Bachelor Plan

College of Engineering

Bachelor of Technology in Mechanical Engineering (2+2)

	Course Code	Course Name	Pre-R	Co-R	Credit Hours	Contact Hours	Course Type
Semester 1	21SMAT310	Engineering Mathematics	N/A		3		
	21SMAT311	Engineering Physics A	N/A		3		
	21SMCE310	Engineering Skills * (PBL)	N/A		3		
	21SMCE311	Statics & Dynamics	N/A		3		
	21SMAT313	Engineering Physics A Lab	N/A	21SMAT311	1		
				Semester Total	13		
Semester 2	21SMCE320	Thermodynamics	21SMAT310, 21SMAT311		3		
	21SMCE321	Solid Mechanics	21SMCE311		3		
	21SMCE322	Materials Science and Engineering	21SMAT310, 21SMAT311		3		
	21SMCE323	Engineering Design: Planning (PBL)	21SMCE310	21SMCE324	3		
	21SMCE324	Engineering Management: Planning (PBL)	21SMCE310	21SMCE323	3		
				Semester Total	15		
Semester 3	21SMCE333	Internship (optional)	21SMCE323, 21SMCE324		3		
	21SMCE410	Project Planning * (PBL)	21SMCE323, 21SMCE324		3		
	21SMCE411	Fluid Mechanics	21SMCE320		3		
	21SMCE412	Engineering Plant Design	21SMCE321		3		
	21SMCE413	Engineering Design: Implementation (PBL)	21SMCE323, 21SMCE324	21SMCE414	3		
	21SMCE414	Engineering Management: Implementation (PBL)	21SMCE323, 21SMCE324	21SMCE413	3		
				Semester Total	15		
Semester 4	21SMCE420	Project Implementation * (PBL)	21SMCE410		3		
	21SMCE421	Energy Conversion	21SMCE411		3		
	21SMCE422	Mechanical Systems	21SMCE412		3		
	21SMCE423	Fluid and Electric Drive Systems * (PBL)	21SMCE413, 21SMCE414	21SMCE424	3		
	21SMCE424	Automation and Sensors in Fluid Systems * (PBL)	21SMCE413, 21SMCE414	21SMCE423	3		
	21SMCE425	Energy Conversion Lab		21SMCE421	1		
	21SMCE426	Mechanical Systems Lab		21SMCE422	1		
				Semester Total	17		
				Program Total	60		

Units Distribution

SEMESTER 1

1. 21SMAT310 Engineering Mathematics

In this course students apply the essential calculus concepts, processes and techniques to develop mathematical models for engineering problems. They use the Fundamental Theorem of Calculus to illustrate the relationship between the derivative and the integral of a function and apply the theorem to engineering problems involving definite integrals. Differential calculus is used to construct mathematical models, which investigate a variety of rate of change and optimization problems. The standard rules and techniques of integration are included. Differential equations are introduced and applied to investigate more interesting problems in an engineering setting. Other important elements of this course are the communication of results, concepts and ideas using mathematics as a language, being able to document the solution to problems in a way that demonstrates a clear, logical and precise approach and communicating, working and learning in peer learning teams where appropriate.
Credits: 3
Prerequisites: None

2. 21SMAT311 Engineering Physics A

This course introduces the principles of engineering physics and aims to develop a fundamental understanding of several broad areas of physics (mechanics, fluids, wave properties, properties of matter and heat) applied to engineering and technology.
Credits: 3
Prerequisites: None

3. 21SMCE310 Engineering Skills (PBL)

Students are introduced to the role of professional engineers as mediators between the technical, business, social, cultural, environmental, economic and political contexts of engineering activities. They investigate and select materials and processes for engineering applications and justify decisions made. Students apply information literacy skills and information technology skills to engineering projects; they use drawing, modeling and simulation tools to analyze and present project outcomes; they apply risk assessment and workplace health and safety assessment to engineering activities; and they design, conduct and report on practical, hands-on activities. The learning is supported by compulsory class sessions. Students explore the complex nature of engineering activities and the need to deal with uncertainty and conflicting information, they prepare a portfolio to demonstrate development of a professional attitude, problem-solving skills, technical knowledge and productive work practices, and provide evidence of a professional capacity to communicate, work and learn productively, both individually and in teams.
Credits: 3
Prerequisites: None

4. 21SMCE311 Statics and Dynamics

This course develops principles of engineering mechanics. Students calculate the geometrical properties of cross sections, analyze loads on engineering structures, determine support reactions, and distribution of forces and moments in members. They analyze problems

involving particle and rigid body motion and simple vibratory systems. Students communicate, work and learn both individually and in teams, using appropriate mechanical engineering language, they document the process of modeling and analysis and present the information in a professional manner.
Credits: 3
Prerequisites: None

5. 21SMAT313 Engineering Physics A Lab

The laboratory experiments performed in this course complement the material covered in the Physics I/ Engineering Physics A lecture course. This lab course mainly covers the topics of Classical Mechanics. The main goal of this lab course is to demonstrate the techniques used to carry out experimental physics. In this course students will be doing hands-on, collaborative activities that illustrate the key topics from the lecture. Upon successful completion of this course students will be able to

1. Ability to measure and compute basic quantities in mechanics related to motion, force, energy and momentum.
2. Prepare a written laboratory report that effectively interprets and communicates the results.
3. Ability to apply experimental principles and error calculations to mechanics.

Credits: 3
Prerequisites: None

SEMESTER 2

6. 21SMCE320 Thermodynamics

The unit introduces students to the basic methods underlying the design and analysis of thermal energy systems. It emphasizes understanding thermodynamics principles and applying them to practical situations. It aims to give students the necessary skills to carry out basic design and performance analysis in the area of power exchange in steam, and similar plant, steam and gas turbines, engines and refrigeration systems.
Credits: 3
Prerequisites: 21SMAT310, 21SMAT311

7. 21SMCE321 Solid Mechanics

Students will use the principles of engineering mechanics to analyze structural members subjected to torsion, bending and shear stresses. Principle stresses will be calculated for members subjected to combined stresses. The course outlines modes of failure including fatigue in engineering materials. Students use appropriate "civil engineering language" in context, document the process of modeling and analysis and present information, and communicate, work and learn, both individually and in teams in a professional manner.
Credits: 3
Prerequisites: 21SMCE311

8. 21SMCE322 Material Science and Engineering

This course introduces students to the properties of engineering materials and their classification, and selection for given applications. They explain relationships between material properties and the internal structures of materials, and explain processes modify these structures to improve material properties. Students should be able to analyze failures of materials, explain failure mechanisms and determine measures to protect against such failures. They describe and choose standard methods of testing for given situations, indicate expected results and limitations of results. Students conduct, analyze, interpret, draw conclusions from and report on materials tests. They apply information literacy skills to obtain relevant engineering information and identify appropriate standards and practices.
Credits: 3
Prerequisites: 21SMAT310, 21SMAT311

9. 21SMCE323 Engineering Design: Planning (PBL)

In this course, students produce a conceptual design and project specifications aligned with relevant standards and current engineering practice given a loosely formed client brief. They demonstrate and justify the incorporation of a systems approach to design activities based on a broad sustainability framework. Students identify, justify and apply the technical knowledge and skills required to successfully complete an engineering project, and produce professional and technically competent design documentation. Students prepare a portfolio to demonstrate development of a professional attitude, problem-solving skills, technical knowledge and productive work practices, and they provide evidence of a professional capacity to communicate, work and learn productively, both individually and in teams. The learning is supported by compulsory class sessions.
Credits: 3
Prerequisites: 21SMCE310
Co-requisites: 21SMCE324

10. 21SMCE324 Engineering Management: Planning (PBL)

In this course students should be able to apply project management techniques to plan engineering projects. They reflect on project activities and develop and describe their personal framework for engineering design and project management. They describe and explain the conduct and management of engineering enterprises and of the structure and capabilities of the engineering workforce. Students produce professional and technically competent project management documentation. Students prepare a portfolio to demonstrate development of a professional attitude, problem-solving skills, technical knowledge and productive work practices, and they provide evidence of a professional capacity to communicate, work and learn productively, both individually and in teams. The learning is supported by compulsory class sessions.

Credits: 3

Prerequisites: 21SMCE310

Co-requisites: 21SMCE323

SEMESTER 3

11. 21SMCE333 Internship

This course covers the professional experience, through training in the execution of real life engineering projects. Practical training aims at developing practical skills for the student so that he/she might develop an awareness of job requirements and become qualified to practice a specialization in a sound and systematic way. It might also help a student to find or locate later job opportunities at the same training site if he/she is able to demonstrate competence and obtain the satisfaction of the Field Supervisor and those responsible at the site.
Credits: 3
Prerequisites: 21SMCE323, 21SMCE324

12. 21SMCE410 Project Planning (PBL)

Students in the final year of their Bachelor of Engineering Technology program working independently to find and plan a project that allows them to demonstrate professional capabilities expected of graduating engineering technologists. Formal and informal project reporting articulates the analysis of project planning issues and critical thinking behind project choices and decisions made. Students report to and work with guidance from a supervisor to scope and define the project, undertake research into project issues, incorporate safety and risk issues, produce a plan and schedule for implementation of the project in the subsequent project implementation course, and produce informal and formal projects reports and presentations
Credits: 3
Prerequisites: 21SMCE323, 21SMCE324

13. 21SMCE411 Fluid Mechanics

This course introduces the fundamental properties of fluids, analysis of pipe flow and analysis of buoyancy and stability of floating objects. It presents methods of analyzing fluid systems using the concept of a control volume combined with the conservation of mass and momentum equations. Students analyze incompressible flows in pipe systems and use similitude and modeling principles and techniques to solve problems in fluid mechanics. Students will prepare technical and laboratory reports using appropriate "mechanical engineering language", and document the process of modeling and analysis. They are required to act professionally in presenting information, communicating, working and learning, both individually and in teams.
Credits: 3
Prerequisites: 21SMCE320

14. 21SMCE412 Engineering Plant Design

This course provides students with opportunities to develop and demonstrate their professional capabilities in the design of mechanical equipment associated with processing plant within the context of the minerals processing and associated heavy industries. Students apply engineering theories, practices, standards and tools to design of equipment and apply their knowledge of strength of materials, tolerances and modes of failure to design. The emphasis is on the design of machine elements as components of larger systems requiring analysis to be reduced to subsystems, assemblies and components, and how the performance of the whole system is affected by the performance of its constituent parts. The design process

equipment and drivelines, and describe specific design issues that apply to common process and general engineering components and equipment. Students evaluate and explain their design decisions, selections and design features. Students will be required to apply their existing knowledge of statics, dynamics, vibrations, strength of materials, thermos-fluids to design tasks, comply with relevant codes of practice and use numerical methods and computer aided design tools where appropriate. They are required to show they can work productively and professionally, both individually and in project teams, to solve problems, and document and communicate their work clearly in a professional manner.
Credits: 3
Prerequisites: 21SMCE321

15. 21SMCE413 Engineering Design: Implementation (PBL)

In this course students should be able to apply techniques of conceptual design of engineering projects. They reflect on project activities and continue to develop and describe their personal framework for engineering design. Students design or select components and elements required for a project and develop a detailed project design consistent with relevant Standards and current engineering practice given a conceptual design and client approved project specifications. They model and evaluate the detailed design and demonstrate and justify the incorporation of a systems approach to design activities based on a broad sustainability framework. Students identify, justify and apply the technical knowledge and skills required to successfully complete an engineering project and produce professional and technically competent project design documentation. Students prepare a portfolio to demonstrate development of a professional problem-solving skills, and technical knowledge. They provide evidence of a professional capacity to communicate, work and learn productively, both individually and in teams.
Credits: 3
Prerequisites: 21SMCE323, SMCE324
Co-requisites: 21SMCE414

16. 21SMCE414 Engineering Management: Implementation (PBL)

In this course students should be able to apply project management techniques to implement an engineering project from previous conceptual design. They reflect on project activities and continue to develop and describe their personal framework for engineering project management. Students implement a project that includes physical models and prototypes based on implementation management documentations. They apply the technical knowledge and skills required to successfully complete an engineering project, and produce professional and technically competent project management documentation. Students prepare a portfolio to demonstrate development of a professional attitude; problem-solving skills, technical knowledge and productive work practices, and they provide evidence of a professional capacity to communicate, work and learn productively, both individually and in teams.
Credits: 3
Prerequisites: 21SMCE323, SMCE324
Co-requisites: 21SMCE413

SEMESTER 4

17. 21SMCE420 Project Implementation (PBL)

The purpose of this course is to provide students who are in the final year of their program with an opportunity to carry out an authentic work assignment type project, which closely approximates technologist's activities in industry. It is expected that while carrying out the project, students will develop their expertise as well as practice skills in the project's discipline are.

Credits: 3

Prerequisites: 21SMCE410

18. 21SMCE421 Energy Conversion

This course introduces students to key concepts and principles required to analyze problems involving heat exchange and energy conversion. They analyze and design heat exchangers and analyze performance of compressors, internal combustion engines, gas turbines and jet propulsion. Students analyze combustion processes and estimate pollutant emissions, and analyze and design nozzles to promote safe and efficient combustion. They prepare technical and laboratory reports that demonstrate critical evaluation of results and experimental uncertainties. Students are required to show they work productively, both individually and collaboratively, to solve problems, and document and communicate their work clearly in a professional manner.

Credits: 3

Prerequisites: 21SMCE411

19. 21SMCE422 Mechanical Systems

This unit describes the behavior and analysis of mechanical systems. Students will be able to apply knowledge of engineering science and mathematics to model and analyze mechanical systems and consider the nature of engineering assumptions and effects uncertainty on analysis and modeling. They will apply control theory, design and analyze mathematical models, and use simulation software to predict behavior of mechanical systems. Students will be expected to apply the modeling and analysis of mechanical systems to industrial contexts, working and learning productively in teams and alone to complete projects, to develop interpersonal and technical communication skills and prepare professional documentation of problem solutions and project reports.

Credits: 3

Prerequisites: 21SMCE412

20. 21SMCE423 Fluid and Electric Drive Systems (PBL)

This project-based learning (PBL) course is one semester course designed for the School of Engineering, which introduces fluid and electrical drives and the design of integrated drive systems for use in industry. It covers comparison of characteristics, construction, selection, design and operation of fluid and electric drive systems, use of mathematical models and software to analyze performance, machine protection and control schemes, and evaluation of drive system performance. Students apply formulas and explain and record calculations. They adopt professional approaches to work in teams and learn collaboratively to manage and complete projects, they manage their own learning, and communicate professionally using discipline language to investigate, design and check work, and present designs and problem

solutions. Distance education (FLEX) students are required to have access to a computer, to make frequent use of the Internet, and are required to participate in Residential School activities.
Credits: 3
Prerequisites: 21SMCE413, 21SMCE414
Co-requisites: 21SMCE424

21. 21SMCE424 Automation and Sensors in Fluid Systems (PBL)

This project-based learning (PBL) course is one semester course designed for the School of Engineering, which introduces automation and sensors in fluid systems and the design of integrated systems for use in industry. It covers comparison of characteristics, construction, selection, design and operation of automation, microprocessor and sensor systems, use of mathematical models and software to analyze performance, machine protection and control schemes, and evaluation of automated system performance. Students apply formulas and explain and record calculations. They adopt professional approaches to work in teams and learn collaboratively to manage and complete projects, they manage their own learning, and communicate professionally using discipline language to investigate, design and check work, and present designs and problem solutions. Distance education (FLEX) students are required to have access to a computer, to make frequent use of the Internet, and are required to participate in Residential School activities.
Credits: 3
Prerequisites: 21SMCE413, 21SMCE414
Co-requisites: 21SMCE423

22. 21SMCE425 Energy Conversion Lab

Energy conversion lab focuses on the understanding of the operating principles of some components encountered in engines, power generating plants, and heating systems as well as experimental measurements, analysis, and reporting techniques. Students will use their fundamental knowledge in thermodynamics, fluid mechanics, and heat transfer in analyzing engines and heat exchangers which results in students will gain hands-on experience with the operating characteristics of common energy conversion devices.
Credits: 3
Prerequisites: None
Co-requisites: 21SMCE421

23. 21SMCE425 Mechanical Systems Lab

The main purpose of mechanical vibration lab is constructing hands-on experience in students to examine 1-DOF (Degree of Freedom), 2-DOF and Multi-DOF engineering vibrational systems. They start with finding fundamental properties of vibratory systems, e.g., spring stiffness, and end up with formulating and analyzing problems by using different types of techniques and equipment (e.g., sensors, acquisition systems, signal processing software, accelerometers, etc.). Spring-mass, simple/compound pendulum, damped, viscous, rotating, torsional and bending systems are tested with free and forced apparatus, and their modal responses and natural frequencies are compared upon different initial conditions.
Credits: 3
Prerequisites: None
Co-requisites: 21SMCE422