

<b>1. Teaching Institution</b>	University of Technology Bahrain (UTB)
<b>2. University Department</b>	College of Engineering
<b>3. Programme Title</b>	Bachelor of Science in Mechatronics Engineering (BSME)
<b>4. Title of Final Award</b>	Bachelor of Science in Mechatronics Engineering (BSME)
<b>5. Mode of Attendance</b>	Full time
<b>6. National Qualification Framework Level and Credit</b>	NQF Level 8 612 NQF Credits (204 ACS Credits)
<b>7. Accreditation</b>	ABET
<b>8. Other external influences</b>	<b>Local External Influences/References</b> Ministry of Education (MOE), Higher Education Council (HEC) Education and Training Quality Authority (BQA) <b>International External Influences/References</b> Accreditation Board for Engineering and Technology (ABET)
<b>9. Date of production/revision of this specification</b>	September 2023
<b>10. Aims of the Programme</b>	
<p>The Bachelor of Science in Mechatronics Engineering (BSME) is an engineering programme which combines mechanical, electronic, electrical, and computer engineering. It is an interdisciplinary scientific area focusing on the study and design of intelligent programmable systems from an engineering perspective and looks into the design, development and controlling of advanced hybrid systems.</p> <p><b>Programme Educational Objectives</b>          The objectives of BSME programme are to produce graduates who will be able to:</p> <ol style="list-style-type: none"> <li>1. pursue careers in Mechatronics Engineering or related fields towards the improvement of engineering practice;</li> <li>2. engage in lifelong learning toward completion of advanced/continuing education or other learning opportunities; and</li> <li>3. demonstrate professional success through strengthened networks and/or positions of increasing social responsibility.</li> </ol>	
<b>11. Learning Outcomes, Teaching, Learning and Assessment Methods</b>	
<p>Upon successful completion of the programme, the student will be able to:</p> <ol style="list-style-type: none"> <li>1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics;</li> <li>2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;</li> <li>3. communicate effectively with a range of audiences;</li> <li>4. recognise ethical and professional responsibilities in engineering situations and make informed</li> </ol>	

judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts;

5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives;
6. develop and conduct appropriate experimentation, analyse and interpret data, and use engineering judgment to draw conclusions; and
7. acquire and apply new knowledge as needed, using appropriate learning strategies.

### Teaching and Learning Methods

1. Active and Engaged Learning. Students are required to attend the sessions regularly. Students learn by doing, making, writing, designing, creating, and solving. Active participation of the students during discussion is expected. Learning is an active process, and as such, students must engage with the course materials, i.e. reading the textbook and other assigned advanced readings.
2. Problem-based learning. After each topic, sample problems will be provided to students. Working in groups, students identify what they already know, what they need to know, and how and where to access new information that may lead to resolution of the problem.
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4. Collaborative learning. Students will be divided into groups with at least three (3) members and each group will be provided with problems or projects that they will work on together to search for understanding, meaning, or solutions. Each group is expected to work together in solving particular engineering problems, discuss the algorithm of the problems, and present the solution in class.
5. Discovery-based learning. During laboratory hours, students will be given experiments to work in groups where they can apply the theories and principles learned. This is an opportunity to have hands-on experience and maximize their learning through actual simulation.

### Assessment Methods

Assessment is through a combination of written examinations (essays, class tests, homework) and assessed coursework (problem sets, laboratory exercises and machine problems).

**12. Programme Structure**

**BACHELOR OF SCIENCE IN MECHATRONICS ENGINEERING (BSME)**  
CURRICULUM PLAN EFFECTIVE AY2022-2023

## REMEDIAL CLASSES

Course Code	Course Title	Lec Hrs	Lab Hrs	Credit Units	Pre-Requisites
ENGL301	Speaking and Listening	9	0	0	
ENGL302	Grammar and Vocabulary	9	0	0	
MATH300	Remedial Mathematics	3	0	0	

**FIRST YEAR**

## FIRST TRIMESTER

Course Code	Course Title	Lec Hrs	Lab Hrs	Credit Units	Pre-Requisites
ARAB400	Arabic Language	3	0	3	
CHEM400	General Chemistry 1	2	2	3	
CENG411	Introduction to Computing	2	2	3	
ENGL401	English Communication Skills 1	3	0	3	
EUTH400	Euthenics 1	1	0	0	
MATH401	College Algebra	3	0	3	
MATH402	Plane and Spherical Trigonometry	3	0	3	
<b>TOTAL</b>				<b>18</b>	

## SECOND TRIMESTER

Course Code	Course Title	Lec Hrs	Lab Hrs	Credit Units	Pre-Requisites
CENG511	Computer Programming	2	2	3	CENG411
ENGL402	English Communication Skills 2	3	0	3	ENGL401
EUTH401	Euthenics 2	1	0	0	EUTH400
HIST400	History of Bahrain and GCC	3	0	3	
MATH406	Differential Calculus with Analytic Geometry	5	0	5	MATH401, MATH402
SOCI400	Sociology	3	0	3	
<b>TOTAL</b>				<b>17</b>	

## THIRD TRIMESTER

Course Code	Course Title	Lec Hrs	Lab Hrs	Credit Units	Pre-Requisites
CENG523	Advanced Programming	2	2	3	CENG511
ENGL403	Speech and Oral Communication	2	2	3	ENGL402
MATH501	Integral Calculus with Differential Equations	5	0	5	MATH406
PHYS501	University Physics 1	2	2	3	MATH406
SCIE400	Biology	2	2	3	
<b>TOTAL</b>				<b>17</b>	

**SECOND YEAR**

## FIRST TRIMESTER

Course Code	Course Title	Lec Hrs	Lab Hrs	Credit Units	Pre-Requisites
ENVS400	Environmental Science	3	0	3	SCIE400
ENGL502	Technical Writing	3	0	3	ENGL402
ENGG410	Engineering Drawing	2	2	3	
ENGG520	Engineering Materials	3	0	3	CHEM400
MATH503	Discrete Mathematics	3	0	3	MATH401
PHYS502	University Physics 2	2	2	3	PHYS501, MATH501
TOTAL				18	

## SECOND TRIMESTER

Course Code	Course Title	Lec Hrs	Lab Hrs	Credit Units	Pre-Requisites
ENGG531	Electric Circuit Theory 1	2	2	3	MATH501, PHYS502
ENGG532	Thermodynamics	3	0	3	PHYS501
HUMR400	Human Rights	3	0	3	SOCI400
MATH409	Probability and Statistics	3	0	3	MATH503
MATH502	Advanced Mathematics	3	0	3	MATH501
PHYS503	University Physics 3	2	2	3	PHYS502
TOTAL				18	

## THIRD TRIMESTER

Course Code	Course Title	Lec Hrs	Lab Hrs	Credit Units	Pre-Requisites
ENGG521	Engineering Mechanics	3	0	3	PHYS501
ENGG522	Engineering Economy	3	0	3	MATH406
ENGG534	Electronics 1	2	2	3	ENGG531
ENGG611	Electric Circuit Theory 2	2	2	3	ENGG531
MATH504	Multivariate Calculus	2	2	3	MATH501
MATH505	Numerical Methods and Analysis	2	2	3	MATH502
TOTAL				18	

**THIRD YEAR**

## FIRST TRIMESTER

Course Code	Course Title	Lec Hrs	Lab Hrs	Credit Units	Pre-Requisites
CENG611	Data Communication & Networking 1	2	2	3	CENG411
ENGG535	Fluid Mechanics	3	0	3	MATH406
ENGG613	Electronics 2	2	2	3	ENGG534
ENGG615	Electromagnetics and Electrical Machines	3	0	3	ENGG611
ENGG627	Logic Circuit, Switching Theory and	3	2	4	ENGG534

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	Programmable Logic Devices				
MATH506	Linear Algebra	2	2	3	MATH504
TOTAL				19	

## SECOND TRIMESTER

Course Code	Course Title	Lec Hrs	Lab Hrs	Credit Units	Pre-Requisites
ENGG501	Safety Engineering	2	0	2	ENGG611
ENGG533	Strength of Materials	3	0	3	ENGG521
MECH610	Pneumatics and Electro-Pneumatics	2	2	3	ENGG535, ENGG627
ENGG614	Control Systems	2	2	3	ENGG611
MECH631	Power Electronics	3	2	4	ENGG613
MECH633	Introduction to Fuzzy/Neural System	3	2	4	ENGG627, MATH503
TOTAL				19	

## THIRD TRIMESTER

Course Code	Course Title	Lec Hrs	Lab Hrs	Credit Units	Pre-Requisites
MATH507	Optimization Methods	3	0	3	MATH505
MECH621	Linear Systems	2	2	3	ENGG614
MECH623	Hydraulics and Electrohydraulics	3	2	4	ENGG535, ENGG627
MECH624	Programmable Logic Controllers	3	2	4	MECH610
MECH641	Process Instrumentation and Control	3	2	4	ENGG532, ENGG614
TOTAL				18	

## FOURTH YEAR

## FIRST TRIMESTER

Course Code	Course Title	Lec Hrs	Lab Hrs	Credit Units	Pre-Requisites
ENGG639	Professional Ethics and Engineering Laws	3	0	3	ENGG501
MECH639	Microcontroller	2	2	3	ENGG627
MECH642	Machine Vision	3	2	4	MECH621
MECH643	Robot Kinematics, Dynamics and Control	3	2	4	MECH631, MECH621
MECH644	Modular Production System	3	2	4	MECH624
TOTAL				18	

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### SECOND TRIMESTER

Course Code	Course Title	Lec Hrs	Lab Hrs	Credit Units	Pre-Requisites
ENGG638	Engineering and Project Management	3	0	3	ENGG522
MECH651	Industrial Attachment	0	6	6	MECH644
MECH652	Mechatronics Engineering Design Project A	0	6	3	MECH641, MECH643
TOTAL				12	

### THIRD TRIMESTER

Course Code	Course Title	Lec Hrs	Lab Hrs	Credit Units	Pre-Requisites
MECH645	Technopreneurship	3	0	3	ENGG638
MECH653	Major Elective 1	2	2	3	See list below
MECH661	Mechatronics Engineering Design Project B	0	6	3	MECH652, ENGG638
MECH662	Major Elective 2	2	2	3	See list below
TOTAL				12	
Grand Total				<b>204</b>	

### ELECTIVE COURSES

#### MAJOR ELECTIVE 1

Course Code	Course Title	Lec Hrs	Lab Hrs	Credit Units	Pre-Requisites
MECH653A	Data Communication and Networking 2	2	2	3	CENG611
MECH653C	System Modeling and Simulation	2	2	3	ENGG614
MECH653D	Digital Control Systems	2	2	3	ENGG614

#### MAJOR ELECTIVE 2

Course Code	Course Title	Lec Hrs	Lab Hrs	Credit Units	Pre-Requisites
MECH662A	Wireless Communications	2	2	3	CENG611
MECH662C	Digital Signal Processing	2	2	3	MECH639
MECH662D	Power Plant	2	2	3	ENGG532

### 13. Awards and Credits

Degree/ Certificate Awarded	Bachelor's Degree
Total Units for Degree	204
Total Trimesters Completed	12

### 14. Personal Development Planning

1. Conduct in-house trainings and seminars related to electronics, AutoCAD, programmable logic controllers, CAD/CAM technology, microcontrollers, automation systems and robotics technology.
2. Send faculty members in local and international conferences, seminars and trainings related to their fields of specialization.

3. Support faculty members in their conduct of research projects aligned to the College's research thrusts and priorities.
4. Establish partnerships and linkages where research collaborations can be made.
5. Encourage publication of research outputs and dissemination of results through participation in international research conferences and fora.

### 15. Admission Criteria

Admission to UTB is open to all qualified applicants. Acceptance to the university depends on the following criteria:

#### A. For First Year Undergraduate Applicants

Acceptance to the University depends on the following admissions requirements:

1. Completely filled out an admission application form
2. Minimum secondary school scores 60% or its equivalent
3. UTB Placement Test (Oxford Online Placement Test (OOPT)) result
4. Submission of all required documents stated in the Admissions Policy

To be admitted to any undergraduate programme, the applicant must satisfy the minimum secondary school grades or its equivalent without the need to take the UTB placement test and remediation classes of English, and Math, as shown in the following table:

Subtest Component for Bahraini, KSA, Kuwait, Qatar, Yemen, Switzerland, USA, and Ecuador Qualification		Programme			
		Engineering Studies (BSIE, BSME, BSEnE)	Computing Studies (BSCS, BSIT)	Business (BSBI, BSAF)	International Business
Mathematics	Science/ Technical/General Track	At least 70% or C	At least 70% or C	At least 70% or C	At least 60% or D
	Commercial and Literature Tracks	At least 80% or B	At least 80% or B	At least 80% or B	At least 60% or D
Science		60	60	60	N/A
English		At least 80 or B	At least 80 or B	At least 80 or B	At least 80 or B

Subtest Component for Other Qualification (Indian, Pakistan, and West African)		Programme			
		Engineering Studies (BSIE, BSME, BSEnE)	Computing Studies (BSCS, BSIT)	Business (BSBI, BSAF)	International Business

Mathematics	Science/ Technical/General Track	At least 51 or C1	At least 51 or C1	At least 51 or C1	At least 41 or C2
	Commercial and Literature Tracks	At least 71 or B1	At least 71 or B1	At least 71 or B1	At least 41 or C2
Science		60	60	60	N/A
English		At least 71 or B1	At least 71 or B1	At least 71 or B1	At least 71 or B1

\*This is applicable to Bahraini and similarly equivalent qualification.

a. Secondary Grade in English

A qualified applicant for all programmes whose secondary school grade in English is within 60-79%, needs to take the placement test in English (OOPT). If the OOPT test result is 55 or above, applicant will not take remediation course in English. However, if the result is lower than 55%, applicant will take remediation course in English.

b. TOEFL/IELTS

Qualified applicant who attains the score of at least 500 (173 CBT, 61 iBT) for TOEFL, or with a score of 5.5 for IELTS, is exempted to sit the required English placement test.

c. Secondary Grade in Math

A qualified applicant for Engineering programme who has a secondary grade score in Math of 60-79% for commercial track and 60-69% for scientific and technical tracks and lower than 60% for the International Business programme has to take the remediation course in Math.

Note: UTB can accept new students equivalent to 5% of the total enrollment where student applicant has a CGPA below 60% but not lower than 50% from Bahraini Schools; below 41% but not lower than 33% from Indian and Pakistan Schools; and for other non-Bahrain based Schools, it will be based on the passing mark of the school. The 5% is subject to strict evaluation by the dean and the applicant's score in the OOPT and the secondary school grades.

d. Secondary Grade in Science

A qualified applicant for Engineering (BSIE, BSME, BSEnE), Computing (BSCS, BSIT) or Business (BSBI, BASF) programme who has a secondary grade score in science of lower than 60% has to take tutorial class in general science before taking any university-level science course.

**B. For Undergraduate Transfer Student Applicants**

Application Requirements:

1. Completely filled out an admission application form
2. Official Transcript of Records (TOR) from the university previously attended. Rules and regulations of the HEC-Bahrain regarding the authentication of foreign certificates and private



school certificates are to be applied when necessary.

3. Course description of all completed courses for which transfer credit is sought (authenticated by the originating university)
4. Certificate of Transfer from the university previously attended stamped by MOE, if any.
5. Withdrawal Certificate stamped by MOE
6. Submission of all required documents stated in the admissions policy.
7. The applicant should have a good moral standing from the university from which he/she is transferring.

**Admissions Requirements:**

- a. For Bahrain and KSA qualifications, the applicant should have at least a secondary school average of 60%. For non-Bahrain secondary qualifications (Indian and Pakistan) the applicant should have at least 41% secondary school average; and for other non-Bahraini qualifications please refer to the table of cut-off.
- b. If the applicant has taken and passed courses in English and Mathematics in the previous university, the applicant will be exempted in taking the remedial courses in both English and Mathematics. The applicant may proceed to mainstream university courses and is eligible to apply for credit transfer.
- c. If the applicant has not taken any courses in English, he/she shall take the OOPT. If the results on the two parts of OOPT results is passed, he will proceed to university English courses, otherwise, he/she will enroll the remedial courses in English where he/she fails.
- d. If the applicant has not taken any course in Mathematics, the basis for evaluation whether remedial course in mathematics is required or not is the score in mathematics subjects in his/her last year in the secondary school certificate using the table presented earlier.

The transfer of course credits is accepted at UTB provided that courses applied for crediting are equivalent to the courses where credit will be transferred. Practicum (Internship) course is eligible for credit transfer with the same practicum (internship) course from other university or re-admitted student from UTB.

The University requires the undergraduate student to complete at least 50% of the required credit units/hours of a programme in residence at UTB. The maximum credit units/hours that are eligible for transfer credits should not exceed two-thirds (66%) of the required credit units/hours based on his/her original degree from another university.

**16. CGPA Requirement for Graduation**

The required CGPA for an undergraduate student to be eligible for graduation is 2.0 out of 4.

**17. Key Resources of information about the programme**

1. Included in the College Catalogue
2. Uploaded on the UTB website

College/Department: College of Engineering/ Mechatronics Engineering

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18. BSME CURRICULUM SKILLS MAPPING										
Year/ Level	Course Code	Course Title	Core (C) or Option (O)	Programme Learning Outcomes / Student Outcomes						
				SO1	SO2	SO3	SO4	SO5	SO6	SO7
Year 1 1st Tri	ARAB400	Arabic Language	(C)				✓			
	CHEM400	General Chemistry 1	(C)	✓				✓	✓	✓
	CENGI411	Introduction to Computing	(C)	✓					✓	
	ENGL401	English Communication Skills 1	(C)			✓				
	EUTH400	Euthenics 1	(C)							
	MATH401	College Algebra	(C)	✓						
	MATH402	Plane and Spherical Trigonometry	(C)	✓						
Year 1 2nd Tri	CENG511	Computer Programming	(C)	✓					✓	
	ENGL402	English Communication Skills 2	(C)			✓				
	EUTH401	Euthenics 2	(C)							
	HIST400	History of Bahrain and GCC	(C)				✓			
	MATH406	Differential Calculus with Analytic Geometry	(C)	✓						
	SOCI400	Sociology	(C)				✓			
Year 1 3rd Tri	CENG523	Advanced Programming	(C)	✓					✓	
	ENGL403	Speech and Oral Communication	(C)			✓				
	MATH501	Integral Calculus with Differential Equations	(C)	✓						
	PHYS501	University Physics 1	(C)	✓				✓	✓	
	SCIE400	Biology	(C)	✓				✓	✓	
Year 2 1st Tri	ENVS400	Environmental Science	(C)				✓			✓
	ENGL502	Technical Writing	(C)			✓				
	ENGG410	Engineering Drawing	(C)	✓						
	ENGG520	Engineering Materials	(C)	✓			✓			
	MATH503	Discrete Mathematics	(C)	✓						
	PHYS502	University Physics 2	(C)	✓				✓	✓	✓
Year 2 2nd Tri	CENG523	Advanced Programming	(C)	✓					✓	
	ENGG531	Electric Circuit Theory 1	(C)	✓	✓	✓		✓	✓	
	ENGG532	Thermodynamics	(C)	✓						✓
	HUMR400	Human Rights	(C)				✓			
	MATH409	Probability and Statistics	(C)	✓						

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Year/ Level	Course Code	Course Title	Core (C) or Option (O)	Programme Learning Outcomes / Student Outcomes						
				SO1	SO2	SO3	SO4	SO5	SO6	SO7
	MATH502	Advanced Mathematics	(C)	✓					✓	✓
	PHYS503	University Physics 3	(C)	✓				✓	✓	✓
Year 2 3rd Tri	ENGG521	Engineering Mechanics	(C)	✓						
	ENGG522	Engineering Economy	(C)	✓			✓			
	ENGG534	Electronics 1	(C)	✓	✓	✓		✓	✓	
	ENGG611	Electric Circuit Theory 2	(C)	✓	✓	✓		✓	✓	✓
	MATH504	Multivariate Calculus	(C)	✓					✓	✓
	MATH505	Numerical Methods and Analysis	(C)	✓					✓	✓
Year 3 1st Tri	CENG611	Data Communication & Networking 1	(C)	✓				✓	✓	✓
	ENGG535	Fluid Mechanics	(C)	✓						✓
	ENGG613	Electronics 2	(C)	✓	✓	✓		✓	✓	✓
	ENGG615	Electromagnetics and Electrical Machines	(C)	✓						✓
	ENGG627	Logic Circuit, Switching Theory and Programmable Logic Devices	(C)	✓	✓	✓		✓	✓	✓
	MATH506	Linear Algebra	(C)	✓				✓	✓	✓
Year 3 2nd Tri	ENGG501	Safety Engineering	(C)				✓			
	ENGG533	Strength of Materials	(C)	✓						
	MECH610	Pneumatics and Electro- Pneumatics	(C)	✓	✓	✓		✓	✓	
	ENGG614	Control Systems	(C)	✓	✓				✓	✓
	MECH631	Power Electronics	(C)	✓	✓	✓		✓	✓	
	MECH633	Introduction to Fuzzy/Neural System	(C)	✓	✓	✓		✓	✓	✓
Year 3 3rd Tri	MATH507	Optimization Methods	(C)	✓						
	MECH621	Linear Systems	(C)	✓	✓	✓		✓	✓	
	MECH623	Hydraulics and Electrohydraulic	(C)	✓	✓	✓		✓	✓	✓
	MECH624	Programmable Logic Controllers	(C)	✓	✓	✓		✓	✓	✓
	MECH641	Process Instrumentation and Control	(C)	✓	✓	✓		✓	✓	✓
Year 4 1st	ENGG639	Professional Ethics, Laws and Contracts	(C)				✓			
	MECH639	Microcontroller		✓	✓	✓		✓	✓	✓
	MECH642	Machine Vision	(C)	✓	✓	✓		✓	✓	✓

18. BSME CURRICULUM SKILLS MAPPING										
Year/ Level	Course Code	Course Title	Core (C) or Option (O)	Programme Learning Outcomes / Student Outcomes						
				SO1	SO2	SO3	SO4	SO5	SO6	SO7
Tri	MECH643	Robot Kinematics, Dynamics and Control	(C)	✓	✓	✓		✓	✓	✓
	MECH644	Modular Production System	(C)	✓	✓	✓		✓	✓	✓
Year 4 2nd Tri	ENGG638	Engineering and Project Management	(C)	✓			✓	✓		
	MECH651	Industrial Attachment	(C)	✓		✓	✓	✓		✓
	MECH652	Mechatronics Engineering Design Project A	(C)	✓	✓	✓	✓	✓	✓	✓
Year 4 3rd Tri	MECH645	Technopreneurship	(C)			✓	✓	✓	✓	✓
	MECH653A	Major Elective 1: Data Communication and Networking 2	(O)	✓	✓			✓	✓	✓
	MECH653D	Major Elective 1: Digital Control Systems	(O)	✓	✓	✓			✓	✓
	MECH653C	Major Elective 1: <b>System Modeling and Simulation</b>	(O)	✓	✓	✓			✓	✓
	MECH661	Mechatronics Engineering Design Project B	(C)	✓	✓	✓	✓	✓	✓	✓
	MECH662A	Major Elective 2: Wireless Communications	(O)	✓	✓	✓		✓	✓	✓
	MECH662D	Major Elective 2: Power Plant	(O)	✓	✓	✓	✓		✓	✓
MECH662C	Major Elective 2: Digital Signal Processing	(O)	✓	✓	✓	✓		✓	✓	

**BACHELOR OF SCIENCE IN MECHATRONICS ENGINEERING (BSME)**  
CURRICULUM PLAN EFFECTIVE AY2022-2023

**COURSES DESCRIPTION**

Course Code	Course Title	Lec Hrs	Lab Hrs	Credit Units	Pre-Requisites
MATH300	REMEDIAL MATHEMATICS	3	0	0	
<p>This course is a foundation in mathematics focusing on the building of the knowledge and skills and understanding to solve problems. It deals with the topics on four general operations relating to whole numbers and money, fractions and decimals, location, time and temperature, percent linked with fraction and decimal, rates and ratios, statistics and probability, and introduction to algebra. It also includes the application of the mathematical thinking process.</p>					
ENGL301	SPEAKING AND LISTENING	9	0	0	
<p>ENGL301 is a required remedial course for entering students whose English language skills need further improvement and enhancement to be able to cope with the university's academic courses. It utilizes an integrated approach in developing the students' English macro skills with emphasis on speaking and listening. Further, this course introduces the students to English language arts where they get involved and engaged in three phases (beginner, intermediate and advanced). It intensifies its course intended learning objectives with the utilization of audio-lingual presentations where the students are expected to gain more knowledge to communicate effectively in English.</p>					
ENGL302	GRAMMAR AND VOCABULARY	9	0	0	
<p>ENGL302 is a required remedial course for entering students whose English language skills need further improvement and enhancement to be able to cope with the university's academic courses. It utilizes an integrated approach in developing the students' skills in grammar and vocabulary in three phases (beginner, intermediate and advanced). In addition, it includes information related to dictionary use, basic grammar rules and daily use vocabulary words through a variety of contexts, written responses, idioms, writing structures, settings of writing and the process of forming written communication where the students are expected to gain more knowledge to communicate effectively in English.</p>					
ARAB400	ARABIC LANGUAGE	3	0	3	
<p>على دراسة أساسيات اللغة العربية كقراءة وتحليل و نقد وبيان خصائص النصوص المطلوبة التي تتناول مختلف ARAB400 يركز مقرر الأجناس الأدبية نثراً وشعراً. كما يركز هذا المقرر على دراسة وفهم وتطبيق القواعد النحوية والأساليب الصرفية الأساسية في اللغة العربية مع مراعاة مهارات الكتابة الإملائية الصحيحة.</p>					
CHEM400	GENERAL CHEMISTRY 1	2	2	3	
<p>This course demonstrates atomic theories, relationships between structure and properties of matter, scientific notation, density calculation, atomic structure and energy levels, periodic table, ions formation and chemical bonding, chemical reactions and emphasizing the chemical change, balancing equation, Discussion on gas law includes properties and application of gas laws, Acids and bases, solution and clarification of acid – base concept.</p>					

CENG411	INTRODUCTION TO COMPUTING	2	2	3	
<p>This course covers the basic concepts of computer hardware and software. It includes the discussion of microcomputer systems and workstations, networking and the internet and the interdisciplinary science of computing. It also provides a discussion of problem solving and algorithm development. Laboratory sessions focus on the use of word processing, spreadsheets and presentations using Microsoft Office applications.</p>					
ENGL401	ENGLISH COMMUNICATIONS SKILLS 1	3	0	3	
<p>This is an introductory course in English communication designed to provide comprehensive, up-to-date and relevant instruction in the correct use of grammar. It intends to build up students' confidence in communicating their thoughts, ideas, information and messages through the functions and structures of different words, phrases, clauses and sentences. In addition, the integration of language skills increases their communicative competence and prepares them for the academic and social challenges in college and beyond.</p>					
EUTH400	EUTHENICS 1	1	0	0	
<p>This course focuses on the discussion of the policies and procedures that are intended to guide each member of the UTB community in the performance of his/her role. This is used as a resourceful tool that orients the students with academic and non-academic policies of UTB. It contains the history, vision / mission and objectives of the institution, the services and academic support available.</p>					
MATH 401	COLLEGE ALGEBRA	3	0	3	
<p>This course is designed to familiarize learners with the main theories, principles and concepts of college algebra that are useful in analysis and simplification of basic and some advanced mathematical problems. Content includes functions which are polynomial, rational, exponential, logarithmic and related equations. Sketching graphs, Matrices, determinants, progressions and inequalities as applied to engineering.</p>					
MATH402	PLANE AND SPHERICAL TRIGONOMETRY	3	0	3	
<p>This course is designed to familiarize learners with main theories, principles and concepts of plane and spherical trigonometry that are useful in analysis and simplification of some advanced mathematical problems. The course covers topics on angles and their measurement, trigonometric/circular functions, inverse trigonometric functions, identities, graphs of trigonometric functions, solutions of trigonometric equations, solutions of right and oblique plane triangles, introduction to spherical trigonometry and its applications.</p>					
CENG511	COMPUTER PROGRAMMING	2	2	3	
<p>This course covers problem solving and algorithm development, which emphasizes on developing good programming habits. It includes discussion of an overview of the Java language syntax, including classes, methods, variables, conditional statements, and control flow. The laboratory focuses on the implementation of the programming theories and concepts using Java.</p>					
ENGL402	ENGLISH COMMUNICATIONS SKILLS 2	3	0	3	
<p>This is an intermediate course in English communication geared towards equipping the college students</p>					

with writing skills in preparation for academic writing. It progresses from familiarizing the sentence conventions to balancing the structures of the sentence for variation and rhythm. Further, it enables students to follow the principles that govern the composition writing in achieving unity, coherence and emphasis; to improve their expository, descriptive, narrative and argumentative works and to get hold of the discipline in academic writing for future advantages by providing them the opportunity in adhering the process of writing for effective communication.

EUTH401	EUTHENICS 2	1	0	0	
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The course introduces the students to the guidelines on disciplinary actions as regards violations of the rules and regulations of the University. The students will be taught the general concepts and principles on values formation, attitudes and personality development. This course will encourage the students to participate in classroom discussion for them to better understand and appreciate acceptable social norms and the conduct of an educated individual.

HIST400	HISTORY OF BAHRAIN AND GCC	3	0	3	
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دراسة تاريخ مملكة البحرين ومنطقة الخليج العربي ويُظهر تعداد اللاحداث الهامة في البحرين ومنطقة الخليج HIST400 يتناول مقرر بدءاً من الحضارات القديمة و مروراً إلى العربي وأثارها على الوضع الراهن ، و يغطي الأهمية الاستراتيجية والمكانية للبحرين للعهد الاسلامي، والاحتلال البرتغالي، وصراع القوى في القرن السابع عشر، وصعود قبيلة العتوب، والبحرين تحت الحماية البريطانية و ابرام ، ويتناول وصف الاماكن والشخصيات والتطورات التاريخية المعاهدات مع بريطانيا، وانسحاب القوات البريطانية من البحرين والخليج والانجازات في البحرين في عهد حكام البحرين، والبعد العربي والاسلامي في تكوين هوية البحرين ، ألانضمام لمجلس التعاون الخليجي ، وتاريخ دول الخليج العربي (دول مجلس التعاون الخليجي)، ومع نهاية الكورس يكون الطالب قادر على تحليل الجذور التاريخية للبحرين لتكوين الهوية الوطنية ، والتمتع بمقدرة الاتصال الشفهي والكتابي والعمل بشكل منتج وفعال ضمن فريق واحد.

This course includes the history of the Kingdom of Bahrain and the Arabian Gulf region. It includes the important events in Bahrain and the Arabian Gulf region and their impact on the current situation. It covers the strategic importance of Bahrain, starting with "Ancient civilizations and passing through" the Islamic era, Bahrain's entry into Islam, Portuguese occupation, competition of powers in the 17th century and the rise of a tribe of Al-Atub. It includes the history of Bahrain under the British protection and the conventions between Bahrain and Great Britain up to British troops leaving the region. It describes the places and persons as well as the historical developments and achievement in Bahrain during the time of Al- Khalifa. It includes independence of Bahrain, issuing of the first constitutional law, reform project by His Majesty King Hamad, constitutional amendments, establishment of GCC, and history of Arab Gulf states. It makes the student able to present his patriotic character through historical discussions.

MATH406	DIFFERENTIAL CALCULUS WITH ANALYTIC GEOMETRY	5	0	5	
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This course is intended to develop practical skills in differential calculus and analytic geometry. Emphasis is placed on functions, limits and continuity, fundamental concepts of analytic geometry, explicit and implicit differentiation of algebraic and transcendental functions, conics, higher derivatives, polar coordinates and its applications (equations of tangent and normal lines, sketching polynomial curves, maxima and minima problems and time rates.

SOCI400	SOCIOLOGY	3	0	3	
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This course is designed to expose students to a detailed approach to studying society. It intends to give emphasis on the sociological perspectives, relationships with other social sciences, the main figures in sociological development, including introduction to culture, transformation of societies, importance of

socialization, social groups, deviance and social control. Further, it integrates the discussions on social institutions that enable the college students to understand the economic perspective from ancient to present, the evolution of education and the current viewpoint of family.

CENG523	ADVANCED PROGRAMMING	2	2	3	
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This course enables students to understand and develop Java applications. Topics include arrays, recursion, exception handling, inheritance and polymorphism, file handling, basic applets, strings, GUI and Java events. The laboratory focuses on the development of programs in Java. It starts from the concepts of arrays and progresses from exception handling to Basic Applets.

ENGL403	SPEECH AND ORAL COMMUNICATION	2	2	3	
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This is a developmental course in English communication geared towards competent, efficient and effective interpersonal speaking across communicative contexts. It refines the oral communication skills of the college students through accurate articulation of segmental phonemes, pronunciation drills and enunciation of the suprasegmental features of speech, specifically sentential stress and intonation. Further, it incorporates the mechanics and techniques of speech craft and delivery with emphasis on practical speaking experiences and analysis of audience psychology, which are deemed applicable in diverse speech situations.

MATH501	INTEGRAL CALCULUS WITH DIFFERENTIAL EQUATIONS	5	0	5	
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This course provides the students with knowledge and understanding of core concepts, theories and principles in evaluating definite and indefinite integrals and their applications in solving engineering and computing problems. The course also covers solutions to ordinary differential equations which can be used in modeling important applications in the scientific and engineering fields.

PHYS501	UNIVERSITY PHYSICS 1	2	2	3	
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This course is designed to explore the concepts of motion using vectors and other mathematical models and their advanced application, such as the application of Newton's laws of motion, projectile motion, work, energy, momentum and impulse, rotational dynamics, equilibrium of a rigid body, and periodic motion.

SCIE400	BIOLOGY	2	2	3	
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This course focuses on the detailed knowledge and understanding of the fundamental life processes and functions of living systems including the nature of knowledge relating to cell structure, function and metabolism, bioenergetics, genetics and biotechnology, cellular reproduction and cell division, evolution, biodiversity, and ecology. The students will demonstrate the importance of explanations based on evidence through inquiry-based laboratory activities to provide insight into scientific methods.

ENVS400	ENVIRONMENTAL SCIENCE	3	0	3	
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This course is an introduction to environmental science. It examines the ecological foundation of environmental systems; the ecological impacts of population growth and environmental degradation by humans and the strategies for sustainable management of environment and natural resources; mineral resource extraction; water resource use and water pollution; air pollution and climate change; and the conventional and sustainable energy supply.



ENGL502	TECHNICAL WRITING	3	0	3	
<p>This is an advanced course in English academic writing designed to deal with the application of the technical writing principles with the correspondence on business, science, and technology. It aims to develop the technical writing skills and communication of the college students thru the discussions of its elements and ethics with the use of digital technologies. Furthermore, it enables students to adapt the various communication routes in the workplace, to conceptualize suitable contents of technical writing, to understand the characteristics and other methods of communication techniques, to plan and organize advanced level tasks and to work effectively and with accountability with other team members in a creative and productive manner, in any language learning scenario when achieving personal and group outcomes.</p>					
ENGG410	ENGINEERING DRAWING	2	2	3	
<p>The course covers the application of Computer-Aided Drafting Design (CADD) in sketching and drawing to produce engineering drawings. The student will learn the appropriate AutoCAD drawing and modifying commands to generate 2D drawings and orthogonal projections of 3D drawings. In addition, the course will cover editing, modifying and plotting 2D and 3D drawings.</p>					
ENGG520	ENGINEERING MATERIALS	3	0	3	
<p>This course deals with engineering materials deals with the study the core principle and concept of engineering material science. It covers the defining features of properties and structure of different engineering materials. It discusses the classifications of materials such as metals, polymers, ceramics, and composites. It also covers the formation of bonds and forces between particles, amorphous and crystalline structure, the impact factor, solid solutions and phase diagram, and defects in crystalline materials. It also covers the analysis of the physical, mechanical, electrical and magnetic properties of materials. This also emphasizes the various considerations in selecting materials appropriate for a particular application.</p>					
MATH503	DISCRETE MATHEMATICS	3	0	3	
<p>This course introduces the basic concepts and techniques of discrete mathematics. The course includes the discussion of mathematical logic, propositions, quantifiers, predicates, proof techniques, mathematical induction, fundamentals of set theory, sets, power sets, algebra of sets, relations, functions, countability and finiteness, graphs and trees.</p>					
PHYS502	UNIVERSITY PHYSICS 2	2	2	3	
<p>This course is designed to explore the concepts of electricity and magnetism using the concepts of mechanics, vectors, and other mathematical models and their advanced application, such as application of Coulomb's law, Gauss's law, Ohm's law, Kirchhoff's laws, electric potential and potential difference, basic circuits, series and parallel circuits and combinations, magnetic field and flux, induced EMF and applications such as electric motors and basic AC electric generators.</p>					
ENGG531	ELECTRIC CIRCUIT THEORY 1	2	2	3	
<p>The course deals with the study of core theories, principles and concepts for analysis of DC networks through the application of basic laws and network theorems. It covers the inter relationship between the parameters of DC circuits, critical analysis of complex circuits excited by DC voltages and current sources through basic circuit laws - KVL and KCL and structured methods and theorems like nodal analysis, Mesh analysis, superposition, Maximum power transfer &amp; Millman's theorem.</p>					

ENGG532	THERMODYNAMICS	3	0	3	
<p>Thermodynamics deals with the study associated with details of the properties of the pure substance to adept the necessary process related to energy concepts, ideal gas laws, work and heat, processes of ideal gases, and gas and steam cycles. It also includes a critical evaluation of various laws and its practical applications of thermodynamic principles in power plan.</p>					
HUMR400	HUMAN RIGHTS	3	0	3	
<p>يتناول هذا المقرر تمكين الطالب و جعله قادرا على معرفة الخلفية التاريخية لحقوق الإنسان، المفاهيم و الاصول الفلسفية و الرؤيا الاسلامية لحقوق الانسان كما يتناول بالعرض و التحليل مصادر حقوق الإنسان كالإعلان العالمي لحقوق الإنسان، و العهد الدولي الخاص بالحقوق المدنية و السياسية و العهد الدولي الخاص بالحقوق الاقتصادية و الإجتماعية و الثقافية و الوثائق الدولية الأخرى ذات الصلة بحقوق الإنسان ماورد فيها من الحقوق و التمييز بينها. كما يتناول بالمقاربة ذاتها ما ورد في الوثائق الوطنية مثل دستور مملكة البحرين و الميثاق الوطني و كيفية تطبيقها. و يُمكن الطلبة من مهارات تحليل و تفسير و نقد التطبيقات و التجاوزات فضلا عن القدرة على التحليل و التواصل و عرض مسائل حقوق الإنسان بمختلف الوسائل.</p> <p>This course makes the students able to know the background, main concepts of Human Rights and the philosophical thoughts and Islamic view which contribute to modern Human Rights. It makes them able to analyze what is mentioned in different kinds of Human Rights sources such as Universal Declaration of Human Rights, International Covenant on Civil and Political Rights and International Covenant on Economic, Social and Cultural Rights. It deals in the same approach with the National Sources of Human Rights such as the Constitutional Law of Kingdom of Bahrain and National Action Charter with applications as well. The course makes the students able to analyze, discuss and debate Human Rights issues in different ways.</p>					
MATH409	PROBABILITY AND STATISTICS	3	0	3	
<p>This course provides a demonstration of the main concepts of probability and statistics with applications. IT also covers identifying the theorem of probability and linked with real life problems. How to differentiate between the combination and permutation; Explain how to find the mean and variance from the moment generating function. Explain and interpret the findings from different hypothesis tests for decision making. Finally, SPSS will be used to run the statistical measures (e.g. hypothesis tests and regression model).</p>					
MATH502	ADVANCED MATHEMATICS	2	2	3	
<p>This course deals with the study of complex numbers, series solutions of ordinary differential equations by power series, Bessel Function, Frobenius method. Basics of Fourier series, Fourier transform, Laplace and inverse Laplace Transforms. Using MATLAB or other mathematical software in order to solve mathematical problems.</p>					
PHYS503	UNIVERSITY PHYSICS 3	2	2	3	
<p>This course is designed to explore the concepts of heat and thermodynamics, waves and optics, relativity, molecular, atomic, and nuclear physics using the concepts of mechanics, electricity and magnetism, vectors, and other mathematical models and their advanced application, such as the application of the laws of thermodynamics, light and electromagnetic waves, Einstein's special theory of relativity, Planck's Quantum theory, de Broglie's waves, Heisenberg's Uncertainty Principle, Dirac's electron theory, Hund's Rule, and atomic models from Thompson's to Quantum Mechanical, as well as nuclear models.</p>					

ENGG521	ENGINEERING MECHANICS	3	0	3	
<p>This course deals with the core theories, principles and concepts of force systems, force components, free body diagrams, vectors, resultant of force systems, moment of forces, and equilibrium of rigid bodies. It also includes critical analysis of structures, methods of analysis of trusses, and, distributed forces centroids and center of gravity, and the theory and application of friction.</p>					
ENGG522	ENGINEERING ECONOMY	3	0	3	
<p>This course deals with the advanced study of the core theories, principles and concepts of economic environment, interest and money-time relationship, depreciation, capital financing, comparing alternatives, replacement studies, break-even analysis, benefit cost ratio, and benefit cost difference. It presents mathematical techniques and practical advice for evaluating decisions in the design and operation of engineering systems.</p>					
ENGG534	ELECTRONICS 1	2	2	3	
<p>Fundamentals of semiconductors, PN junction diode, Analysis, application and design of diode circuits, Zener diode characteristics and applications, special purpose diodes. Fundamentals of Bipolar junction transistor (BJT), characteristic; amplifier types of CE, CC and CB, dc analysis and switch circuit analysis; different biasing, Multistage Amplifiers, Differential Amplifier and CMRR.</p>					
ENGG611	ELECTRIC CIRCUIT THEORY 2	2	2	3	
<p>This course deals with core theories, principles and concepts of the topics of sinusoidal voltage and current on RLC circuits, vector algebra and its application to AC circuit analysis, sinusoidal and non- sinusoidal single phase system, and three phase systems. It also covers reactance, impedance, resonance, power in AC circuits, power factor correction and impedance network. The course evaluates the theorems which includes Kirchhoff's laws, Mesh, Superposition, Nodal Analysis, Thevenin's, Norton, and Maximum power transfer.</p>					
MATH504	MULTIVARIATE CALCULUS	2	2	3	
<p>This is the third part of the course in calculus focused on vector and multi-variable calculus. Topics associated with the course demonstrate advanced knowledge and understanding of the following: vectors and vector operators, calculus of functions of several variables including partial differentiation and multiple integrals, Lagrange multipliers, applications of partial differentiation, line integrals, Green's theorem, Stoke's theorem, and Divergence theorem. The course also includes laboratory components that make use of MATLAB as a tool in solving problems in Multivariate Calculus.</p>					
MATH505	NUMERICAL METHODS AND ANALYSIS	2	2	3	
<p>This course demonstrates critical knowledge and understanding of specialist theories, principles and concepts of the study of numerical approximations and errors, numerical solutions of non-linear equations, interpolation and curve fittings, numerical differentiation and integration. The course also covers analysis of accuracy of numerical differentiation and integration methods and solution of initial value problems using Euler Method. Analysis of accuracy of Euler's method. The course also includes laboratory components that make use of MATLAB as a tool in solving problems in Numerical Analysis.</p>					

CENG611	DATA COMMUNICATION AND NETWORKING 1	2	2	3	
<p>This course provides discussion of data communications and networking. It includes a detailed discussion of the different network models, concepts that have direct effect on the efficiency of a network, network technologies, distributed computation, networking, communication software, and security issues.</p>					
ENGG535	FLUID MECHANICS	3	0	3	
<p>Fluid Mechanics deals with the study associated with details of the properties of the fluid and gas to adept the necessary Knowledge related to fluid power concepts such as the fluid properties of compressible and incompressible fluids which include viscosity, Density, bulk modulus and compressibility. The topics covered are Fluid Statics; fluid mechanics fundamentals, including concepts of mass and momentum Integral relations for control volume: Bernoulli, energy and momentum equations. Flow in pipes; laminar and turbulent flow, Reynolds number and Moody chart, laminar and turbulent boundary layer fundamentals. The learning approach is to apply engineering principles to performance analysis and prediction of simple fluid systems such as hydraulics and pneumatics.</p>					
ENGG613	ELECTRONICS 2	2	2	3	
<p>This is an advanced course in electronics which deals with concept, analysis and design of electronic circuits using linear and integrated devices. In this course include AC and DC analysis, principles and concepts of frequency response of BJT amplifier and further extends the study to multistage amplifier and various FET. The other topics include study and critical analysis of Operational Amplifier, its application, Feedback topologies &amp; explore NE555 Timer and its applications.</p>					
ENGG615	ELECTROMAGNETICS AND ELECTRICAL MACHINES	3	0	3	
<p>This course examines the core theory, characteristics, construction operation and application of static and rotating electrical machines. It includes the detailed study and analysis of direct current motors, direct current generators, AC Machines, special machines etc. The course offers a detailed understanding of the application of electromagnetic machines in the field of industry.</p>					
ENGG627	LOGIC CIRCUIT, SWITCHING THEORY AND PROGRAMMABLE LOGIC DEVICES	3	2	4	
<p>This course provides critical knowledge and understanding of designing digital logic circuits. It covers number systems and conversion, Boolean algebra, algebraic manipulation, applications of Boolean algebra, Karnaugh maps, multi-level gate circuits, multiplexers, decoders, comparators, latches and flip-flops, registers and counters, programmable logic devices. Through laboratory and in-course projects, the students will creatively implement complex applications of digital logic circuits.</p>					
MATH506	LINEAR ALGEBRA	2	2	3	
<p>This course uses specialist level skills to relate to and adapt main and core theories and concepts in the study of matrices and determinants, and their applications in numerical solutions of systems of linear equations. It also includes important topics such as linear transformations, eigenvalues and eigenvectors,</p>					

complex vectors and matrices and numerical linear algebra. In the laboratory, MATLAB is used as a mathematical software and solutions to a variety of mathematical problems are determined.

ENGG501	SAFETY ENGINEERING	2	0	2	
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This course deals with the study of the foundations of safety engineering and applications of safety principles to industrial and commercial systems. It covers topics concerning safety management, occupational health, fire prevention and control, electrical safety and environmental safety. Further, students will learn how to conduct risk analysis and some of the mitigation measures.

ENGG533	STRENGTH OF MATERIALS	3	0	3	
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This course deals with the study of the relationship between externally applied loads and their internal effects on bodies. It covers analysis of the different stresses such as normal, flexural, shear and bearing stress. It also deals with the Hooke's Law analysis, axial deformation, torsion, twisting angles, helical springs, and thin-walled cylinders as well as analysis of shear and moment in beams.

MECH610	PNEUMATICS & ELECTRO-PNEUMATICS	2	2	3	
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This course introduces the student to the knowledge base and technical skills related to industrial pneumatic and electro-pneumatic systems. Areas of study include pneumatic principles, Symbols and standards in pneumatics, components of a pneumatic system, display of motion sequences and switch states, set-up controls with relays, electrical self-latching switches, memory circuit and speed control of a cylinder, design of electro-pneumatic system, representation of motion sequences and operating status, and practical application.

ENGG614	CONTROL SYSTEMS	2	2	3	
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The course deals with the study of the concepts of control systems. It also covers the discussion of mechanical and electrical modeling using conventional differential equations, reduction rules applied to block-diagram of linear control systems and signal flow graph. Laplace and Inverse Laplace Transformations. Discussion of time-domain response of first and second order control systems, steady-state errors, Routh-Hurwitz Criterion for stability, root locus method, frequency response (bode diagram and polar plot), Nyquist stability criterion, and compensator design techniques. MATLAB is used for analyzing and simulating control systems.

MECH631	POWER ELECTRONICS	3	2	4	
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This course covers the power electronics semiconductor switches, Thruster, Triac, GTO and advanced types of power transistor. Triggering devices: UJT, DIAC, and PUT. Types of power conversion: single phase and three phase uncontrolled and controlled rectifiers and their performance. AC voltage regulator, inverters single phase and three phase with PWM techniques.

MECH633	INTRODUCTION TO FUZZY/NUERAL SYSTEM	3	2	4	
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This course deals with the core concepts and theories of Artificial Neural Networks (ANN), Perceptron networks, training methodology, and typical application to linearly separable problems, Fuzzy systems, training methods and implementation of ANN and Fuzzy systems for complex industrial applications. Students will also learn to utilize more advanced tools, features, and training methods in implementing

intelligent control systems. Higher level software programming will be used for critically analyzing, evaluating, and synthesizing the implemented fuzzy logic and neural networks systems.

MATH507	OPTIMIZATION METHODS	3	0	3	
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The course takes a unified view of optimization and covers the main areas of application of core optimization algorithms. The topics include linear optimization, robust optimization, network flows, dynamic optimization and non-linear optimization.

MECH621	LINEAR SYSTEMS	2	2	3	
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This course deals with detailed knowledge and understanding of theories for linear systems. This module develops a detailed understanding of the fundamentals of linear systems analysis and design using the state space approach. Topics covered include state space representation of systems; solution of state equations; stability analysis using Lyapunov methods; controllability and observability; linear state feedback design; and state observer. MATLAB is used for analyzing and simulating Linear systems.

MECH623	HYDRAULICS & ELECTRO-HYDRAULICS	3	2	4	
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This course deals with the core concepts and physical principles of hydraulics, circuit symbols and components of a hydraulic and Electro-Hydraulics system. It also covers the study of the components of the power supply, Hydraulic Power Generation, control valves, actuators and accessories, and the extended cylinders. Students will also learn to design and implement hydraulic and electro-hydraulic systems for complex industrial applications. Students will critically analyze, evaluate and synthesize the Electrical circuit Design including electrical components and memory Circuit, Time lag relays, Pressure Control, Speed control valve. Hands-on simulation on advanced industrial applications related to hydraulics and electro hydraulics is conducted for the students using the Festo hydraulics modules.

MECH624	PROGRAMMABLE LOGIC CONTROLLERS	3	2	4	
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The course deals with core concepts and theories of the hardware and software of Programmable logic controllers. This course also deals with programming, connecting, and testing Programmable Logic Controllers (PLCs) for control of complex industrial/commercial processes. It covers sensor interfacing, application of PLCs in some specific Industrial process, and utilization of a hand-held programmer in troubleshooting PLCs. Hands-on simulation is conducted for the students to understand the critical PLC implementation process in industry using advanced tools such as Festo PLC modules and CodeSys software.

MECH641	PROCESS INSTRUMENTATION AND CONTROL	3	2	4	
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This course deals with the core concepts and theories of industrial process control and the instrumentation used for it. It elaborates on various sensors used in the process industry and special emphasis is given on measurement sensors such as Pressure transmitter, Ultrasonic sensors, thermistors and proportional valves. Students will learn the working principle, specifications, design and selection aspects used for sensing complex process parameters, along with merits and limitations of each type of sensor. The course will also build the detailed knowledge of the participants on working principles of control loop components, control strategies, and PID controller fundamentals including terminology, algorithms and advanced methods. A special emphasis on real life implementations, case studies and international standards would ensure students to critically analyze, evaluate and synthesize with their day-to-day practice.

ENGG639	PROFESSIONAL ETHICS AND ENGINEERING LAWS	3	0	3	
<p>This course covers topics in the core theories and concepts of ethics, law, contracts, intellectual property, the responsible engineer, moral thinking, risk/safety/liability, employer responsibilities, product liability, and environmental responsibilities. The course deals with several case studies of ethical problems in engineering. It discusses the core concepts of environmental protection and sustainability to understand how they relate to engineering ethics. The course is intended to promote greater reflection by engineers on their activities to better understand the social dimensions of engineering practice. It also provides a historical perspective on society's environmental concerns, and discusses environmental statutes, our regulatory system, approaches to preventing and mitigating environmental problems, and the elements of an effective environmental management system.</p>					
MECH639	MICROCONTROLLER	2	2	3	
<p>This course provides critical knowledge and understanding of microcontroller-based systems design, development and implementation. It includes embedded system types, microcontroller architecture, programming, digital and analog I/O interfacing, task scheduling, interrupt and timers management, and communication interfaces. Through laboratory and in-course projects, the students will creatively implement complex applications of microcontroller-based systems.</p>					
MECH642	MACHINE VISION	3	2	4	
<p>This course discusses core theories, principles and concepts of machine vision devices and techniques and learns about computer vision systems and digital image processing. It also relates to fundamental issues and techniques of computer vision and image processing. Emphasis will be on physical, mathematical, image-processing, pattern recognition, and feature extraction aspects of vision. The course will have a proper lab activity to enable students to understand the breadth and depth of the lecturing materials. The main topics will be as: Machine vision concepts, Image acquisition, Lighting, Image formation, Image conversion, Image processing and analysis. Image enhancement, Edge detection and Image segmentation.</p>					
MECH643	ROBOT KINEMATICS, DYNAMICS AND CONTROL	3	2	4	
<p>This course facilitates the core learning and understanding of robot manipulators for students to understand complex design and applications of robots in industrial application. Successful completion allows students to formulate the kinematics and dynamic modelling of robotic manipulators consisting of a serial chain of rigid bodies and to implement control algorithms with sensory feedback during the lab sessions. Students will gain specialist skills in dealing with complex control architecture and manipulator structure typical to new-generation robots.</p>					
MECH644	MODULAR PRODUCTION SYSTEM	3	2	4	
<p>This course integrates core theories of mechanical design, computer control and electronic components in designing an Industrial automation system. Students will be provided with the detailed knowledge and understanding on various automation strategies, automation layouts, material handling devices used in assembly lines, automated assembly lines and computer integrated manufacturing. It discusses the step by step manner of designing, assembling, and programming a modular station based on the given system requirement. The laboratory uses Codesys software for PLC programming and advanced FESTO educational modules in simulating processes in the modular production system.</p>					

ENGG638	ENGINEERING AND PROJECT MANAGEMENT	3	0	3	
<p>This course provides critical knowledge and understanding of project management and the essential tools needed to deliver successful projects on time and on budget from the standpoint of the manager, who must skillfully organize, plan, implement and control non-routine activities to achieve schedule, budget and performance activities. Topics include project life cycles, principles and concepts of strategic management process in project selection and organization, planning, budgeting and scheduling systems. It also covers planning and control methods such as PERT- CPM, Gantt Charts, earned value techniques, project audits, and risk management to critically evaluate various project management situations.</p>					
MECH651	INDUSTRIAL ATTACHMENT	0	6	6	
<p>This 6-unit course is a practicum course where the students are exposed to an actual work environment. The students are required to complete 240 hours of on-site training. They are sent to work environments under the supervision of a practicum professor. Moreover, the students submit a report and a performance evaluation made by the on- site supervisor.</p>					
MECH652	MECHATRONICS ENGINEERING DESIGN PROJECT A	0	6	3	
<p>This is the first of two courses in Mechatronics Engineering design sequence which prepares students for engineering practice through a culminating major design experience or capstone based on the knowledge and skills acquired in foundation and core courses and incorporating appropriate engineering standards (IEEE, ISO) as an integral part and with due consideration of multiple realistic constraints tradeoffs. This is a group supervised design project in which students analyze, specify, design, construct, evaluate and adapt physical computing in various applications such as in smart environments and embedded systems. They also incorporate design standards and make decision as a result of multiple design tradeoff/constraints (economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability) analysis and evaluation as part of the design process.</p>					
MECH645	TECHNOPRENEURSHIP	3	0	3	
<p>The course deals with the study of entrepreneurship in IT industry by applying the core theories and principles of entrepreneurship and management in IT business. The course covers types of entrepreneurs, legal factors related to the project like Business act, company act, technology act and Industrial act, developing a business plan by integrating business proposal writing skill, software skills, innovation and creativity skills. It also covers advanced level topics like risk management, configuration management and quality management.</p>					
MECH661	MECHATRONICS ENGINEERING DESIGN PROJECT B	0	6	3	
<p>This course is a continuation of Mechatronics Engineering Design A (MECH652) which enables students to design a system, component, or process to meet desired needs within realistic constraints through a culminating major design experience or capstone based on the knowledge and skills acquired in foundation and core courses and incorporating appropriate engineering standards (IEEE, ISO) as an integral part and with due consideration of multiple realistic constraints tradeoffs.</p> <p>This is a group supervised design project in which students analyze, specify, design, construct, evaluate and</p>					



adapt physical computing applications in smart environments and embedded systems. They also incorporate design standards and make decisions as a result of multiple design tradeoff/constraints (economics, environmental, social, political, ethical, health and safety, manufacturability, and sustainability) analysis and evaluation as part of the design process.

MECH653A	DATA COMMUNICATION AND NETWORKING 2	2	2	3	
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This course provides an in-depth and advanced discussion of routing technology. It integrates the core theories, concepts, functions and operations of a router including the principles and applications of routing protocols. Topics include router components and configuration; Unicast and Multicast routing protocols: RIPv1, RIPv2, EIGRP, OSPF and BGP; VLSM and IPv6.

The students make use of a range of approaches including the Packet Tracer, GNS3 and the actual network devices in the laboratory in performing advanced and complex network configurations using the different routing protocols and in the critical analysis of network requirements, issues and/or problems.

MECH653D	DIGITAL CONTROL SYSTEMS	2	2	3	
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Introduction to Digital Control, Discrete-Time Systems ( Difference equations, The z-transform, z-Transform solution of difference equations, The time response of a discrete-time system, The modified z-transform, The sampling theorem), Modeling of Digital Control Systems, Stability of Digital Control Systems, Digital Control System Design ( z-Domain root locus, Digital implementation of analog controller design, Direct z-domain digital controller design, Frequency response design, Direct control design), Discrete-time State-Space Representation, The solution of linear state-space equations, The transfer function matrix, Stability of state-space realizations, Controllability and stabilizability, Observability and detectability, Detectability, State-space realizations, State Feedback Control, Pole placement, State estimation, Observer state feedback, Optimal control, The linear quadratic regulator.

MECH653C	SYSTEM MODELING AND SIMULATION	2	2	3	
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This course examines core theories and principles of engineering system modeling and simulation methods, as well as numerical and computer-based solution techniques utilized in industrial and engineering environments. Techniques for finding solutions to these systems include graphical, algebraic, numerical, state space, simulation and computational processes. Case studies in industry and engineering applications are used to illustrate the techniques and modeling concepts. Examples of simulation and analysis methods will be related to the linear and non-linear, deterministic and non-deterministic systems.

MECH662A	WIRELESS COMMUNICATIONS	2	2	3	
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This course aims to develop the core knowledge of communications theories and their applications in digital communications. The course covers the structure of the digital communication systems, analog modulation technique, digital modulation techniques, probability of error in digital communication system, multiple access techniques, channels and source encoding, mobile communication systems.

MECH662D	POWER PLANT	2	2	3	
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The course deals with the major systems and components practice related to power plan to generate electrical power such as Boiler, Turbine, Condenser and pumps. The topics covered are thermodynamic

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cycles; ranking cycle modified Rankin cycle with re-heater and feed water heater, also steam, gas and combined cycle power plant are covered. This course required the student to integrate all these topics to analyze and design the deferent type of power plant systems and components.

MECH662C	DIGITAL SIGNAL PROCESSING	2	2	3	
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The course deals with the detailed study of the core theories, principles and concepts of digital signal processing; discrete convolution; Z-transform; sampled data system; digital filters; discrete Fourier transforms; fast Fourier transforms. DSP Applications. Introduction of 2-D signal (image) processing. This course is designed to provide students with a comprehensive treatment of the important issues in design, implementation and applications of digital signal processing theory and algorithm. Further, computer simulation exercises are intended to familiarize the student with implementation aspects and the application of theoretical knowledge to practical problems.