222 | | | |
| 466 | Process Indust | 3 | · | $(3 \cdot - \cdot 1)$ | CHEN 555 | | | |
| CHEN 466 S | Safety in Chem Pro | cess Indust | | | | | | |
| Safety and I | loss prevention. Ma | jor process ha | azards. Hazard identific | cation, assessment and preventi | on. Personal safety in | | | |
| industrial en | vironment. Fire expl | osion and toxi | c release. Safety system | IS. | | | | |
| CHEN 471 | Chem Eng Design for Environ | 4 | 5 | (2 • 4 • 1) | CHEN 201 | | | |
| CHEN 471 | Chem Eng Design f | or Environ | | | | | | |
| Meteorology | , lapse rate, introdu | uction of plui | ne, air pollution dispe | rsion models, devices and tech | nniques for control of | | | |
| particulates, | Wastewater treatme | ent techniques | , membrane separation | , biological treatment, chemical | treatment, design for | | | |
| wastewater t | reatment plant | 1 | , I | | , 8 | | | |
| CHEN | Industrial | | ~ | | | | | |
| 472 | Pollution | 3 | 5 | $(2 \cdot 2 \cdot 1)$ | CHEN 442 | | | |
| 772 | Control | | | | | | | |
| CHEN 472 Industrial Pollution Control | | | | | | | | |
| Sources of p | Sources of pollution from chemical industries. Standards and legislations. Health and environmental effects of pollution. Air | | | | | | | |
| pollutants; particulate, SOx, NOx and organic vapors. Air pollution control. Treatment of industrial wastewater. Handling of | | | | | | | | |
| solid waste. Monitoring of pollutants. Case studies for specific industries like petrochemicals, fertilizers, desalination and | | | | | | | | |
| petroleum re | fining | | | | 1 | | | |
| CHEN | Biochemical | 3 | 5 | $(2 \cdot 2 \cdot 1)$ | CHEN 321 | | | |
| 481 | Engineering | | | | | | | |
| Introduction to biofuel sources of biofuel biofuel properties, manufacturing processes for biofuel biodiesel bioethanol biogas | | | | | | | | |
| Introduction | to biofuel, sources of | f biofuel, biofu | iel properties, manufacti | aring processes for biofuel, biodic | esel, bioethanol, biogas | | | |
| CHEN 421 | Fundamentals of Biofuel | 3 | 5 | (2 • 2 • 1) | CHEN 321 | | | |
| CHEN 421 | Fundamentals of Bi | ofuel | | | · | | | |
| Biofuel introduction, chemistry of biofuels, bioenery production technologies, first and second generation technologies for | | | | | | | | |
| biofuel production, sources of fuel and fuel properties, environmental impacts, biorefinery, biofuel process design, recent | | | | | | | | |
| developments in biotechnology. | | | | | | | | |
| CHEN 432 | Energy | 3 | 5 | (2 • 2 • 1) | CHEN332 | | | |
| 432 CHEN 432 | Energy Conservation | n | | | | | | |
| World and local energy situation, energy policies and strategies, the environment and the economy, renewable sources and | | | | | | | | |
| social energy | v requirements conse | ervation subst | itution and technology of | options integrated energy manage | ement systems energy | | | |
| conservation | technologies | er varion, subst | | perone, integrated energy manag | emene systems, energy | | | |
| CHEN | Design of Altern | | 7 | | | | | |
| 455 | Energy Sys | 4 | / | $(2 \cdot 4 \cdot 1)$ | CHEN 202 | | | |
| CHEN 455 Design of Altern Energy Sys | | | | | | | | |
| Introduction and overview of the energy system, modeling skills in energy systems, design of energy systems, issues associated | | | | | | | | |
| with alternative energy | | | | | | | | |
| CHEN | Petroleum | | _ | | CHEN 201 %- | | | |
| 461 | Refinery | 4 | 7 | (2 • 4 • 1) | CHEN 321 & | | | |
| 401 | Engineering | | | | | | | |
| CHEN 461 Petroleum Refinery Engineering | | | | | | | | |

| Oil production. Surface operations. Characterization and classification of crude oils. Physical properties of oils. Refinery | | | | | | | |
|--|--|----------------|-------------------------|--|-----------------------|--|--|
| operations; at | operations; atmospheric and vacuum distillation, treatment processes, catalytic cracking, reforming, alkylation, coking, asphalt | | | | | | |
| production an | production and lubricating oil production. Blending of refinery products. Waste treatment. | | | | | | |
| CHEN | Natural Gas | 3 | 4 | (3,, 1) | CHEN 321 & | | |
| 462 | Engineering | 5 | | (5 • • • • • • • • • • • • • • • • • • • | CHEN 333 | | |
| CHEN 462 N | Natural Gas Engine | ering | | | | | |
| Characterizat | tion and properties | of natural ga | s. Gas gathering system | ms. Gas-oil multistage separation | on. Gas treatment and | | |
| liquefaction. | Gas transportation t | hrough pipelir | es, signal-telemetering | Industrial usages. | | | |
| CHEN | Petrochemical | 3 | 4 | (3,, 1) | CHEN 333 | | |
| 463 | Technology | 5 | | (5 1 1) | CHEN 555 | | |
| CHEN 463 Petrochemical Technology | | | | | | | |
| Production technologies of synthesis gas, olefins and aromatic. Manufacture of important petrochemicals derived from base | | | | | | | |
| chemicals and synthesis gas. Production technologies of important polymers and plastics. | | | | | | | |
| CHEN | Selected Topics | 3 | 5 | (2, 2, 1) | | | |
| 497 | in Chem Eng | 5 | | $(2 \cdot 2 \cdot 1)$ | - | | |
| CHEN 497 Selected Topics in Chem Eng | | | | | | | |
| In-depth study of relevant Chemical and Materials engineering topics not covered in other courses of the program in order to | | | | | | | |
| enhance students' knowledge in the field of chemical engineering. | | | | | | | |
| , | Total 63 100 (41,44,19) | | | | | | |

Courses Desc.:

1- CHEN 411 Materials Selection

Selection criteria for metals, alloys, ceramics and plastics, mechanical behavior, corrosion and oxidation resistance at ambient and elevated temperatures, materials for marine environments, oil production and transport, refineries, petrochemical and desalination industries, refractory materials. Computer applications, and economic considerations, laboratory experiments

2- CHEN 412 Composite Materials

Role of interfaces, processes and production of polymer matrix composites, metal matrix composites, ceramic matrix composites, design aspects of composites bases structures, application and properties of composite materials, production of glass fiber and carbon fiber composites, Titanium bases composite materials.

3- CHEN 413 Materials Structure and Failure Analysis

Structural characterization, quantitative and qualitative analysis, thermal analysis, differential calorimetry, molecular spectroscopy, engineering aspects of failure and failure analysis, failure modes, characterization of fractured surface, chemical analysis, failure prevention and histories, mechanical and metallurgical causes of failures, creep failures, corrosion induced failure, pitting as stress concentration.

4- CHEN 414 Mat and Nanomat Character

Nano fabricated computed devices, bio molecular devices and molecular electronics, integrated micro systems and MEMS, molecular manufacturing and nano robots, material engineering processes applied to electro-active polymers, micro-nano scale instrumentation measuring

5- CHEN 415 Biomaterials

Classification of biomaterials, classes of materials used in medicine, biomaterials surfaces, practical aspects of biomaterials, surface characterization of biomaterials, applications of materials used in medicine.

6- CHEN 416 Extractive Metallurgy

Major operations in the iron and steel-making industry; direct reduction processes, blast furnaces, converter and electric-arc steel-making and steel refining methods; electro slag (ESR) and vacuum induction refining (VIR). Bauxite production. Electro-thermal reduction of cryolite to produce commercial aluminum. Production of TiO2. Extractive metallurgy of titanium. Gold extraction. Continuous casting.

7- CHEN 452 Water and Wastewater Treatment

Wastewater introduction, Wastewater charac-teristics, Technologies in wastewater treatment, wastewater constituents, wastewater sampling and analytical procedures, physical characteristics of water, metallic and nonmetallic constituents, analysis and selection of wastewater flow rates, Physical unit operations, chemical unit processes, biological treatment, advanced wastewater treatment, water reuse

8- CHEN 454 Water Desalination

Resources for water, composition of sea water, introduction to desalination, desalination processes, single effect evaporation, evaporators, single effect thermal vapor compression, single effect mechanical vapor compression, multiple effect evaporation

9- CHEN 466 Safety in Chem Process Indust

Safety and loss prevention. Major process hazards. Hazard identification, assessment and prevention. Personal safety in industrial environment. Fire explosion and toxic release. Safety systems.

10- CHEN 471 Chem Eng Design for Environ

Meteorology, lapse rate, introduction of plume, air pollution dispersion models, devices and techniques for control of particulates, Wastewater treatment techniques, membrane separation, biological treatment, chemical treatment, design for wastewater treatment plant

11- CHEN 472 Industrial Pollution Control

Sources of pollution from chemical industries. Standards and legislations. Health and environmental effects of pollution. Air pollutants; particulate, SOx, NOx and organic vapors. Air pollution control. Treatment of industrial wastewater. Handling of solid waste. Monitoring of pollutants. Case studies for specific industries like petrochemicals, fertilizers, desalination and petroleum refining

12- CHEN 481 Biochemical Engineering

Introduction to biofuel, sources of biofuel, biofuel properties, manufacturing processes for biofuel, biodiesel, bioethanol, biogas

13- CHEN 421 Fundamentals of Biofuel

Biofuel introduction, chemistry of biofuels, bioenery production technologies, first and second generation technologies for biofuel production, sources of fuel and fuel properties, environmental impacts, biorefinery, biofuel process design, recent developments in biotechnology.

14- CHEN 432 Energy Conservation

World and local energy situation, energy policies and strategies, the environment and the economy, renewable sources and social energy requirements, conservation, substitution and technology options, integrated energy management systems, energy conservation technologies.

15- CHEN 455 Design of Altern Energy Sys

Introduction and overview of the energy system, modeling skills in energy systems, design of energy systems, issues associated with alternative energy

16- CHEN 461 Petroleum Refinery Engineering

Oil production. Surface operations. Characterization and classification of crude oils. Physical properties of oils. Refinery operations; atmospheric and vacuum distillation, treatment processes, catalytic cracking, reforming, alkylation, coking, asphalt production and lubricating oil production. Blending of refinery products. Waste treatment.

17- CHEN 462 Natural Gas Engineering

Characterization and properties of natural gas. Gas gathering systems. Gas-oil multistage separation. Gas treatment and liquefaction. Gas transportation through pipelines, signal-telemetering Industrial usages.

18- CHEN 463 Petrochemical Technology

Production technologies of synthesis gas, olefins and aromatic. Manufacture of important petrochemicals derived from base chemicals and synthesis gas. Production technologies of important polymers and plastics.

19- CHEN 497 Selected Topics in Chem Eng

In-depth study of relevant Chemical and Materials engineering topics not covered in other courses of the program in order to enhance students' knowledge in the field of chemical engineering.