A.Mathematics

1. **College Algebra (MA 81- 3 Units)**
   This course deals with discussion on set theory; real numbers; algebraic expressions and equations; solution sets of algebraic equations in one variable; linear, quadratic, polynomial of degree *n*, fractional, radical equations, quadratic form, exponential and logarithmic equations; decomposition of fractions into partial fractions; solution sets of systems of linear equations involving up to three variables.

2. **Plane and Spherical Trigonometry (MA 82 - 3 Units)**
   This course is about Trigonometric functions; identifies and equations ; solutions of triangles; law of sines; law of cosines; inverse trigonometric functions; spherical trigonometry.

3. **Advanced Algebra (MA 83 - 3 Units)**
   This course covers the basic combinatorial mathematics; matrices and determinants; progression; binomial theorem; mathematical induction; partial fractions.

4. **Analytic Geometry (MA 84 - 3 Units)**
   This course deals with equations of lines and conic sections; curve tracing in both rectangular and polar coordinates in two-dimensional space.

5. **Solid Mensuration (MA 85- 3 Units)**
   This course discusses topics on concept of lines and planes; Cavalieri's and volume theorems; formulas for areas of plane figures, volumes for solids; volumes and surfaces areas for spheres, pyramids, and cones; zone, sector and segment of a sphere; theorems of Pappus.

6. **Diffferential Calculus (MA 86- 3 Units)**
   This course deals primarily on the basic concepts of calculus such as limits, continuity and differentiability of functions; differentiation of algebraic and transcendental functions involving one or more varaibles; applications of differential calculus to problems on optimization, rates of change, related rates, tangents and normals, and approximizations; partial differentiation and transcendental curve tracing.

7. **Integral Calculus (MA 87- 3 Units)**
   This course offers discussion on concept of integration and its application to physical problems such as evaluation of areas, volumes of revolution, force, and work; fundamental formulas and various techniques of integration applied to both variable and multi-variable functions; tracing of two functions of two variables.

8. **Differential Equations (MA 88- 3 Units)**

This is an undergraduate course that deals largely on the inroduction to the study of differential equations and their solution. Topics inlude differentiation and integration in solving first order, first degree differential equations, linear differential equations of order *n;* Laplace transforms in solving differential equations, power series solutions

9. **Probability And Statistics (MA 89- 3 Units)**
   A course that discusses the basic principles of statistics; presentation and analysis of data; average, median, mode; deviations ; probability distribution; normal curves and applications; regression analysis and correlation; application to engineering problems.

B. Allied and Other Technical Courses:

1. **Engineering Drawing (ES 01- 3 units)**
   This course is designed to introduce the students about techniques of graphical communication; apllication of drafting instruments, lettering scale, and units of measure; descriptive geometry, orthographic projections; auxilliary views; dimensions; sectional views; pictorial drawings; requirements of engineering working drawings; and assembly and exploded detail drawings.

2. **Computer Aided- Drafting (ES 02- 3 Units)**
   The course introduces the concepts of computer –aided drafting(CAD); introduction to the CAD environment; terminologies; and the general operating procedures and techniques in entering basic CAD commands.

3. **Computer Fundamentals an Programming(ES 03- 3 Units)**
   This course, which consists of lectures and laboratory computer exercises and machine problems, discusses about logic formulation, fundamentals of development; high-level language and programming apllications and flowcharting. Laboratory sesion will cover discussion of the fundamentals of the C++ programming language, and interpretation of the algorithm and flowchart by programming using C++.

4. **Statics of Rigid Bodies(ES 04-3 Units)**
   This is a course covering topics on statics of rigid bodies including force systems, structure analyses, frictions, centroids and centers of gravity and moments of inertia.

5. **Dynamics of Rigid Bodies(ES 05 – 3 Units)**
   This is a lecture course covering the topics on dynamics of rigid bodies including kinetics and kinematics of a particle, kinetics and kinematics of rigid bodies, work energy method and impluse and momentum.

6. **Mechanics of Deformable Bodies (ES 06- 3 Units)**
   This course tackles the mathematical terms of the mechanics involved in materials under load conditions, with topics on Axial stress and strain; stresses ofr torsion and

bending; combined stresses; beam deflections; indeterminate beams; and elastic instability. It also focuses on the properties of the material under consideration and the effects of relations between externally applied loads and their internal effects on bodies.

7. **Engineering Economy and Accounting (ES 07- 3 Units)**
   This course is a combination of two major areas, namely engineering economy and accounting. Engineering economy deals with the basic concepts and principles of engineering economy as a tool in decision making process. The other topic covers the fundamentals of accounting. Topics include the time value of money and equivalence; basic economy study methods; decisions under certainty; decisions recognizing risk; and decisions admitting uncertainty.

8. **Engineering Management(ES 08- 3 Units)**
   This course integrates the different theories in management and apllies the four basic managerial functions in their actual practice of their respective profession and ultimately become an effective employers/employees in the future. Topics include Decision-making; the function of management, managing production and service-operations;managing the marketing function;managing the finance fucntion.

9. **Environmental Engineering(ES 09- 2 Units)**
   This non-laboratory course is intended for undergarduate students for an introductory study on environmental engineering including topics in ecological framework of sustainable development, pollution environments; water; air; and solid; waste treatment processes, disposal, and management; government legislation,rules and regulation related to the environment and waste management; and environmental management system.

10. **Safety Management/Engineering (ES 10.1, 1 unit)**
    This course covers the engineering and management principles of safety in engineering practice. Topics include evolution of safety management; safety terminology; safety programs adopted by high risk industries; hazards in the construction, manufacturing, gas and power plants, and other engineering industries and how to prevent or mitigate them; techniques in hazard identification and analysis in workplaces; off-the-job safety; disaster prevention and mitigation; and incident investigation.

11. **Basis Mechanical Engineering(ACE 01- 3 Units)**
    This course is an introduction to fundamental concepts of thermodynamics; heat transmissions in building structures; ventilating and air-conditioning systems; air distribution system design; and indoor air quality. It includes study of design considerations of electrical services, elevator and escalator, fire protection system, illumination, acoustics and automated system for buildings.

12. Basic Thermodynamics(ACE 02- 3 Units)

This is a course dealing with the thermodynamic properties of pure substances, ideal and real gases and the syudy and apllication of the laws of thermodynamics in the analysis of processes and cycles. It includes introduction to vapor and gas cycles.

13. Basic Electrical Engineering (ACE 03- 3 Units)

This is a course that introduces the fundamentals of circuit anlaysis. Beginning with the basci concepts such as voltage, current, sources and Ohm's law; then it proceeds to develop general and powerful procedures used in analyzing electric circuits. These methods are first applied in resistive circuits and later to citcuits with more complex elements such as capacitors, inductors and operational amplifiers.

14. Basic Electronics Laboratory and Lecture (ACE 04- 2 Units lec & 1 Unit Lab)

This course comprises of a lecture and a laboratory component that covers the concepts and application of the construction, operation and characteristics of basic electronics devices such as PN junction diode, light emitting diode, Zener diode, Bipolar Junction Transistor and Field Effect Transistor. Diode circuit applications such as clipper, clamper and switching diode circuits will be a part of the lecture; Operation of a DC regulated power supply as well as analysis of BJT and FET amplifier circuit; the operation and characteristics of operational amplifiers.

15. Basic Electrical and Electronics Engineering (ACE 05- 2 Units lec & 1 Unit lab)

This course, with lectures and laboratory exercises, deals with the basic principles of electrical and electronics engineering of relevance to all students who are taking engineering courses. Topics include DC and AC Circuits, basic electrical and electronic devices, electromagnetic theories, electrical power technology.

16. Methods of Research (ACE 08- 3 Units)

This is an undergraduate introductory course to the process of inquiry, research and writing of a research, project or design proposal. It presents the basic techniques or qualitative research applicable to engineering. Topics include the types and application of research, characteristics of a good research, research design, problem formulation, research instrument and data gathering procedures, and data analysis.

17. Quantitative Methods in Management (ACE 09- 3 Units)

The course introduces the students to quantitative decision-making tools. It covers decision models for planning, decision-making, resource allocation, and control. More specifically, these models are discussed in the context of linear programming, transportation and assignment, network models, queuing and waiting times, project control, and inventory management. These models are applied in solving decision problems to improve the efficiency of operations.

18. Discrete Mathematics (ACE 21-3 Units)

This course covers the basic concepts in discrete mathematics that deal with logic, sets, proofs, growth of functions, theory of numbers, counting techniques, trees and graph theory.

19. **Fundamentals of Material Science and Engineering (ACE 22- 3 Units)**
This course introduces the students to a broad study on the structure and composition of materials (metals, polymers, ceramics, and composite materials) and their properties and behavior in service environments.

C. Natural/ Physical Sciences

1. **General Chemistry (CHEM 81, 3 units); General Chemistry Laboratory (CHEM 81L)**
This course covers the basic concepts of matter and its classification; mass relationships in chemical reactions; properties of gases, liquids, and solids; concepts of thermochemistry; quantum theory and electronic behavior; periodic relationship of elements in the periodic table; intermolecular forces; and solutions. Lecture and Laboratory can be taken separately.

2. **General Physics 1 (PHYS 21, 3 units); General Physics 1 Laboratory (PHYS 21L, 1 unit)**
This course deals with the essential concepts, principles, theories, laws and applications in Mechanics. The study includes physical quantities and measurements; vectors; kinematics; dynamics; the Newton's laws of motion and their applications; work, energy and power; momentum; rational motion. Lecture and Laboratory can be taken separately.

3. **General Physics 2 (PHYS 22, 3 units); General Physics 2 Laboratory (PHYS 22L, 1 unit)**
The course tackles heat and transfer, thermodynamics, electricity, Fluids, thermal expansion, thermal stress; calorimetry; wave; electrostatic; electricity; magnetism; optics; image formation by plane and curved mirrors; and image formation by thin lenses. Lecture and Laboratory can be taken separately.

D.1. Professional Course Specifications for BS Civil Engineering

1. **Orientation to Civil Engineering (CE 01)**
This course presents an introduction to engineering and engineering study, the different engineering disciplines, careers in engineering especially in Civil Engineering, skills of a Civil Engineer, various opportunities of Civil Engineers, fundamental concepts in problem solving; as well as strategies for pursuing engineering courses.

2. **Elementary and Higher Surveying (CE 30, 3 units lec, 1 unit lab)**

This course covers plane surveying principles and its techniques, and various types of higher engineering surveys through lectures, laboratory and field exercises. The course includes topics on measurements of distances, angles and elevations; techniques of data reduction to compute bearings, azimuths, coordinates and areas; precision and accuracy; tacheometric surveys, plane table surveys, mapping, control surveys, topographic surveys, astronomical observations, hydrographic surveys; and introductory topics on modern surveys such as GIS, GPS and photogrammetry.

3. **Engineering Surveys (CE 31, 3 units lec, 1 unit lab)**
   The course comprises of lectures on the various types of engineering surveys and an actual laboratory that enhances students' knowledge on its application. The course covers the design of horizontal and vertical highway curves; volume and preliminary costs estimation of construction of highways; control and topographic surveys, route surveys, construction survey, hydrographic survey, land survey and the modern surveys such as GPS and photogrammetry.

4. **Advanced Engineering Mathematics for CE (CE 32, 3 units)**
   This course covers parameters, laws, theorems and the different methods of solutions in advanced mathematics, and their application in the field of civil engineering. Topics include Complex numbers and complex variables, Laplace and inverse Laplace transforms, Power series, Fourier series, Fourier transforms, Z-transforms, power series solution of ordinary differential equations, and partial differential equations.

5. **Building Design 1 (CE 33, 1 unit lec, 1 unit lab)**
   This course covers the theories regarding building plans, its construction, and its application into actual construction. Topics include the different building parts and its construction, i.e. from the foundation to the roofing, the National Building Code and other pertinent codes.

6. **Structural Theory 1 (CE 40, 3 units lec, 1 unit lab)**
   This course covers the principles and practical techniques for the analysis of statically determinate beams, frames, trusses, and combined structures. Theories are introduced and emphasis is given in solving practical problems to acquire conceptual understanding of how structures work and how their behavior can be predicted.

7. **Soil Mechanics (CE 41, 3 units lec, 1 unit lab)**
   Soil Mechanics is the introduction of physical and behavioral characteristics of soils as an engineering material. This course is a study of the nature of soils as a prerequisite to a wide- range of practical applications in the analysis and design techniques for geotechnical situations and in advancement of related researches. Topics covered include identification and classification of soils and rocks, Site investigation and subsurface exploration, the physical and index properties of soil, compaction, water flow through soils, subsurface stress and deformation phenomena in soils, laboratory

testing, and the relevance of these topics as they affect soil strength, compressibility, stability, and drainage.

8. **Mechanics of Fluids Lecture & Laboratory (CE 34 & CE 34 L, 2 units lec, 1 unit lab)**
   This is a Lecture and Laboratory course with topics on basic principles governing the behavior of fluids at rest and in motion. It emphasizes on the various methods employed in the development of general relationships in static, kinematics, and kinetics of fluids through calculations and general observation.

9. **Building Design 2 (CE 42, 1 unit lec, 1 unit lab)**
   This course is a continuation of Building Design 1 which covers more theories regarding building plans, its construction, and its application into actual construction. Topics include plumbing code, fire code and electrical code of the Philippines, its interpretation and application in building design and construction.

10. **Construction Materials and Testing (CE 43, 3 units lec, 1 unit lab)**
    This course deals with the introduction to the physical and behavioral characteristics of various Civil Engineering materials. Topics include compositions, engineering behaviors, design methods, standard test procedures, and environmental concerns in the production/sourcing of common Civil Engineering materials, including concrete, cement, asphalt, metal, timber, aggregate, adhesive, polymer, etcetera.

11. **Highway Engineering (CE 44, 3 units)**
    This course covers the concepts and theories relevant to the analysis and design of roads, highways and related structures. Topics include highway administration; traffic, driver, pedestrian and vehicle characteristics; geometric design, roadside design, highway and related structures; intersection, interchanges, terminals; drainage structures; traffic engineering; asphalt and concrete pavements, survey, plans, estimates, contracts and supervision, earthworks, bases and sub-bases, highway maintenance and rehabilitation; with emphasis on the Standard Specification for Public Works and Highways.

12. **Structural Theory 2 (CE 45, 3 units lec, 1 unit lab)**
    The early part of this course tackles some approximate methods for analyzing statically indeterminate structures. The most part discusses various methods of analyzing indeterminate structures including an introduction to matrix structural analysis which students will be prepared in using software for structural analysis.
13. **Foundation Engineering (CE 46, 3 units lec, 1 unit lab)**
    This course is a continuation of the Soil Mechanics course focusing on the design and construction of shallow and deep foundations. Additional topics ~~will~~ include slope stability analysis and retaining wall design, subsurface investigations and soil improvements.

14. Hydraulics (CE 47, 2 units lec, 1 unit lab)

This course comprises of lecture and laboratory sessions to cover the principles and theories of water behavior. Topics include the analysis and the hydraulic design of by systems such as reservoirs dams, spillways, gates, open channels, pipe networks, pumps and turbines; sediment transport in rivers and reservoir; computer hydraulic modeling.

15. Engineering Hydrology (CE 48, 3 units)

The study of Engineering Hydrology is an introduction to the broad topic of water engineering, ranging from hydrologic cycle to flood and various computational tools such as deterministic modeling and probability application that will be used in the design of structures. Topics include precipitation, weather modification, evaporation, infiltration, hydrographs, probability concepts, river and reservoir routing, and storm drain design.

16. Construction Methods and Project Management (CE 49, 3 units lec, 1 unit lab)

This course comprises of lecture, laboratory and field exercises which deal with principles of construction methods and equipment, management and their applications. It covers project planning, scheduling, monitoring and control. It also includes concepts on organization, safety, information systems and computer applications. Students are given opportunities to visit actual project sites and observe the application of these theories in construction projects.

17. On-the-Job Training Program (CE 80, 2 units)

As part of the BS Engineering curricula, the 300-hour On-the-Job Training requires the students to be assigned to various companies and government agencies, such as in design firms, construction works, testing laboratories, where they learn practical applications of the Civil Engineering concepts they learn from the academe and at the same time learn and begin to engulf people skills.

18. Structural Design 1 (Reinforced Concrete) (CE 50, 3 units lec, 1 unit lab)

This course comprises of lecture, laboratory and field exercises which cover the design, applications and code specifications used in structural reinforced concrete members to flexure (beams, girders, joists, lintels, girts, etc.), tension, and compression members (columns), combined stressed members (beam-columns), beam-column connections using the Elastic Limit Method, also known as the Alternate Stress Design (ASD) or Working Stress Design (WSD), and the Plastic Limit Method or the Ultimate Strength Design (USD).

19. Structural Design 2(Steel and Timber) (CE 51, 4 units lec, 1 unit lab)

This is the continuation of Structural Design 1 which covers the basic theories and design philosophies of strength and behavior of structural concrete members and their interrelationships in complex structural systems. Theories are introduced and emphasis is given ~~in~~ to solving practical problems to acquire conceptual understanding of how structural concrete elements work and how their behavior can be predicted. Included

topics are on its uses in axial and lateral members, in foundation systems, and application to buildings, bridges, and specialized structures.

20. Transportation Engineering (CE 52, 3 units)

This course covers the analysis and design related to transportation structures and systems, with topics on Design and construction aspects of Highway Surfaces and Railways' Guideways; Capacity and Level of Service of Air, Rail, and highways; Environmental impacts and their mitigation of transportation system; Traffic-Analysis Techniques; Traffic Flow and Control.

21. Water Resources Engineering (CE 53, 3 units)

This course covers the principles, theories and analysis of water resources systems such as multi-purpose reservoir, water supply distribution system and stormwater drainage; irrigation system and agricultural drainage system; special topics include river, flood control, drought mitigation and water resource planning management

22. CE Laws, Contracts, Specifications and Ethics (CE 54, 3 units)

This course exposes the students to the study of selected engineering and business laws applicable to the engineering profession such as labor law, Civil Code and intellectual property laws. It also includes a study of the code of ethics of the engineering profession, competitive bidding practice and techniques for resolving moral problems normally encountered in the practice of profession.

23. Final Year Project Study (FYPS 10 and 20, 1 unit lec, 1 unit lab)

This course involves lecture and laboratory that serve as a venue where Civil Engineering Students develop and present a research paper or study that represents in a nutshell each group's skill and knowledge in the civil engineering field.

24. Final Year Project Study 2 (FYPS 30, 1 unit lec, 1 unit lab)

This course is a continuation of FYPS 1 geared towards the ultimate completion, defense and presentation of the students' study, project or research in the field of Civil Engineering.

ELECTIVES:

25. Earthquake Engineering (CETE 10)- *Structural Engineering*

Earthquake Engineering deals with the study of the fundamental concepts, emphasizing on methods, of analysis and design for earthquake loading effects in structural systems. The course also covers the basics of dynamic response calculation and prediction for structural systems to various common forms of loading. The analytical techniques include both spectral and time-domain methods. Other topics include principles of earthquake- resistant design, introduction to general disaster risk management.

26. Prestressed Concrete Design (CETE 20) - *Structural Engineering*

This course covers topics on elastic and ultimate strength analysis and design of prestressed concrete structures. The also includes calculations of stresses due to bending, shear, torsion and anchorages, losses of prestresses and deflections; and the theories related to the behavior of statically indeterminate prestressed concrete beams.

Special Topics in Construction Engineering (CETE 30) - *Construction Engineering and Management)*

Special Topics in Structural Engineering (CETE 40) – *Structural Engineering*

D.2. Professional Course Specifications for BS Chemical Engineering

1. **General Chemistry Calculations (CHEM 82, 2 units lec, 1 unit lab)**
   This course comprises of lectures and calculation laboratory exercises that cover the basic chemical theories and concepts often encountered in general chemistry and their corresponding applications in engineering and other fields. Topics include basic stoichiometric calculations, periodic properties of elements, Lewis structures of molecules, stoichiometric calculations involving gases, solutions and heats of reactions, thermodynamics of chemical reactions, chemical kinetics and equilibria, electrochemistry, nuclear reactions.

2. **Analytical Chemistry (CHEM 83, 3 units lec, 2 units lab)**
   The lectures and laboratory exercises deal with the principles and theories and their applications of gravimetric and volumetric methods of analysis, including an introduction to instrumental methods of analysis. Topics include aqueous solutions and chemical equilibria, buffer solutions, titrimetric methods, neutralization, precipitation, titration, spectrochemical methods.

3. **Organic Chemistry (CHEM 84, 4 units lec, 1 unit lab)**
   Lectures cover topics on chemistry carbon compounds and their properties, structures and reactions; principal classes of aliphatic and aromatic compounds, which in conjunction with selected experiments, mechanisms of organic reactions. The laboratory portion covers exercises on variety of techniques for the synthesis, purification, and analysis of organic compounds.

4. **Industrial Chemistry (CHEM 85, 2 units lec, 1 unit lab)**
   The course comprises of lectures and laboratory exercises dealing with the different chemical industries with emphasis on reaction mechanisms that serve the basis of the

industrial chemical processes. Topics include the theoretical background of the reactions and processes behind industries on oils and fats, flavors and fragrances, sugar, fermentation, soap and detergents, hydrogen peroxide and inorganic peroxy compounds, industrial acids and bases, polymers petrochemicals, and paints, pigments and industrial coatings. Also included is a discussion of catalysis and its application in the chemical industry.

5. **Orientation to Chemical Engineering (ChE 01)**
   This course presents an introduction to engineering and engineering study, the different engineering disciplines, careers in engineering especially in Chemical Engineering, skills of a Chemical Engineer, various opportunities of Chemical Engineers, fundamental concepts in problem solving; as well as strategies for pursuing engineering courses.

6. **Chemical Engineering Calculations 1 (ChE 10, 2 units lec, 1 unit lab)**
   This course comprises of lectures and calculations laboratory exrcises that cover the basic principles in material balances associated with the chemical engineering operations and processes. Topics include Lever Arm Rule, material balances without chemical reactions, stoichiometry, material balances with chemical reactions, multiphase systems and phase diagrams.

7. **Chemical Engineering Calculations 2 (ChE 11)**
   This course deals on material and enargy balances in industrial process and involves the application of stoichiometric principles in fuel combustion and related process industries. This includes combustion of gaseous, liquid and solid fuels, production of sulfuric acid, nitrogen compounds, lime and cement.

8. **Advanced Mathematics fro Chemical Engineering (ChE 12, 3 units)**
   This course covers parameters, laws, theorems and the different methods of solutions in advanced mathematics, and their application in the field of chemical engineering. Topics include Complex numbers and complex variables, Laplace and Inverse Laplace Transforms, Power series, Fourier series, Fourier Transforms, z-transforms, power series solution of ordinary differential equations, and partial differential equations.

9. **Process of Dynamics and Control (ChE 13, 2 units lec, 1 unit lab)**
   This course combines the mathematical, physical and chemical concepts for application to process simulation and control. Topics include control system, Laplace transforms, modeling, first order open loop systems, higher order open loop systems, feedback control systems, controller tuning.

10. **Computer Applications in Chemical Engineering (ChE 14, 1 unit lab)**
    The course involves exposure, through machine problems and activities, to modern computer apllications including design simulations and numerical methods, statistical methods and uses of mathematical software packages for solving problems relevant to the chemical engineering discipline.

11. Physical Chemistry fo Engineers 1 (ChE 20, 3 units lec, 1 unit lab)

This course deals with the study of the physical properties and structure of matter, which laws of chemical reaction, and with the theories governing these. Topics include the physical and chemical behaviors of matters, physical systems, laws of thermodynamics and their equations.

12. Physical Chemistry fo Engineers 2 (ChE 21, 3 units lec, 1 unit lab)

The lectures and the accompanying laboratory exercises cover the fundamental principles of physical and chemical properties of matter covering chemical and ionic equilibria, electrochemistry, kinetics, surface phenomena and catalysis, and introduction to quantum mechanics.

13. Chemical Engineering Thermodynamics 1 (ChE 22, 3 units)

This course tackles topics on the applications of the 1st and 2nd laws of thermodynamics to close and open systems, volumetric properties of pure substances, the use of Phase diagrams and thermodynamic tables, applications of equations of state for ideal and non-ideal fluids.

14. Chemical Engineering Thermodynamics 2 (ChE 23, 3 units)

This course discusses topics on thermodynamic analysis of power and refrigeration cycles; solution thermodynamics and chemical Equilibria. Topics also include Vapor-liquid equilibrium, phase equilibria, molecular thermodynamics, liquefaction.

15. Chemical Reaction Engineering (ChE 24, 3 units)

This course is an introduction to the fundamentals of chemical reaction engineering, chemical kinetics and their mathematical description; the behavior, analysis and design of batch, semi-batch; continuously stirred tank reactors and tubular reactors; non-isothermal and non-homogeneous systems; heterogeneous catalytic reactions and catalyzed bed reactors.

16. Principle of Transport Processes (ChE 30, 3 units)

This course discusses the phenomenological development of the equations that describe the transport phenomena (mass, energy, and momentum) and illustrates applications of these equations through examples in chemical engineering. Both molecular and macroscopic transport are covered highlighting unifying principles of transport processes and properties. It serves as the introduction to all mass and/or energy transport-based courses in the ChE program.

17. Momentum Transfer (ChE 31, 3 units)

This course deals with the fundamental concepts of the two branches of fluid mechanics (statics and dynamics) which are important in unit operations. The combined mass, energy and momentum balances are applied in compressible or incompressible fluid

flow, branching of fluids in transport, steady or unsteady flow, including metering of fluids that are important in the design of fluid flow piping network. The course also covers the design of different types of filtration equipment operated at constant pressure, constant rate or a combined constant pressure preceded by constant rate; and the design of continuous rotary vacuum filter.

18. Heat and Mass Transfer (ChE 32, 3 units)

This course discusses the application of heat transfer and mass transfer to the design of equipment employing heat exchange, mass exchange and simultaneous heat and mass exchange. Topics include types and design of heat exchangers, evaporation, crystallization, gas absorption, humdification/dehumidification, drying, water cooling towers.

19. Separation Processes (ChE 33, 3 units)

This course covers the application of principles to equilibrium stage separation operations such as distillation, liquid- liquid extraction, solid- liquid extraction, adsorption, gas absorption and membrane separation.

20. Chemical Engineering Laboratory 1 (ChE 34, 1 unit lab)

This course provides hands-on laboratory experience where students perform experiments to apply the theories and principles of unit operations. It is also a laboratory course that investigate various theories encountered in momentum transfer, heat transfer and evaporation. Laboratory exercises include friction losses in pipes pipes and fittings, calibration of flow meters such as pitot tube, orifice meter, venturi meter and weirs, Reynolds number, fluidization and packed bed experiments, double pipe or shell and tube heat exchangers, performance of condensers, radiation, evaporation, performance of a plate and frame filter press, batch or continuous sedimentation, centrifugation.

21. Chemical Engineering Laboratory 2 (ChE 35, 1 unit lab)

This courses is a continuation of Chemical Engineering Laboratory 1 that provides hands-on laboratory experience where students perform experiments to apply the theories and principles of unit operations. The course covers mainly laboratory experimenrs in Mass Transfer Operations such as diffusion, distillation, humidification, drying etc. And experiments in reaction kinetics using a continous stirred tank reactor(CSTR)and a plug flow tubular reactor.

22. Introduction to Biotechnology (ChE 40, 3 units)

This course discusses the overview of basic microbiology which includes the types of cells and their physical and chemical structure, enzymes for industrial application; the mechanism by which cells grow and work in batch and continuous processes and how environmental factors affect their metabolic activity; and how cells can be altered so that their metabolic capability may be enhanced.

23. Biochemical Engineering (ChE 41, 3 units)

This course deals with the processing of biological materials and processing using biological agents such as cells and enzymes. Topics include enzyme kinetics, stoichiometry of microbial growth and product formation, kinetics of substrate utilization, product formation and biomass production on cell cultures, bioprocess systems, bioreactors, fermentation technology, mixed microbial population.

24. Chemical Proces Industries (ChE 50)

This course is the synthesis and familiarization of undergraduate chemical engineering students to the different chemical process industries, through lectures, reports and plant visits. The course will cover a variety of industrial chemical processes, including both inorganic reactions such as the manufacture of sulfuric acid, ammonia,nitric acid and fertilizers, and the chemistry of metallurgy and air pollution abatement, as well as organic processses, focuing principally on the petrochemical industry and the synthesis pf polymers.

25. Safety in Process Industies (ChE 51, 2 units)

This course covers all the aspects of safety in relation to the industrial field including government regulations and audit and inspection standards that will familiarize the student on the various aspects of safety in the industrial arena. Topics include safety standards, industrial safety practices, safety audit and inspection, current good manufacturing practices, HACCP, emergency preparedness, accident investigation.

26. Industrial Waste Mangemennd and Control (ChE 52, 3 units)

This course covers the study of the different environmental management programs applied to industry. These includes: environmental impact assessment, environmental management system, risk assessment, life cycle analysis, pollution prevention and waste treatment (wastewater, air pollutants, solid and hazardous waste).

27. Field Trips and Seminars (ChE 53)

This course deals with a series of lectures and seminars on selected topics that are highly relevant to chemical engineering but are not covered in any of the other formal courses. It covers recent advances in chemical engineering. Visits to industrial plants are also conducted during the term.

28. Fundamentals of Materials Science and Engineering (ChE 60, 3 units)

This course introduces the students to a broad study on the structure and composition of materials and their properties and behavior in service environments. Topics include crystalline and non-crystalline materials, metals, metal alloys, ceramics, polymers, composites, electrical, dielectric, magnetic, optical and thermal properties.

29. Process Equipment Design (ChE 61, 1 unit lec, 1 unit lab)

This course is an application of technical and economic selection and design of the principal kinds of chemical process equipment with some integration of number of units into a process. Topics covered in lectures include process documentation design report, codes, standards and recommended practices, safety and design factors, flowsheeting, materials of construction, cost estimation, and various equipment designs. Design activities cover equipment cost estimation, pumps and piping, pressure vessel, heat exchanger, contactors, and chemical reactor.

30. Process Design and Project Feasibility (CHE 62, 2 units lec, 1 unit lab):

This course is intended to develop and test the students' ability to coordinate the knowledge gained in earlier course and apply it to the complete design of a process plant. The course uses experimental research/investigation as a way to obtain primary data needed to develop, verify and test the technical feasibility aspects of the proposed process design. The final major requirement is the Final Year Project Study document which is basically an apllied research paper that includes technical and economic analysis of a process design.

31. Chemical Engineering Plant Design (ChE 63, 3 units lec, 2 units lab)

The course is a continuation of Process Design and Design and Project Feasibility 1 which cover the major areas in the process design and establishes the fundamental requirements of a chemical plants and integrates the outputs of the course into a over-all design of a chemical plant. Also the course used expiremental research/ investigation as a way to obtain primary data needed to develop, verify and test the technical feasibility aspects of the proposed design. The final major requirement of this course is the Final Year Project Study document which is basically an applied research paper that includes technical and economic analysis of a process design.

32. Laws and Ethics for Chemical Engineering (ChE 64, 2 units)

The course offers discussion on the relevant national laws on the professional practice in the Philippines, chemical engineering profession, contracting, project implementation, environment and safety, investments and setting of enterprises in the Philippines.

33. Introduction to Particle Technology (ChE 65, 2 units)

This course is an introduction to the theories and concepts in particle technology, focusing on characterization, behavior, production, separation, and modeling of particulate systems and surveying engineering processes that involve particulates and powders. Multiphase transport phenomena and fluidization are also discussed.

ELECTIVES:

34. Food Science and Engineering (ChETE 10)

This course covers topics on food chemistry (carbohydrates, proteins, lipids, etc.), food microbiology, drying, heating, freezong; milk and dairy products, red meat and poultry, grain products, fruit and vegetable products, beverages; mass and energy balances in food manufacturing process; unit operaions for food manufacturing.

35. Food Safety Systems (ChETE 26)

This course includes topics on Good Manufacturing Practices (GMP), Hazard Analysis and Crictical Control Points (HACCP), and ISO 2200.

36. Food Processing Technologies (ChETE 12)

The course an overview of the different processes involved in food manufacture covering the handling and sourcing of raw materials, process parameters, manning requirements, finished products handling and limitations inherent to each type of food product. It includes meat processing, canned goods, baked products, dairy products and all types of beverages. It also includes topics on food preservation techniques, chemical and heat treatment processes.

37. Oleochemical Processing Technologies (ChETE 13)

This course covers the production of oleochemical products like fatty acids, fatty acid methyl esters, fatty alcohols, fatty amines and glycerols, and the processes and technologies involved. Topics also include the application of oleochemicals in biodiesel production, production of detergents, lubricants, and bioplastics.

38. Wastewater Engineering(CHETE 14)

This course is a specialized course encompaasing the protection of the environment commensurate with the public health, economic,social and political concerns. It is aslo concerned with the basic principles of science and engineering apllied to the problems of industrial, municipal and stormwater wastewater and water pollution control.

39. Solid Waste Management (ChETE 15)

This course will cover the integrated management of municipal solid waste; waste generation, reduction, storage, collection, transportation, transfer station, recycling and resource recovery, materials recovery facility and management options and engineering principles in the various disposal treatment methods. Design of landfill, composting facility and incineration plant are included in the course. Regulations and policies relevant to solid waste management, technical considerations in the development of engineering design will be addressed.

40. Air Pollution Control (ChETE 16)

The course covers of the chemistry of the earth's atmosphere, its evolution and composition, the meteorology and fate of the pollutants as they diffuse and travel in this medium. The course includes the different types and categories of air pollutants, their sources and effects and the engineering measures to control them. The course will

also discuss the relevant laws and policies governing air pollution in the country. Special topics will cover green house gasses, photochemical smog and volatile organic carbons.

41. Hazardous Waste Manegement (ChETE 17)

This course covers the regulations and guidelines of RA 6969, Toxic and Hazardous Waste Law with emphasis on the requirements, the generation and sources of the waste, their life cycle analysis, minimization, control, and management strategy. The course will also cover life cycle and risk assessment analysis, brownfields and site remediation.

42. Energy Management (ChETE 18)

This course deals with energy management topics of relevance to chemical engineers.

43. Renewable Energy Technologies (ChETE 19)

This course deals with the technologies and impacts of renewable energy sources as alternative sources of power.

44. Cell and Molecular Biology (ChETE 20)

This course covers the dynamics of cells; their structures and kinetics, genetic analysis, chemical fundamentals, biotechnology, bioinformatics and its applications in the manufacturing industry and in addressing environmental concerns.

45. Nanotechnology (ChETE 21)

This course deals with topics on surveys the core concepts and underlying principles, applications, Social and environmental impacts, workplace concerns and employability outlook of nanotechnology.

46. Introduction to Polymer Engineering (ChETE 22)

This course is a survey of fundamental and general knowledge pertaining to structure-property relationships, and the synthesis and manufacture of polymers. In addition, it provides the student an overview of reactor design, including environmental issues to be considered in design and operation of such reactors.

47. Enzyme Technologies (ChETE 23)

This course covers study on different enzymes and their functions and uses in the different industries; Latest developments on enzyme technologies and opportunities in the local setting. The course also covers equipment requirements in enzyme production.

48. Statistical Process Control for Chemical Engineers (ChETE 24)

This course covers the concepts and principles of control charts and scientific sampling procedures. Topics include quality and defective products, simple bar X and R charts, control chars for fraction rejection, control chart for nonconformities. AQL system, models for quality management.

49. Enterpreneurships for Chemical Engineers (ChETE 25)
This is a course that is designed to guide students through the business and legal fundamentals of starting and running a business in the new economy.

D.3. Professional Course Specifications for BS Electronics Engineering

1. **Orientation to Electronics Engineering (ECE 01, 1 unit)**
   This course presents an introduction to engineering and engineering study, the different engineering disciplines, careers in engineering especially in Electronics Engineering, skills of an Electronics Engineer, various opportunities of Electronics Engineers, fundamental concepts in problem solving; as well as strategies for pursuing engineering courses.

2. **Vector Analysis (ECE 30, 3 units)**
   This course covers topics on vector algebra, vector calculus, vector analysis, and their applications.

3. **Electronic Devices and Circuits (ECE 31, 3 units lec, 1 unit lab)**
   This course comprises lecture and laboratory components to cover topics on quantum mechanics state electronics; diode and transistor characteristics and models (BJT and FET); diode circuit analysis and applications; transistor biasing; small signal analysis; large signal analysis; transistor amplifiers; Boolean Logic; transistor switch.

4. **Electronic Circuit Analysis and Design (ECE 32, 3 units lec, 1 unit lab)**
   This is a course with lecture and laboratory exercises dealing with the High frequency transistor models; analysis of transistor circuits; multi-stage amplifier, feedback, differential amplifiers and operational amplifiers; integrated circuit families (RTL, DTL, TTL, ECL, MOS).

5. **Advanced Mathematics for Engineering (ECE 33, 3 units)**
   This course covers selected topics in mathematics and their applications in the field of electronics engineering and other allied sciences. Topics include Complex numbers and complex variables, Laplace and Inverse Laplace Transforms, Power series, Fourier series, Fourier Transforms, z-transforms, power series solution of ordinary differential equations, and partial differential equations.

6. **Electromagnetics (ECE 34, 3 units)**
   Electromagnetics deals with vector algebra, vector analysis, electric and magnetic fields, resistive, dielectric and magnetic materials, coupled circuits, magnetic circuits and fields, time-varying electromagnetic fields, Maxwell's equations and their applications.

7. **Signals, Spectra and Signal Processing (ECE 41 lecture and Laboratory, 3 units lec, 1 unit lab)**
   This course includes lecture and laboratory sessions with topics on Fourier transform; Z transform; convolution; FIR filters; IIR filters; random signal analysis; correlation functions; DFT; FFT; spectral analysis; applications of signal processing.

8. **Logic Circuits and Switching Theory (ECE 42, 3 units lec, 1 unit lab)**
   This course has lecture and laboratory components that cover the review of number systems, coding and Boolean algebra; inputs and outputs; gates and gating networks; combinational circuits; standard form; minimization; sequential circuits; state and machine equivalence; asynchronous sequential circuits; race conditions; algorithmic state machines; design of digital sub-systems.

9. **ECE Safety Engineering (ECE 43, 2 units)**
   This course covers the concepts and principles of safety in engineering practice, with topics on safety programs adopted by high risk industries; hazards in the construction, manufacturing, gas and power plants, and other engineering industries and how to prevent or mitigate them; techniques in hazard identification and analysis in workplaces; off-the-job safety; disaster prevention and mitigation; and incident investigation.

10. **Numerical Methods (ECE 44 Lecture and Laboratory, 3 units lec, 1 unit lab)**
    This course, which consists of lectures and laboratory, discusses topics on direct and interactive numerical methods in engineering, determination of error bounds in calculations, computation of series expansions, roots of algebraic and transcendental equations, numerical differentiation and integration, solution to simultaneous linear and non-linear equations, function approximation and interpolation, differential equations, optimization, and their applications.

11. **Feedback and Control Systems (ECE 45 Lectures and Laboratory, 3 units lec, 1 unit lab)**
    This course deals with the time and frequency response of feedback control systems. The topics include, time response of the first order and second order systems, modeling, transfer functions, pole-zero map, stability analysis, root locus, bode plots, compensators, PID controllers, and introduction to state-space technique.

12. **Industrial Electronics (ECE 51 Lectures and Laboratory, 3 units lec, 1 unit lab)**
    This is course with lecture and laboratory exercises dealing with the theory and operating characteristics of electronic devices and control circuits for industrial processes; industrial control applications; electronics instrumentation; transducers; data acquisition system, power supply and voltage regulator.

13. **Microprocessor Systems (ECE 52 Lectures and Laboratory, 3 units lec, 1 unit lab)**

The course covers concepts on microprocessor/ microcontroller systems architecture/ organization including microprocessor/ microcontroller programming, interfacing techniques, memory systems and bus standards. In the laboratory, the students are involved with experiments using microcontrollers and the use of microprocessor/ microcontroller development systems and other tools.

14. ECE Laws, Contracts, and Ethics (ECE 53, 3 units)

This course includes topics on contracts; warranties; liabilities; patents; bids; insurance; and other topics on the legal and ethical positions of the professional engineer.

15. ECE Final Year Project Study 1 (ECE 54, 1 unit lec, 1 unit lab)

This course covers lectures, laboratory and other activities necessary for the students in carrying out the process of doing scientific activities to complete the required Final Year Project Study. As a pre-requisite for the completion of an Engineering degree in Xavier University, the study, project or research aims to produce new knowledge or to solve a practical problem in the field of Electronics Engineering.

16. ECE Final Year Project Study 2 (ECE 55, 1 unit lec, 1 unit lab)

This course is a continuation of FYPS 1 geared towards the ultimate completion, defense and presentation of the students' study, project or research in the field of Electronics Engineering.

17. Seminars and Field Trips (ECE 56, 1 unit lab)

This course includes seminars and lectures on current topics on electronics engineering development; fieldtrips to different companies and plants dealing or engaged in electronics facilities.

18. On-the-Job Training (ECE 80, 2 units)

As part of the BS Engineering curricula, the 300-hour On-the-Job Training requires the students to be assigned to various companies and government agencies, where they learn practical applications of the Electronics Engineering concepts they learn from the academe and at the same time learn and begin to engulf people skills.

COMMUNICATION Courses:

19. Principles of Communications (COM 01, 3 units lec, 1 unit lab)

This is a course with lecture and laboratory exercises that cover the concepts and analysis of communication systems. Topics include Bandwidth; filters, linear modulation; angle modulation; phase locked loop; pulse modulation; multiplexing; noise analysis; radio transmitters and receivers.

20. Digital Communications (COM 02 Lecture and laboratory, 3 units lec, 1 unit lab)

This course, which comprises of lecture and laboratory, focuses on Random variables, bit error rate; matched filter, Digital modulation techniques; ASK,QAM, PSK/QPSK, CDMA and W-CDMA systems; signal space; generalized encoding; error correcting codes information theory; data compression; coding theory.

21. **Transmission Media & Antenna System (COM 03 lecture and laboratory, 3 units lec, 1 unit lab)**
    This a lecture and laboratory course dealing with topics on Transmission media; radio wave propagation wire and cable transmission systems; fiber-optic transmission system; transmission lines and antenna systems.

22. **Wireless Communications (COM 04, 3 units)**
    This is a lecture and laboratory course that covers topics on cover signal transmission modes; spread spectrum modulation system; terrestrial microwave; satellite systems; satellite multiple access techniques; terrestrial and satellite systems path calculations and link budgets.

23. **Data Communications (COM 05 lecture and Laboratory, 3 units lec, 1 unit lab)**
    This lecture and laboratory course covers theoretical concepts and applications involving Data communication systems; terminals, modems; terminal control units; multiplexers; concentrators; front-end processors; common carrier services; data communication system design; computer network models; TCP/IP; Principles; LAN; WAN; sample case studies.

ELECTIVES:

- **Microelectronics**
- **Instrumentation and Control**
- **Biotech/Biomedical Engineering**
- **Communication Systems Design**
    - This course includes topics on Communication systems analysis and design; operating performance and interface standards for voice and data circuits; telecommunications facility planning; outside plant engineering; surveying; switching and handling systems; mobile systems and standards; cellular radio systems (GSM AND UMTS architecture) ; PSTN

D.4. Professional Course Specifications for BS Electrical Engineering

1. **Orientation to Electrical engineering (EE 01, 1 unit)**

This course presents an introduction to engineering and engineering study, the different engineering disciplines, careers in engineering especially in Electrical Engineering, skills of an Electrical Engineer, various opportunities of Electrical Engineers, fundamental concepts in problem solving; as well as strategies for pursuing engineering courses. Topics also include aptitude and academic requirements, professional responsibilities, problem definition and solution, engineering design, and terminology.

2. **Advanced Engineering Mathematics for EE (EE 30, 3 units)**
   The content of this course involves modeling, solving, and interpreting various basic and advanced mathematical tools such as matrices and system of linear and differential equations including eigenvectors, scrutinized topics of Laplace and Fourier transform, and partial differential equations needed for engineering applications, especially in the field of Electrical Engineering.

3. **Electromagnetics (EE 33, 3 units)**
   This course deals with electric and magnetic fields, resistive, dielectric and Magnetic materials, coupled circuits, magnetic circuits and fields, time-varying Electromagnetic fields and Maxwell's equations.

4. **Electrical Circuit 1 (EE 35, 3 units lec, 1 unit lab)**
   This course comprises of lectures and laboratory exercises that introduce the fundamentals of circuit analysis. Topics include electrical circuit theory , voltage, current, energy sources and Ohm's law; analysis and applications of series, parallel and series-parallel resistive circuits; mesh and nodal analysis; network theorems; characteristics of inductors and capacitors; analysis of RL, RC, and RLC circuits with DC excitation ; general and powerful procedures used in analyzing electric circuit. These methods are first applied to resistive circuits and later to circuits with more complex elements such as capacitors, inductors operational amplifiers and other electronic devices.

5. **Electrical Circuit Theory II (EE 36, 3 units lec, 1 unit lab)**
   This course, accompanied with laboratory exercises, deals with the introduction of the characteristics of passive and active elements, its mathematical and practical interpretations, use of phasors or vectors (complex quantities) as alternative solutions for its circuit analysis, and the calculation of power and energy involve in these elements. Topics include steady state frequency domain analysis of RLC circuits driven by sinusoidal voltage/current source(s); impedance bridge circuits; application of mesh/nodal analysis and network theorems in AC circuit analysis; concept of power and power factor correction in AC circuits; resonant and tuned circuits; two port network analysis; analysis of dynamic circuits with AC excitation

6. **Research Methods for EE (EE 40, 1 unit)**

Research Methods is an undergraduate introductory EE course to the process of inquiry, research and writing of a research, project or design proposal. This course presents the basic techniques of qualitative and quantitative research applicable to Engineering. Topics include the types and application of research, characteristics of a good research, research design, problem formulation, research instrument and data gathering procedures, and data analysis.

7. **Electrical Circuit Theory III (EE 42, 2 units lec, 1 unit lab)**
   This course is an introduction to the field power system. Lectures and Laboratory exercises focus on polyphase systems, especially the most economical three-phase system. It also discusses on symmetrical components which is one of the requirements to fault calculations. Topics include analysis of balanced three-phase systems, with balanced and unbalanced loading; analysis of circuits with magnetically-coupled coils; symmetrical components; per unit calculations.

8. **DC Machinery (EE 43, 2 units lec, 1 unit lab)**
   This course comprises of lectures and laboratory exercises which cover the basic principles and theories of DC Machinery in preparation for study in AC Machinery. Topics include electromechanical energy conversion, generalized machine model, and the operating characteristics of DC machines and synchronous machines.

9. **AC Machinery (EE 44, 3 units lec, 1 unit lab)**
   The entire course comprises lectures and laboratory exercises that cover the theories and principles of operation, engineering aspects and applications of three phase alternators, three-phase induction motors, synchronous motors and single-phase motors

10. **Control System Analysis (EE 45, 3 units)**
    This course introduces the fundamental theory and practice of control systems. The emphasis is on the analysis and design of a feedback system. Beginning with the study of the basic concepts of system modeling, in both mechanical and electrical system, the course gradually progresses to the study and analysis of the system responses such as the transient response, steady state response and stability. The topics covered include time response of first order and second order systems, modeling, transfer functions, pole-zero map, stability analysis, root locus, bode plots, compensators, PID controllers, and introduction to state-space techniques.

11. **AC Apparatus and Devices (EE 46, 2 units lec, 1 unit lab)**
    The course covers learning the theories and principles of operation and applications of single-phase transformers, parallel operation of transformers, autotransformers, three phase transformers, instrument transformers, circuit breakers, power relays and other selected equipment and devices currently used in the field as basic requirements of an electrical system in a lecture and laboratory environment.

12. Microprocessor Systems (EE 47, 2 units lec, 1 unit lab)

The course covers concepts involving microprocessor/ microcontroller systems architecture/ organization including microprocessor/ microcontroller programming, interfacing techniques, memory systems and bus standards, through various lectures and laboratory exercises .Experiment topics include: assembly language programming topics, interfacing with input and output devices, data transfer between micro controller-based and the PC via serial port and parallel port.

13. Numerical Methods with Computer Applications (EE 48, 2 units lec, 1 unit lab)

The entire course consists of a lecture and laboratory environment for the study of direct and interactive numerical methods in engineering, determination of error bounds in calculations, computation of series expansions, roots of algebraic and transcendental equations, numerical differentiation and integration, solution to simultaneous linear and non-linear equations, function approximation and interpolation, differential equations, optimization, and their applications.

14. Electrical Engineering Safety (EE 49, 1 unit)

The course covers topics on industrial accident prevention and safety organization, accident analysis, selection and application of remedy/corrective actions, industrial health and environmental concerns, first-aid and CPR.

15. EE Research Project 1(EE 50, 1 unit lec, 1 unit lab)

This course covers lectures, laboratory and other activities necessary for the students in carrying out the process of doing scientific activities to complete the required research or project. As a pre-requisite for the completion of an Engineering degree in Xavier University, the study, project or research aims to produce new knowledge or to solve a practical problem in the field of Electrical Engineering.

16. Electrical Transmission & Distribution System (EE 51, 3 units lec, 1 unit lab)

The understanding of the theories and principles of the operation of distribution systems and equipment is covered in lectures and laboratory exercises. This course covers the study and design of primary and secondary distribution networks, load characteristics, voltage regulation, metering techniques and systems, and protection of distribution systems.

17. Illumination Engineering Design (EE 52, 2 units lec, 1 unit lab)

Through lectures and laboratory exercises, this course offers topics on the basic principles and the components of lighting system, its design, maintenance, cost estimation and use of energy efficient lighting systems in the residential, commercial and industrial establishments.

18. Electrical System Design (EE 53, 2 units lec, 1 unit lab)

This course comprises of lectures and laboratory or drafting exercises that cover the basic concepts of electrical designing. Topics include electrical system design, installation, and cost estimation for commercial and Industrial establishments, guided by the provisions of the Philippine Electrical Code (PEC) and other relevant laws and standards.

19. Instrumentation and Control (EE 54, 2 units lec, 1 unit lab)

Topics on the basic concepts and principles of instrumentation and control are learned in a lecture and laboratory environment. Specific topics include Control and Testing; Electromechanical, analog, and digital measuring and testing instruments; R, L and C measurements: calibration; graphic and waveform analyzing instruments; and detectors for the measurements of process variables; analysis of performance characteristics of control systems, electronics, magnetic, hydraulic and mechanical control.

20. EE Laws, Contracts and Ethics (EE 55, 2 units)

This course, intended for Electrical Engineering students, involves topics on Philippine Electrical Code, Contracts, Patent and Copyright Law, Electrical Engineering Professional Ethics, and EE Scope of Work.

21. Electrical Equipment Operation Maintenance (EE 56, 3 units)

This course covers the basic concepts of difference electrical equipment and devices; and their operation, functions, characteristics and applications of different electrical equipment and devices; the design, installation and troubleshooting, automation and control of different kinds of industrial motors.

22. Power System Analysis & Design (EE 57, 3 units lec, 1 unit lab)

This course has lecture and laboratory components which cover topics on Basic structure of power systems, recent trends and innovations in power systems, complex power, per-unit quantities, transmission line parameters, network modeling and calculations, load flow studies, short circuit calculations, use of computer software for simulation

23. Power Plant Engineering (EE 58, 2 units lec, 1 unit lab)

Through lectures and laboratory and drafting exercises, the various existing types of electrical equipment, apparatus and devices used in power plant substations are covered. Specific topics also covered include Load Graphics, types of power plants, power plant operation and protection, interconnections, economics of electric service and arrangement of equipment for modern plants.

24. Seminars and Field Trips (EE 59, 1 unit lab)

This is a Seminars and lectures on current topics on Electrical engineering development; fieldtrips to different companies and plants dealing or engaged in Electrical facilities.

25. EE Research Project 2 (EE 60, 1 unit lec, 1 unit lab)

This course is a continuation of EE Research Project 1 geared towards the ultimate completion, defense and presentation of the students' study, project or research in the field of Electrical Engineering.

26. On-the-Job Training (EE 80, 2 units)

The 300-hour On-the-Job Training requires the students to be assigned to various companies and government agencies, where they learn practical applications of the Electrical Engineering concepts they learn from the academe and at the same time learn and begin to practice people skills.

27. Mechanics of Fluids (ACE 40, 2 units)

This course covers the basic principles and practical aspects of fluid mechanics, with topics on properties of fluid, pressure intensity, static pressure, relative equilibrium of liquids, kinematics of flow and fluid dynamics, flow through orifices, nozzles, venturi meters, weirs and flow meters.

28. Information Technology (ACE 41, 2 units lec, 1 unit lab)

This course comprises of lectures and laboratory exercises that deal with data and databases, telecommunications. Topics covered include software development, data communications computer networking, databases, internet and web technologies.

D.5. Professional Course Specifications for BS Industrial Engineering

1. **Introduction to Industrial Engineering (IE 01- 3 Units)**

   This is a first year course intended for Industrial Students to achieve a smooth transition from high school to IE academic life while attaining understanding about the field. This course presents an introduction to engineering and engineering study, history of IE, elements of IE, skills of Industrial Engineer, opportunities in IE, and IE at Xavier University, through various activities interactive activities such as lectures, readings, role plays, workshops and testimonies.

2. **Industrial Economics (ECON 216, 3 units)**

   This course covers the concepts, theories and principles of economics and its application.

3. **Industrial Material Processes (IE 21- 3 Units)**

   This course comprises of a lecture and laboratory environment that focus on Industrial Materials and Processes and their effects on production system decisions. Topics include Metals, plastics, glass and ceramics, elastomers, wood, pulp and other common engineering materials, their uses and their production process.

4. **Advanced Statistics (IE 31-3 Units)**
   This course covers topics on the tools and techniques of statistical design and analysis for engineering application. Topics include Regression, correlation, and design of experiments and their applications in Industrial Engineering.

5. **Financial Accounting (IE 32 -3 Units)**
   The course covers the basic Accounting concepts and principles applied to service, merchandizing and manufacturing operations; partnerships and corporations; the analysis, interpretation and use of accounting data for management.

6. **Methods Study (IE 35- 3 Units)**
   This course covers topics and concepts on Productivity and its techniques. Topics include methods study and work measurement, wage payment, indirect and expense labor standards, training practices.

7. **Advanced Engineering Mathematics for IE (IE 35- 3 Units)**
   This is a lecture course which covers topics on Matrices, determinants, systems of linear and nonlinear equations, elements of error analysis, real roots of an equation, polynomial approximation by finite difference and least squares methods, and numerical solution on systems of linear and nonlinear equations.

8. **Management Accounting (IE 36- 3 Units)**
   This course covers the basic concepts and theories of cost accounting process, and its uses of accounting information for managerial planning and control.

9. **Industrial Quality Control (IE 41- 3 Units)**
   This course deals with lectures on Natural and assignable variations, central limit theorem, process control, tools for process control, benefits of control charts, traditional control chart for variables, traditional control charts for attributes, process capability and acceptance sampling.

10. **Operation Research 1 (IE 42- 3 Units)**
    The course deals with the fundamentals concepts of deterministic methods of operation research. It applies the scientific method to management and engineering. This course addresses both model building and optimization by focusing on the deterministic methods of operation research. This course also discusses Linear programming formulation and solution techniques, duality theory, sensitivity analysis; transportation and assignment problems; network models.

11. **Ergonomics (IE 43- 3 Units)**
    This course comprises of lectures and laboratory exercises that cover topics on origins and development of human factors and ergonomics, movement, cognitive and

environmental factors in ergonomic workplace design and evaluation, tools and techniques of ergonomic risk assessment.

12. Undergraduate Research (IE 44-3 Units)

This course is intended for IE students who are entitled to study fundamentals of research design; quantitative research methodologies; conduct of actual research; research proposal and report writing.

13. Operation Research 2 (IE 45- 3 Units)

This course is designed to help students quantify and organize stochastic problems through modeling of relationships and decision making variables. This course involves topics on the role of models for understanding the impacts of interdependent elements has become more important. Probability and statistics, risk and uncertainty, stochastic processes, and other techniques of operations research provide a way to organize, model, and understand such relationships.

14. Production Systems (IE 43- 3 Units)

The course deals with the Analysis, design, and management of production systems. Productivity measurement, forecasting techniques, project planning, line balancing, inventory systems, aggregate planning, master scheduling, operations scheduling, and modern approaches to production management such as Just in- Time production.

15. Engineering Values and Ethics (IE 51- 3 Units)

This course covers an overview on values, value system, value formation and value clarification processes; work and responsibilities of an industrial engineer; relations of the industrial engineer with the state, the public, the clients, employer, engineers, and other professionals.

16. Facilities Planning and Design (IE 52- 3 Units)

This is a course that covers topics on Principles and practices of the planning of facility layout and material handling equipment for manufacturing and service systems; Analytical approaches in site location, facility layout, material handling, and storage systems; Systematic procedures and computer-aided techniques.

17. Project Feasibility (IE 53- 3 Units)

This course deals with the application of principles and tools in Industrial Engineering in analyzing problems in the large manufacturing industrial and small and medium enterprises. It is a combination of lecture, consultation and actual immersion in the industry from which project feasibility study will be expected from each or group of students at the end of the semester. Each group or students shall have a faculty adviser. At the end of the semester, the students are expected to present his project and validated solutions to the Industrial Engineering Unit, the management of the company

they have conducted of study with and/ or Department of Trade and Industry if study is part of the XUIE-DTI-SME linkage program.

18. Information Systems (IE 54- 3 Units)

This course is a study of Information systems as one of the important resources of business management process. This includes the fundamental technology employed in information systems; the support made by information systems in numerous business operations and the management decision making processes. As a practical operation in this course, the students are grouped to come up with an application project which they will present and discuss at the end of the semester.

19. Systems Engineering (IE 55- 3 Units)

This course covers topics on total systems analysis and design, integration of subsystems with concentration on optimal total systems implementation.

20. On the Job Training (IE 56)

As part of the BS Engineering curricula, the 800-hour On-the-Job Training requires the students to be assigned to various companies and government agencies, where they learn practical applications of the Industrial Engineering concepts they learn from the academe and at the same time learn and begin to engulf people skills

TECHNICAL ELECTIVES:

- Project management
- Job Evaluation and Wage Administration
- Product Design and Development
- Energy Management

D.6. Professional Course Specifications for BS Mechanical Engineering

1. **Orientation to Mechanical Engineering (ME 01, 1 unit)**

This course is intended to provide information in the field of Mechanical Engineering. This course presents an introduction to engineering and engineering study, the different engineering disciplines, careers in engineering especially in Mechanical Engineering, skills of a Mechanical Engineer, various opportunities of Mechanical Engineers, fundamental concepts in problem solving; as well as strategies for pursuing engineering courses.

2. **Workshop Theory and Practice (ME 21, 2 units lab)**

This a laboratory course that covers the basic principles of machine shop practices. It includes workshop safety and organization; simple workshop measuring instruments, hand tools, fitting bench work, bench drill and bench grinder; sheet metal working;

principles of welding processes; welding metallurgy; joining processes; testing and inspection of welds; foundry and metal casting.

3. **Thermodynamics 1 (ME 22, 3 units)**
   This course deals with the thermodynamic properties of pure substances, ideal and real gases and the study and application of the laws of thermodynamics in the analysis of processes and cycles. It includes introduction to vapor and gases.

4. **Machine Elements 1 (ME 23, 2units lec, 1 unit lab)**
   The course comprises of lectures and laboratory exercises that covers the study of mechanisms regarding the forces and energies that causes the motion. It emphasizes on the analytical and graphical study of displacement, velocity and acceleration.

5. **Machine Shop Theory (ME 24, 2 units lab)**
   This is a laboratory course that covers the use and operation of machines such as lathes, shapers, planers, drilling and boring machines, milling machine, cutters, grinding machines, machine tools and accessories. It also covers technological advances in metal working and new innovations in machine shop.

6. **Thermodynamics 2 (ME 25, 3 units)**
   This course is aimed to further enhance the student's knowledge regarding the principles of thermodynamics by using these principles in practical application specifically in the field of power generation. This includes study of real gases, properties of gas and vapor mixtures and introduction to reactive systems.

7. **Machine Elements 2 (ME 26, 2 units lec, 1 unit lab)**
   This course covers learning the elements of mechanism such as gears, gear trains, rolling bodies, belt and pulleys, ropes, hoisting, chairs, sprockets, cams and follower through lectures and laboratory exercises.

8. **Fluid Mechanics (ME 27, 3 units lec, 1 unit lab)**
   This is a course with lectures and laboratory exercises concerning topics on nature and physical properties of fluids as well as the identification and measurement of fluid properties. It emphasizes the application of conservation laws on mass, energy and momentum to fluid systems either incompressible or compressible flow and inviscid or viscous flow as well as headloss calculation on pipes and fittings.

9. **Engineering Economy for ME (ME 28, 3 units)**
   This course is intended for Mechanical Engineering students to study the concepts of the time value of money and equivalence; basic economy study methods; decisions under certainty; decisions recognizing risk; and decisions admitting uncertainty.

10. **ME Laboratory 1 (ME 29, 2 units lab)**

The course involves the study and use of devices and instruments used to measure pressure, temperature level, flow, Speed, weight, area, volume, viscosity, steam quality, and products of combustion. It also includes the study and analysis of fuels and lubricants.

11. Machine Design 1 (ME 30, 3 units lec, 1 unit lab)

This lecture with laboratory course covers topics on the various mechanical properties of engineering materials in lieu of the determination of design stresses. It includes of simple, variable and combined stresses applied to different mechanical elements such as shafts and mechanical springs.

12. Materials Engineering (ME 31, 3 units lec, 1 unit lab)

The course comprises of lectures and laboratory exercises that deal with the properties of engineering materials including mechanical acoustical, electrical, magnetic, chemical, optical and thermal properties; laboratory experiments using equipment include; tension, compression, bending shear, torsion and impact tests.

13. Heat Transfer (ME 32, 3 units)

The course covers topics on the different modes of heat and mass transfer; laws governing conduction, convection and radiation and its application to the design of common heat exchangers such as condenser; Cooling coils and evaporators; and the environmental impact of their operation.

14. Combustion Engineering (ME 33, 3 units)

The course deals with principles involved in combustion, carburetion and fuel injection; fundamentals and basic of the most commonly used fluid machineries such as pumps, fans, blowers, compressors and turbines.

15. ME Laboratory 2 (ME 34, 2 units lab)

The course involves the study and test of mechanical engineering equipment and machineries such as steam generator, steam turbine, heat exchangers, internal and external combustion engines, pumps, fans, blowers and compressors

16. Machine Design 2 (ME 35, 3 units lec, 1 unit lab)

The course covers the design of various mechanical elements such as brakes and clutches, bearings, flexible transmitting elements, gears, flywheels. It also includes the study of welding design.

17. Refrigeration Systems (ME 36, 3 units)

This course covers the concepts and foundation of the thermodynamic principles and components of mechanical refrigeration systems; cycles and associated equipment, and the effect of their operation on the environment.

18. Methods of Research for Mechanical Engineering (ME 37, 3 units)

This course covers the study of the methodologies used in conducting an engineering research. It includes the types and application of research, characteristics of a good research, problem formulation research design, research instrument and data gathering procedures, data analysis. It also deals with the study of writing a research proposal and various formats.

19. Fluid Machinery (ME 38, 3 units)

The course is a comprehensive study of the principles and theories in the proper operation, selection and application of the most commonly used fluid machineries such as pumps, fans, blowers, compressors and turbines.

20. Safety Engineering for ME (ME 39, 2 units)

This is a course related to the study of industrial safety and health. It includes risk mitigation process and components from hazards and risk identification, evaluation and control.

21. Advanced Engineering Mathematics for ME (ME 41, 3 units)

This course includes topics in mathematics and their applications in mechanical engineering and other allied sciences. It covers the study of complex numbers, Laplace and inverse Laplace transforms, power series, Fourier series, matrices and determinants, vector analysis and numerical methods.

22. ME Laboratory 3 (ME 42, 2 units lab)

The course covers the practical study of performance analysis and evaluation of refrigeration, air-conditioning and ventilation systems and power plants.

23. Instrumentation & Control Engineering (ME 43, 2 units lec, 1 unit lab)

The course includes lectures and laboratory exercises that introduce the basic concepts of instrumentation and process controls as well as important applications of feedback control systems with emphasis on analysis as well as design techniques.

24. Air-conditioning & Ventilation System (ME 44, 2 units lec, 1 unit lab)

This is a course that deals with Psychometric properties of air; affecting human comfort; air distribution and basic duct design drying, heating and ventilation; cooling load calculations; complete design of an air-conditioning system and its component and different types of refrigerants , their uses and effects as used air-conditioning system.

25. Industrial Processes (ME 45, 2 units)

This course studies the methods of transformation of raw materials to finished products by utilizing power, machineries, equipment, technology and operation.

26. Seminars and Plant Inspections (ME 46, 1 unit lab)

This course exposes students to attendance and participation in Seminars and lectures on current topics on Electrical engineering development; and fieldtrips to different companies and plants dealing or engaged in Mechanical Engineering facilities.

27. Final Year Project 1 (ME 47, 1 unit lec, 1 unit lab)

This course covers lectures, laboratory and other activities necessary for the students in carrying out the process of doing scientific activities to complete the required research or project. As a pre-requisite for the completion of an Engineering degree in Xavier University, the study, project or research aims to produce new knowledge or to solve a practical problem in the field of Mechanical Engineering.

28. Power Plant Engineering (ME 48, 4 units lec, 2 unit lab)

This course covers the fundamental concepts in the design and installation of typical power plants such as steam power plant, diesel electric plant, geothermal power plant as well as other generating plants using non-conventional sources of energy.

29. Industrial Plant Engineering (ME 49, 3 units lec, 1 unit lab)

This course is related to mechanical engineering theories, equipment and systems that are needed in the operation of an industrial/manufacturing plant.

30. ME Laws, Ethics, Codes & Standards (ME 51, 3 units)

The course deals with the study of the Mechanical Engineering law, code of ethics, ethical theories, and ethical issues in the practice of engineering. Familiarization with the technical codes and standards are included.

31. Engineering Management for ME (ME 52, 3 units)

The course involves the study of Decision-making; the functions, roles and skills in engineering management. It covers the planning, organizing, leading, controlling and staffing of engineering organization.

32. ME Final Year Project Study 2 (ME 53, 1 unit lec, 1 unit lab)

This course is a continuation of ME Final Year Project Study 1 geared towards the ultimate completion, defense and presentation of the students' study, project or research in the field of Mechanical Engineering.

33. Vibration Engineering (ME 54, 2 units)

This course is an introduction to the fundamental concepts of vibration as it affects operation and performance of machine components. It covers topics on modeling of mechanical systems, derivation of the differential equations for such systems and its varying solutions (responses) based on different excitations; analysis, design, measurement, damping and computational aspects. The computer as a computational tool will also be utilized.

34. On the Job Training (ME 80, 2 units)

As part of the BS Engineering curricula, the 300-hour On-the-Job Training requires the students to be assigned to various companies and government agencies, where they learn practical applications of the Mechanical Engineering concepts they learn from the academe and at the same time learn and begin to engulf people skills.

35. DC/AC Machinery (ACE 10, 3 units); DC/AC Machinery Laboratory (ACE 10L, 1 unit, 3 units lec, 1 unit lab)

The course covers the concepts and practical application of performance characteristics and operation including losses and efficiencies of DC and AC machines such as alternators, induction/synchronous motors, synchronous converters and transformers. It includes demonstrations and laboratory experiments.