PROGRAM COURSE STRUCTURE AND TOTAL CREDIT REQUIREMENT BACHELOR OF MECHANICAL ENGINEERING (ZK08)

Total credit required for graduation is listed in table below. The duration of study to be completed is long 8 semesters and 1 short semester. Courses need to be taken are described in the following section.

COURSE	CREDIT
University Courses: i. University Core ii. University Elective	 24 6
Program Core Courses: i. Program Core ii. Faculty Core	 81 20
Program Elective Course (Technical Specialization)	9
TOTAL CREDIT FOR GRADUATION	**140**

PROGRAM CORE COURSES

CODE	COURSE	CREDIT	PRE-REQUISITE	PRE-STATUS
EMM 3313	Engineering Mechanics (Statics)	3		
EMM 3323	Dynamics	3	EMM 3313	MP
EMM 3463	Materials Engineering	3		
EMM 3423	Strength of Materials I	3	EMM 3313	MP
EMM 3433	Strength of Materials II	3	EMM 3423	MP
EMM 3533	Mechanics of Machines	3	EMM 3323	MP
EMM 3543	Vibration	3	EMM 3323	MT
EMM 3443	Thermodynamics I	3		
EMM 3513	Thermodynamics II	3	EMM 3443	MP
EMM 3593	Heat Transfer	3	EMM 3513	MT
EMM 3453	Fluid Mechanics I	3		
EMM 3523	Fluid Mechanics II	3	EMM 3453	MP
EMM 3623	Computer Aided Engineering (CAE)	3		
EEE 3352	Introduction to Electrical Engineering	2		
EEE 3362	Electronics	2		
EMM 3552	Instrumentation	2		
EMM 3563	Control Engineering	3	EMM 3323 EEE 3362 EFA 3213	MT MT MT
EMM 3333	Mechanical Engineering Drawing	3		
EMM 3573	Mechanical Engineering Design	3	EMM 3433 EMM 3533	MT MT
EML 3512	Mechanical Engineering Laboratories	2		
EML 3522	Advanced Mechanical Engineering Laboratories	2	EML 3512	MT
EMM 3633	Capstone Project	3	EMM 3573	MT
EMM 3341	Workshop Practice	1		
EMM 3583	Manufacturing Technology	3		
EMM 3594	Industrial Training	4		
EMM 3642	Engineering Management	2		
EMM 3652	Engineers in Society	2		
EMM 3662	Operations Management	2		
EMT 3612	Final Year Project I	2	EMM 3433 EMM 3513 EMM 3523 EMM 3533 EMM 3573	MT MT MT MT MT
EMT 3624	Final Year Project II	4	EMT 3612	MP

PROGRAM ELECTIVE COURSES (TECHNICAL SPECIALIZATION)

CODE	COURSE	CREDIT
EME 3713	Composite Materials	3
EME 3723	System, Structure and Dynamics of Ground Vehicles	3
EME 3733	Turbomachinery	3
EME 3743	Non-Destructive Testing	3
EME 3753	Air-Conditioning & Refrigeration	3
EME 3763	Energy Efficient Buildings	3
EME 3773	Aerodynamics	3
EME 3783	Combustion	3
EME 3793	Turbocharging	3
EME 3803	Machine Learning and Artificial Intelligence	3

PROGRAM CURRICULUM STRUCTURE
BACHELOR OF MECHANICAL ENGINEERING (ZK08)

FIRST YEAR							
SEMESTER 1				SEMESTER 2			
CODE	COURSE	CREDIT	PRE-REQUISITE	CODE	COURSE	CREDIT	PRE-REQUISITE
University Core Courses							
DUS 3012	Military History	2	-	MPU 3132	Appreciation of Ethics and Civilisation	2	-
MPU 3142	Philosophy and Current Issues	2	-	DUM 3022	Military Leadership	2	-
LLE 3012	English for Academic Writing	2	-				
University Elective Courses							
PLS 3111	PALAPES **	1**	-	QKX 3XX2 / ALK 3112 / PLS 3121	Co-Curriculum / General Military Training 1* / PALAPES **	2 / 2* / 1**	-
Faculty Core Courses							
EFA 3253	Engineering Mathematics I (Calculus III)	3	-	EFA 3213	Engineering Mathematics II (Differential Equation)	3	-
EFB 3212	Introduction to Engineering	2	-				
Program Core Courses							
EEE 3352	Introduction to Electrical Engineering	2	-	EEE 3362	Electronics	2	-
EMM 3341	Workshop Practice	1	-	EMM 3333	Mechanical Engineering Drawing	3	-
EMM 3313	Engineering Mechanics (Statics)	3	-	EMM 3323	Dynamics	3	+EMM 3313
TOTAL		**17/17*/18****		**TOTAL**		**17/17*/16****	

Civillian Student
* Cadet Officers
** PALAPES
+ Must pass
# Must taken

SECOND YEAR							
SEMESTER 3				SEMESTER 4			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**	**CODE**	**COURSE**	**CREDIT**	**PRE-REQUISITE**
University Core Courses							
DUS 3022	Introduction to Strategic Studies	2	-	MPU 3312	Nationhood in World Politics	2	-
				LLE 3022	English for Oral Communication	2	-
University Elective Courses							
QKX 3XX2 / ALK 3122 / PLS 3131	Co-Curriculum / General Military Training 2 * / PALAPES **	2 / 2* / 1**	-	QKS 3172/ PLS 3141	Unarmed Combat*/ PALAPES **	2*/1**	-
Faculty Core Courses							
EFA 3233	Engineering Mathematics III (Complex Variable and Vector)	3	-	EFA 3223	Engineering Mathematics IV (Statistics)	3	-
EFC 3223	Computing I (C and C++)	3	-	EFC 3213	Computing II (Numerical Methods and Engineering Software)	3	-
Program Core Courses							
EMM 3423	Strength of Materials I	3	+EMM 3313	EMM 3433	Strength of Materials II	3	+EMM 3423
EMM 3443	Thermodynamics I	3	-	EMM 3453	Fluid Mechanics I	3	-
EMM 3463	Materials Engineering	3	-				
TOTAL		**19/19*/18****		**TOTAL**		**16/18*/17****	

Civillian Student
* Cadet Officers
** PALAPES
+ Must pass
# Must taken

THIRD YEAR							
SEMESTER 5				SEMESTER 6			
CODE	COURSE	CREDIT	PRE-REQUISITE	CODE	COURSE	CREDIT	PRE-REQUISITE
University Core Courses							
LLF 3XX1	Foreign Language I	1	-	LLF 3XX1	Foreign Language II	1	-
LLA 3XX1	Foreign Language I	Audit	-	LLA 3XX1	Foreign Language II	Audit	-
MPU 3412 or MPU 3422	Human Movement Science or Community Service	2	-				
University Elective Courses							
QKX 3XX2 / PLS 3151	Co-Curriculum / PALAPES **	2 / 1**	-	PLS 3161	PALAPES **	1**	-
Program Core Courses							
EML 3512	Mechanical Engineering Laboratories	2	-	EML 3522	Advanced Mechanical Engineering Laboratories	2	#EML 3512
EMM 3583	Manufacturing Technology	3	-	EMM 3573	Mechanical Engineering Design	3	#EMM 3433 #EMM 3533
EMM 3513	Thermodynamics II	3	+EMM 3443	EMM 3593	Heat Transfer	3	#EMM 3513
EMM 3523	Fluid Mechanics II	3	+EMM 3453	EMM 3563	Control Engineering	3	#EMM 3323 #EEE 3362 #EFA 3213
EMM 3533	Mechanics of Machines	3	+EMM 3323	EMM 3543	Vibration	3	#EMM 3323
				EMM 3552	Instrumentation	2	-
TOTAL		**19/17*/18****		**TOTAL**		**17/17*/18****	

* Cadet Officers + Must Pass
** PALAPES # Must Taken

THIRD YEAR			
INTER – SESSION			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**
EMM 3594	Industrial Training	4	Passed 60 credit hours
TOTAL		**4**	

FOURTH YEAR							
SEMESTER 7				**SEMESTER 8**			
CODE	**COURSE**	**CREDIT**	**PRE-REQUISITE**	**CODE**	**COURSE**	**CREDIT**	**PRE-REQUISITE**
University Core Courses							
DUS 3032	Military Law and Laws of Armed Conflict	2	-	MPU 3212	Basic Entrepreneurship	2	-
Program Core Courses							
EMT 3612	Final Year Project I	2	#EMM 3433 #EMM 3513 #EMM 3523 #EMM 3533 #EMM 3573	EMT 3624	Final Year Project II	4	+EMT 3612
EMM 3633	Capstone Project	3	+EMM 3573	EMM 3652	Engineers in Society	2	-
EMM 3662	Operations Management	2	-	EMM 3642	Engineering Management	2	-
EMM 3623	Computer Aided Engineering	3	-				
Program Elective Courses							
EME 3XX3	Elective I	3	-	EME 3XX3	Elective II	3	-
				EME 3XX3	Elective III	3	-
TOTAL		**15**		**TOTAL**		**16**	

Civillian Student
* Cadet Officers
** PALAPES
+ Must pass
# Must taken

SYNOPSIS OF CORE COURSES PROGRAM
BACHELOR OF MECHANICAL ENGINEERING PROGRAM (ZK08)

COURSE CODE : EMM 3313
COURSE NAME : ENGINEERING MECHANICS (STATICS)
MEKANIK KEJURUTERAAN (STATIK)

3 Credit Hours
Pre-requisite : None

Course Synopsis

Statics is the study of methods for quantifying the forces between bodies. This course introduces the concepts of engineering based on forces in equilibrium and the importance of free body diagram in analysis of forces on simple objects, structures joined by engineering connections, basic machines, frames and trusses, friction, centre of gravity on rigid body and moment of inertia. Newtonian method is used to find solution for equilibrium of particles and rigid body with an applications of algebra, trigonometry and many key physics concepts. Students will undergo selected laboratory experiments to strengthened understanding on basic mechanics. The course will promote conceptual understanding and problem solving skills of basic engineering mechanics problems.

Course Outcomes

At the end of the course students should be able to:

1. Describe basic principles and theories related to statics based on 2-D and 3-D force system in equilibrium.
2. Solve problems on statics based on 2-D and 3-D force system including center of gravity using principle of equilibrium of rigid bodies.
3. Analyze simple engineering problems related to 2-D and 3-D force system.
4. Analyze the mechanics of rigid bodies in statics experimentally.
5. Function effectively as individual and as team member in conducting experimental work.

Reference

1. Hibbeler R.C, Engineering Mechanics Statics, 14th Edition in SI Units, Pearson, 2016.

COURSE CODE : EMM 3323
COURSE NAME : DYNAMICS
DINAMIK

3 Credit Hours
Pre-requisite : Engineering Mechanics (Statics) EMM 3313

Course Synopsis

This course is a continuation of EMM 3313. It deals with further topics in the field of Engineering Mechanics, covering the broad subfield of Dynamics. The course covers the principles of kinematics and kinetics of particles and rigid bodies in planar motion. Students are required to undergo selected laboratory experiments related to the course.

Course Outcomes

At the end of the course students should be able to:

1. Analyze the displacement, velocity and acceleration of moving particles and rigid bodies using kinematics method.
2. Analyze the kinetics of particle and rigid body motion using Newton's Law of motion, Work-Energy and Impulse-Momentum principle as well as concept of mass moment of inertia.
3. Analyze kinetics of rigid bodies experimentally.
4. Function effectively as individual and as team member in conducting experimental work.

Reference

1. Hibbeler R.C, 2016. Engineering Mechanics Dynamics SI 14th Edition, Pearson Prentice-Hall, Inc.

COURSE CODE : EMM 3463
COURSE NAME : MATERIALS ENGINEERING
KEJURUTERAAN BAHAN

3 Credit Hours
Pre-requisite : None

Course Synopsis

This subject introduces the basic principles of materials engineering covers introduction to engineering materials, interatomic bonding, crystalline structure, phase diagrams stressing the relationship between internal structures to mechanical properties, material processing on properties and the selection of materials for design Explanation on different types of engineering material, its mechanical properties, basic applications and processing are also included.

Course Outcomes

At the end of the course students should be able to:

1. Explain individual atom as well as inter-atomic bonding, crystal structure of solids, phase transformation and interpret phase diagram.
2. Explain the characteristics, structure, properties and processing of metal, ceramic, polymer and composite materials.
3. Apply properties of engineering materials to select and specify suitable materials to meet specific application.
4. Analyze materials properties experimentally.
5. Function effectively as individual and as team member in conducting experimental work.

References

1. Shakelford, J.F., 2016, Introduction to Materials Science for Engineers, 8th Ed., Pearson.
2. Callister, W.D., 2015, Materials Science and Engineering, 9th Ed., John Wiley & Sons.

COURSE CODE : EMM 3423
COURSE NAME : STRENGTH OF MATERIALS 1
KEKUATAN BAHAN 1

3 Credit Hours
Pre-requisite : Engineering Mechanics (Statics) EMM 3313

Course Synopsis

This course will provide students with the knowledge on material strength based on the study of mechanics on stress, strain, torsion and bending and its effects on rigid bodies. Among rigid body structures that will be emphasized in this course are shaft, bar, pin, bolt, beam and etc. The study of various types of loadings such as to axial loadings, transverse loadings and torsions which will cause deformations in rigid bodies. The study will only cover the effect of various loads on rigid bodies within its elastic limit. At the end of the course, students should be able to calculate the stress, strain and the deformation of structures caused by the different types of loading conditions. Students should also be able to solve limited complex problems related to statically determinate and indeterminate structures.

Course Outcomes

At the end of the course students should be able to:

1. Describe basic principles and theories related to stresses, strains and deformation of structures caused by various types of loading such as axial load, transverse load and torsional load.
2. Solve problems on stresses, strains and deformation of structures caused by various types of loading such as axial load, transverse load and torsional load.
3. Analyze engineering problems related to stresses, strains and deformation of structures caused by various types of loading such as axial load, transverse load and torsional load.
4. Analyze the mechanics of stress, strain and bending of structures experimentally.
5. Function effectively as individual and as team member I conducting experimental work.

References

1. Hibbeler R.C., Mechanics of Materials, 10th Ed., Pearson, 2017.
2. Beer, F.P., Johnston, E.R. and DeWolf, J.T., Mechanics of Materials, 5th Edition, Singapore: McGraw-Hill Higher Education.

COURSE CODE : EMM 3433
COURSE NAME : STRENGTH OF MATERIALS II
KEKUATAN BAHAN II

3 Credit Hours
Pre-requisite : Strength of Material I EMM 3423

Course Synopsis

The course is an extension to EMM 3423, which is the pre-requisite to this course. It aims to extend the student's knowledge and understanding of the behavior of materials and structures under a variety of loading conditions. It will examine 2D and 3D stress and strain, multi-axial elastic constitutive relations, failure criteria and thick and thin cylindrical structures. The course will also provide an opportunity to investigate structural behaviors such as determinate and indeterminate analyses for displacement by using the energy method. At the end of the course, students should be able to solve problems in plane stress, plane strain, torsion and bending. Besides, they should be able to determine the stresses, strains and displacements of structures. They should also be able to evaluate failure modes of structures and components. The aspect of designing safe components and structures shall also be emphasized to the students.

Course Outcomes

At the end of the course students should be able to:

1. Describe/derive the principles/theories in relation to stresses, strains of structures.
2. Analyse and solve problems on stresses and strains of structures under various types of loading.
3. Design simple structures for complex stresses and strains conditions.

References

1. Beer, F.P., Johnston, E.R. and DeWolf, J.T., Mechanics of Materials, 11th Edition, McGraw-Hill Higher Education, 2016.
2. Gere, J.M. and Goodno, B.J., Mechanics of Materials, 9th edition, Cengage Learning, 2016
3. Hibbeler, R.C. Mechanics of Material, 12th Edition, Singapore: Prentice Hall, 2016.

COURSE CODE : EMM 3533
COURSE NAME : MECHANICS OF MACHINES
MEKANIK MESIN

3 Credit Hours
Pre-requisite : Dynamics EMM 3323

Course Synopsis

This course emphasizes the application of velocity diagram and acceleration diagram in analysing kinematics of linkage mechanism. Analytical approach is used to solve kinetics of planar mechanism problem. Application of principles of dynamics in analysis of gear system, belt drive, flywheel and balancing of masses are also explored. Extension of principles of dynamics to simple harmonic motion of single degree freedom is also presented.

Course Outcomes

At the end of the course students should be able to:

1. Analyse the kinematic and kinetics on selected mechanism in machinery.
2. Evaluate kinematics and kinetics in machinery using suitable engineering tools.

Reference

1. Mahmoud A. Mostafa. Mechanics of Machinery. CRC Press, 2012.
2. William L. Cleghorn, Nikolai Dechev. Mechanics of Machines. Oxford University Press, 2015.
3. Ilie Talpasanu, Alexandru Talpasanu. Mechanics of Mechanisms and Machines. CRC Press, 2019.

COURSE CODE : EMM 3543
COURSE NAME : VIBRATION
GETARAN

3 Credit Hours
Pre-requisite : Taken Dynamics EMM 3323

Course Synopsis

This subject introduces the concept of modeling and analysis of lumped parameter and simple distributed parameter system, stressing the importance of natural frequencies and mode shape. The control and suppression of vibrations and/or their effect for simple systems are also explored. It also covers experimental work in vibration testing and measurements.

Course Outcomes

At the end of the course students should be able to:

1. Sketch a simplified model of vibratory system.
2. Formulate an analytical model for a simplified vibratory system.
3. Evaluate the model for the associated mode shapes.
4. Evaluate the techniques used in vibration control.
5. Perform vibration test and measurement.
6. Function effectively as individuals and as team member in conducting experimental work.

References

1. S.S. Rao, “Mechanical Vibration” SI Edition (2005), Prentice-Hall.
2. W T Thompson, Dahleh, “Theory of Vibration with Application” 5th Edition, Prentice – Hall.

COURSE CODE : EMM 3443
COURSE NAME : THERMODYNAMICS I
TERMODINAMIK I

3 Credit Hours
Pre-requisite : None

Course Synopsis

This course begins with the identification of the unique vocabulary associated with thermodynamics through the precise definition of basic concepts to form a sound foundation for the development of the principles of thermodynamics. Students are introduced to the first law of thermodynamics, energy balances and mechanism of energy transfer to or from a system. Various forms of energy and energy transfer are considered which a general relation for the conservation of energy principle or energy balance is developed. Procedures for determining thermodynamics properties of pure substances from tables of property data are demonstrated. The general energy balance relation to closed systems is applied which extends the energy analysis to systems involving mass flow across their boundaries. Students are then introduced to the second law of thermodynamics and applied it to cycles, cyclic devices and processes, which lead to the definition of entropy.

Course Outcomes

At the end of the course students should be able to:

1. Explain basic principles, definitions and theories of the laws of thermodynamics.
2. Apply the principle of thermodynamic in obtaining other thermodynamics properties.
3. Analyze engineering thermodynamics problems related to the laws of thermodynamics.
4. Analyze engineering thermodynamics experimentally.
5. Function effectively as individual and as team member in conducting experimental work.

References

1. Yunus A. Cengel and Michael A. Boles, 2019. Thermodynamics - An Engineering Approach, 9th Edition in SI Units, McGraw-Hill.
2. Yunus A. Cengel and Michael A. Boles, 2015. Thermodynamics - An Engineering Approach, 8th Edition in SI Units, McGraw-Hill.
3. T.D. Eastop & A. McConkey, Applied Thermodynamics for Engineering Technologists, 5th Edition: Pearson Education.

COURSE CODE : EMM 3513
COURSE NAME : THERMODYNAMICS II
TERMODINAMIK II

3 Credit Hours
Pre-requisite : Thermodynamics I EMM 3443

Course Synopsis

This course is designed to extend the student's understanding of the first and second law of thermodynamics. It illustrates the broad application of the theory to many engineering applications. It emphasizes the analysis of compression process, energy transfers during power generation, heating and refrigerating processes. At the end of the course, students should be able to apply the thermodynamic concepts and perform calculations to evaluate the performance of positive displacement machine, gas and vapor power cycles and the performance of refrigeration and heat pump cycles. The students should be able to perform a thermodynamic analysis of gas-vapor mixtures. The students should also be able to define, analyze and evaluate exergy engineering devices in light of the second law of thermodynamics.

Course Outcomes

At the end of the course students should be able to:

1. Explain the thermodynamic engineering cycles.
2. Analyze the thermodynamic engineering cycles.
3. Evaluate thermodynamic engineering cycles.
4. Investigate the real situations of the thermodynamic engineering cycles.
5. Function effectively as individual and as team member in work team

References

1. Yunus A.Cengel, Michael A.Boles and Mehmet Kanoglu, 2019. Thermodynamics - An Engineering Approach, 9th Edition in SI Units, McGraw-Hill.
2. Moran, M.J. and Shapiro, H. N., 2004. Fundamentals of Engineering Thermodynamics, Fifth Edition. New Jersey: John Wiley & Sons
3. Eastop, T.D. and McConkey, A., Applied Thermodynamics for Engineering Technologists, Fifth Edition Pearson Education.

COURSE CODE : EMM 3593
COURSE NAME : HEAT TRANSFER
PEMINDAHAN HABA

3 Credit Hours
Pre-requisite : Taken Thermodynamics II EMM 3513

Course Synopsis

This course introduces the basic principle and fundamental of heat transfer. It covers various modes of heat transfer such as conduction, convection and radiation. Thermal analysis on extended surfaces (fins) and heat exchanger (LMTD and Effectiveness – NTU methods) are also included in this course.

Course Outcomes

At the end of the course students should be able to:

1. Explain the concepts of heat transfer in engineering applications.
2. Analyze heat transfer related to engineering problems in conduction, convection and radiation.
3. Evaluate heat exchanger related to engineering applications.

References

1. Yunus A. Cengel and A. J. Ghajar, Heat and Mass Transfer, Fundamentals and Applications, 5th edition in SI Units. McGraw-Hill, Singapore, 2015.
2. F. P. Incropera, D.P. Dewitt. T.L.Bergman, A.S. Lavine, Principles of Heat and Mass Transfer, John Wiley & Sons; 7th edition, Singapore, 2013.

COURSE CODE : EMM 3453
COURSE NAME : FLUID MECHANICS I
MEKANIK BENDALIR I

3 Credit Hours
Pre-requisite : None

Course Synopsis

This course will provide students with an understanding of the fluid properties, an introduction to fundamental laws and description of fluid behaviour either in static and dynamic. It will emphasize on the concept of gauge and absolute pressure and calculating of a hydrostatic force due to immersed of flat and curved surfaces, floatation and buoyancy analysis. Flow and pressure measurements by using fluid manometer. Derivation and application of a continuity, momentum, and energy equations such as Euler and Bernoulli in the flow problems. Friction due to flow in pipe for turbulent and laminar conditions. Dimensional analysis and similarities will be introduced at the end of the course. At the end of the course, the student should be able to demonstrate an ability to analyse whether statically, dynamically or kinematically problems related directly to fluids.

Course Outcomes

At the end of the course students should be able to:

1. Explain basic principles, definitions and theories in all topics as given in the lecture contents and syllabus.
2. Apply the principle of fluid mechanics in solving related problems.
3. Analyze fluid mechanics problems in related topics.
4. Analyze fluid mechanics problems experimentally.
5. Function effectively as individual and as team member in conducting experimental work.

Reference

1. Yunus A. Chengel. & J. M. Cimbala, Fluid Mechanics Fundamental and Applications, McGraw Hill International Edition, 4rd Edition in SI Units, 2018.

COURSE CODE : EMM 3523
COURSE NAME : FLUID MECHANICS II
MEKANIK BENDALIR II

3 Credit Hours
Pre-requisite : Fluid Mechanics I EMM 3453

Course Synopsis

This course will further enhance the basic fluid mechanics knowledge and application to the real engineering fluid problems. Importance of ideal fluid flow in fluid modeling and analysis of boundary layer flow in engineering problems are among the main topics in this course. Besides that, a flow analysis and basic design of hydraulic turbo machine such as centrifugal pump and turbine are also discussed. Finally, the introduction to compressible flow was introduced. However, the course will cover up to an isentropic flow problem only.

Course Outcomes

At the end of the course students should be able to:

1. Apply the principles and theories in Boundary Layers and Ideal flow, Compressible Flow, Pumps and Turbines.
2. Analyze the problems related to Boundary Layers, Ideal flow, Compressible Flow, Pumps and Turbines.
3. Investigate real engineering problems related to pumps and turbines selection.
4. Communicate the findings in real engineering problem investigations related to pumps and turbines.

References

1. Yunus A. Chengel. & J.M. Cimbala, Fluid Mechanics Fundamental and Applications, McGraw Hill International Edition, 4rd Edition in SI Units, 2018.
2. Fluid Mechanics II note by W.A.Wan Mat, 2017.

COURSE CODE : EMM 3623
COURSE NAME : COMPUTER AIDED ENGINEERING
KEJURUTERAAN BERBANTUKAN KOMPUTER

3 Credit Hours
Pre-requisite : None

Course Synopsis

This course presents the fundamental concepts and techniques for the application of computer–aided engineering tools in solving basic engineering problems. The methods learned in this course can be applied to almost any engineering field, or form a basis for further research and study in computer-aided engineering field. This course includes theoretical and practical components and is intended to provide the student with a good foundation of CAE techniques in Finite Element Analysis (FEA) and Computational Fluid Dynamics (CFD). Upon completion of the course, (1) students will have the basic theory of FEA and CFD and (2) hands-on experience to design and perform simulation analysis using commercial FEA/CFD software packages to solve engineering problems.

Course Outcomes

At the end of the course students should be able to:

1. Formulate the basic equations of finite element method and finite volume method for simple one- and two-dimensional element models.
2. Apply the basic finite element analysis and computational fluid mechanics to model and analyze simple real engineering problems, by hand calculation, and then interpret the results.
3. Make use of available finite element and computational fluid dynamics software to solve real-life engineering problems, especially those of the structural mechanics type, and correctly interpret the results obtained.

References

1. Dante, A.W., "Introduction to Computational Fluid Dynamics", Cambridge University Press, 2012.
2. Chandrupatla T.R and Belegundu A.D, Introduction to Finite Elements in Engineering, 4th edition, Prentice Hall Inc., 2011.
3. Saeed Moaveni, Finite Element Analysis: Theory and Applications with ANSYS, 4th Ed., ISBN Prentice Hall, 2015.

COURSE CODE : EEE 3352
COURSE NAME : INTRODUCTION TO ELECTRICAL ENGINEERING
PENGENALAN KEPADA KEJURUTERAAN ELEKTRIK

2 Credit Hours
Pre-Requisite : None

Course Synopsis

This is an introduction course for students who are not majoring in electrical and electronics engineering. It mostly covers the basics of circuit theories, the application aspects of transformers and electric machineries. In the circuit theory part, various analysis methods like, Ohm's Law, Kirchhoff's Law, Thevenin's Theorem, Norton's Theorem, etc will be taught. Inductive and capacitive elements would also be included. Some theory on magnetic circuit and transformer functionality will also be given. For the introductory material on electric machinery, the students will be taught about magnetic circuits, AC and DC motors and generators and various aspects of energy conversion involving the devices.

Course Outcomes

At the end of the course students should be able to:

1. Understand the basic theories of electric and magnetic circuits, and electric machines.
2. Apply the above concepts to solve problems on the electric and magnetic circuits, and electric machines.
3. Analyze the circuits involving electric and magnetic circuits, and electric machines.

References

1. Giorgio Rizzoni, "Fundamentals of Electrical Engineering", McGraw Hill, 2009.
2. Alexander and Sadiku, Fundamentals of Electric Circuits, 6th ed. McGraw Hill, 2016.
3. Thomas L. Floyd, "Electronic Devices", 9th Edition, Pearson Education 2012.

COURSE CODE : EEE 3362
COURSE NAME : ELECTRONICS
ELEKTRONIK

2 Credit Hours
Pre-requisite : None

Course Synopsis

This is an introduction of Electronics field to Mechanical Engineering based programs. It covers the fundamental and basic topics in both analog and digital electronics combined, with emphasis towards the applications. This course is divided into 3 parts; namely analogue electronics, digital electronics and microcontrollers. In analogue electronics, it covers the fundamental properties of operational amplifier along with its characteristics and applications. In digital electronics, it covers on the digital devices, its essential features of digital logic circuits and systems used in applications. Overall, this course is devoted to an overview of the basic functions of microcontroller, including the architectures, applications and assembly language.

Course Outcomes

At the end of the course students should be able to:

1. Understand the fundamental properties of analog and digital circuits, and microcontroller.
2. Apply the above concepts to solve problems involving analog and digital circuits, and microcontroller.
3. Analyze the circuits of analog and digital circuits, and microcontroller.

References

1. Giorgio Rizzoni, Principles and Applications of Electrical Engineering, 6th Edition, McGraw Hill 2015.
2. Thomas. L. Floyd, Electronic Devices, 9th Edition, Pearson Education 2012.

COURSE CODE : EMM 3552
COURSE NAME : INSTRUMENTATION
INSTRUMENTASI

2 Credit Hours
Pre-requisite : None

Course Synopsis

The course shall cover the essentials and basic theory of instrumentation for undergraduate students. It will emphasize on the concepts, principles and characteristics of instrumentation system signal conditioning, transducers and application of strain gauges in load measurements. At the end of the course, students should be able to acquire knowledge on the fundamentals of an instrumentation system, relate and describe the operating principle and application of various transducers that are typically used in industry, design instrumentation system for measuring load, displacement, temperature and other physical quantities, select suitable instrumentation components and tools for intended application and solve problems related to basic instrumentation system.

Course Outcomes

At the end of the course students should be able to:

1. Describe the basic principles of an instrumentation system.
2. Relate the operating principle and application of various transducers with suitable signal conditioning system.
3. Solve and analyze problems related to an instrumentation system.
4. Develop an instrumentation system for measuring load, displacement, temperature and other physical quantities.
5. Function effectively as individual and as team member in conducting experimental work.
6. Develop a simple instrumentation system for a transducer using electric and electronics equipments.

References

1. C. D. Johnson, Process Control Instrumentation Technology, 8th edition, Pearson, 2014.
2. Northrop, Robert B. Introduction to Instrumentation and Measurement. CRC Press, 2018.
3. Anthony J.Wheeler & Ahmad R Ghanji, Introduction to Engineering Experimentation, 3rd edition, Pearson, 2010.
4. D.G. Alciatore & M. B. Histand, Introduction to Mechatronics and Measurement Systems, 5th edition, McGraw-Hill, 2018.

COURSE CODE : EMM 3563
COURSE NAME : CONTROL ENGINEERING
KEJURUTERAAN KAWALAN

3 Credit Hours
Pre-requisite : Taken Dynamics EMM 3323, Electronics EEE 3362, Engineering Mathematics II EFA 3213

Course Synopsis

This course is designed to enable the students to acquire the essential and basic theory of control engineering for open and closed loop system. The topics covered would be mathematical modeling of dynamic systems, transfer function, time response analysis, stability criteria, root locus and frequency response methods. The course will also provide students with an exposure to basic control system design. Engineering tool for control simulation (Matlab - Simulink) will be introduced in this course.

Course Outcomes

At the end of the course students should be able to:

1. Describe the basic principles and main components of control system.
2. Build the mathematical model, block diagram, signal flow graph and its equivalence transfer function for a given control system.
3. Analyze the time responses and the stability of control system.
4. Design a simple control system according to the required specifications.
5. Develop a simple plant model or control system using Matlab-Simulink.

References

1. Hishamuddin Jamaluddin, Mohd ShafiekYaacob and Robiah Ahmad, Introduction to Control Engineering, 1st Edition, UTM Press, 2011.
2. N.S. Nise, Control System Engineering, 8th edition, JohnWiley & Sons,Inc. 2019.
3. K.Ogata, Modern Control Engineering, 5th Ed. Prentice Hall, 2010.

COURSE CODE : EMM 3333
COURSE NAME : MECHANICAL ENGINEERING DRAWING
LUKISAN KEJURUTERAAN MEKANIKAL

3 Credit Hours
Pre-requisite : None

Course Synopsis

This course provides students with the knowledge on standard engineering drawing techniques. It consists of two main parts: conventional practices and computer aided design (CAD) approach. The topics covered are code and engineering standards, sketching and text, mechanical engineering geometry, orthographic, isometric, oblique, and sectional and assembly drawings, threads, fasteners and springs and geometry dimensioning and tolerance. With these knowledge, students are able to produce a standard and well-defined mechanical engineering drawing using not only the conventional practices but also in the CAD environment.

Course outcomes

At the end of the course students should be able to:
1. To apply fundamentals and conventional practices in creating mechanical engineering drawing.
2. To apply CAD system in creating mechanical engineering drawing.
3. To create a standard and well-defined mechanical engineering drawing.

References

1. Goetsch, D.L., Chalk, W.S, Nelson, J.A. & Rickman R.L, Technical Drawing and Engineering Communication, 7th Ed. Delmar Cengage Learning, 2016.
2. Alejandro Reyes, 2019, Beginner's Guide to Solidworkds 2019 Lebal 1, 1st edition, SDC Publications

COURSE CODE : EMM 3573
COURSE NAME : MECHANICAL ENGINEERING DESIGN
REKABENTUK KEJURUTERAAN MEKANIKAL

3 Credit Hours
Pre-requisite : Taken Strength of Materials II EMM 3433 and Mechanics of Machines EMM 3533

Course Synopsis

This course is intended for students to embark on the introduction to mechanical design. The approach is by developing understanding of mechanical components design using the fundamental applications of statics, mechanics of materials, material science, and failure criterion. Common components such as shafts, gears, bearings, bolts and mechanical joints are covered in detail. Computational tools for engineering are also applied. The course covers three main parts: the basic of machine design, failure prevention under static and variable loading and design process and analysis of common mechanical components.

Course Outcomes

At the end of the course students should be able to:

1. Develop a mechanical system to fulfill design specification.
2. Apply failure criteria to select commercially available components and materials based on design requirements.
3. Utilise computer-aided engineering tools in design process.
4. Conduct project and perform tasks individually and in a team.

References

1. Budynas, R.G. & Nisbett, J. K., Shigley's Mechanical Engineering Design, 11th. Edition. McGraw-Hill, 2019.
2. Ugural, A.C., Mechanical Design of An Integrated Approach, International Edition, McGraw Hill, 2009.

COURSE CODE : EML 3512
COURSE NAME : MECHANICAL ENGINEERING LABORATORIES
MAKMAL KEJURUTERAAN MEKANIKAL

2 Credit Hours
Pre-requisite : None

Course Synopsis

This course enables students to have hands-on experience in conducting experimental works related to engineering theories learnt in the classes. The laboratory activities involved are divided to Thermodynamic, Fluids, Strength and Materials. Overall, students are required to complete all these activities with minimum supervision from the lecturers. The laboratory activity started with 1 hour lectures and followed by 2 hour laboratory work per week. The laboratory activities given to the students are based on open-ended concept. The lab manual/sheets given to the students comprise only the title, objective, background theories and type of apparatus/instruments used. With these limited information, they have to study and propose the relevant procedures to conduct the laboratory activities. Based on the given objectives, they also have to think of the types of output data, analysis, discussion and conclusion needed to accomplish the task.

Course Outcomes

At the end of this course students should be able to:

1. Create relevant procedures and conduct the experiment.
2. Collect and analyse the data from the experiment.
3. Discuss and conclude finding.
4. Team work in conducting experiment and preparing technical report.

Reference

1. J.P. Hollman, Experimental Methods for Engineers 8th edition, McGraw-Hill, 2012.

(Refer to any subject course references related to experiments)

COURSE CODE : EML 3522
COURSE NAME : ADVANCED MECHANICAL ENGINEERING LABORATORIES
MAKMAL KEJURUTERAAN MEKANIKAL LANJUTAN

2 Credit Hours
Pre-requisite : Taken Mechanical Engineering Laboratories EML 3512

Course Synopsis

This is a hands-on subject for Mechanical Engineering students taken in the 3rd year of their program. In this course, students will be able to relate the theory and applications as much as possible when the experiments being handled by them. Using an open-ended approach, students are required to think critically and creatively in problem solving. There are 2 different modules in this course, short module and long module experiments. Students will be divided into small groups of around 5 people and each group will be assigned with 2 experiments from 2 short modules and 2 long modules. Therefore, each student in this course will be completing 4 experiments altogether. The durations for each short and long module experiment are 1 and 4 weeks respectively. Short module experiments are conducted based on the lab sheet to cover subjects that have not been covered in previous laboratory. For long module, students will only be given problem description as guideline. With this guideline, students are required to conduct their own experiment based on their engineering background. Report is expected from each of the students individually. The understanding of each student will be evaluated based on the presentation, log book and final report.

Course Outcomes

At the end of this course students should be able to:

Short Module:
1. Create relevant procedures and conduct the experiment.
2. Collect and analyse the data from the experiment .
3. Discuss and conclude findings.
4. Team work in conducting experiment and preparing technical report.

Long Module:
1. Explain the theory in relation to the experiment and equipment used in addressing a given mechanical engineering problems within a given time frame.
2. Develop the appropriate objectives, experiments procedures, method and equipment.
3. Discuss, conclude findings and recommendation.
4. Team work in conducting experiment and preparing technical report.

Reference

1. Wheeler, A.J., Ganji, A.R., Introduction to Engineering Experimentation, 3rd Ed. Prentice Hall, 2009.
(Refer to any subject course references related to experiments)

COURSE CODE : EMM 3633
COURSE NAME : CAPSTONE PROJECT
PROJEK CAPSTONE

3 Credit Hours
Pre-requisite : Mechanical Engineering Design EMM 3573

Course Synopsis

Capstone project is a final year group project that emphasizes on systematic design. It intends to provide the senior engineering student with a realistic understanding of the design process and project management. It draws on a diverse set of inputs namely; decision making, engineering optimization, engineering economy, planning apart from combining the theory of science, engineering fundamental and mathematics, technologies and social aspects to produce a system. The design solution is suitable to overcome engineering problems through an approach of using creativity and innovative solutions. The students are expected to apply theories taught in the mechanical program in their project design solution. The subject provides an exposure to senior engineering students the appropriate approach and training in the undertaking of design processes and project management in a limited non-industry environment.

Course Outcomes

At the end of the course students should be able to:

1. Analyze the various steps in a systematic design process.
2. Develop a mechanical system for given specifications.
3. Develop a proper solution to the design problem to fulfill the design specifications.
4. Design and evaluate a system using the engineering system design method.
5. Use modern tools as an aid to design and solve engineering problems.
6. Apply reasoning to knowledge that affects societal, health, safety, legal and cultural issues.
7. Demonstrate the understanding of engineering solutions in societal and environmental contexts.
8. Apply ethical principles.
9. Communicate effectively.
10. Conduct project and perform tasks individually and in a team.
11. Recognize and aware of the existing scientific literatures.
12. Plan and manage project.

References

1. David G. Ullman, The Mechanical Design Process, 6th Edition, McGraw Hill, 2017.
2. Dieter, G.E and Schmidt, L.G, Engineering Design – A material and processing approach, 5th Edition, McGraw Hill, 2013.
3. Budynas, R.G and Nisbett, J.K. Shigley's Mechanical Engineering Design, 11th Ed. McGraw-Hill, 2019.

COURSE CODE : EMM 3341
COURSE NAME : WORKSHOP PRACTICE
AMALI BENGKEL

1 Credit Hour
Pre-requisite : None

Course Synopsis

This course introduces students to the practical experience of workshop technology with a range of materials and processes. This course aims to provide an opportunity, through some structured practical training modules, for students to understand and appreciate the kind of practical skills required in normal engineering workshop practices involving the selection and operation of some commonly used workshop tools and machines. After the successful completion of the course, students are expected able to fabricate some engineering work-pieces/product, by operating ordinary workshop machine tools such as lathe, milling machine, sheet metal forming and arc welding equipment. A strong emphasis will be made on the acquisition of safe workshop practices in workshop environment.

Course Outcomes

At the end of the course students should be able to:

1. Acquire hand-on practical skills in turning and milling operations.
2. Acquire hand-on practical skills in sheet metal forming operation.
3. Acquire hand-on practical skills in arc welding operation.

References

1. Manufacturing Processes for Engineering Materials, 6th Ed., Kalpakjian • Schmid. Pearson, 2016.
2. Materials and Process in Manufacturing, 10th Ed., Degarmo, Black and Kohser. John Wiley, 2007.

COURSE CODE : EMM 3583
COURSE NAME : MANUFACTURING TECHNOLOGY
TEKNOLOGI PEMBUATAN

3 Credit Hours
Pre-requisite : None

Course Synopsis

This subject provides students with knowledge on the fundamentals of various processes or production/ manufacturing techniques. It started from the overall introduction about manufacturing issues, followed by manufacturing topics such as new material processes, metal forming processes, non-traditional processes, computer aided manufacturing and quality control. Students are equipped with understanding of various types of processing with engineering materials; metallic and non-metallic. Knowledge is conveyed through classroom lecturing and laboratory or industrial visits. Continuous assessments are conducted through assignments, tests, quizzes and final exam. Students are expected to polish interpersonal and teamwork skill in solving manufacturing related problem through group projects.

Course Outcomes

At the end of the course students should be able to:

1. Explain the various manufacturing processes.
2. Apply the manufacturing processes towards efficiency, competitiveness and current trend.
3. Analyze & compare the advantages & limitations of the selected manufacturing processes.
4. Plan the right processes based on product specification.
5. Demonstrate knowledge and understanding of engineering and management principles to project work.

References

1. Kalpakjian, S. et al., Manufacturing Engineering and Technology, 8th edition, Pearson, 2020.
2. Lefteri, C., Making it: Manufacturing techniques for product design, Laurence King Publishing, 2007.

COURSE CODE : EMM 3594
COURSE NAME : INDUSTRIAL TRAINING
LATIHAN INDUSTRI

4 Credit Hours

Pre-requisite : Taken minimum 60 credits

Course Synopsis

Practical training is the platform for the students to get the opportunity to practice and apply the engineering knowledge and skills in various actual working environments. The ultimate goal is to give exposure, experience and professional skills to the students that will help in shaping them to become an effective and responsible military officer as required by the UPNM vision and mission. Students will undergo a practical training in the duration of 10 weeks at an approved private, government or semi-government agency. The faculty will release the list of participating agencies. Placement at the respective agencies will be initiated based on the applications by the students. Approval of the application is at the discretion of the department mainly based on the company nature of business and the type of exposure offered.

Course Outcomes

At the end of the course students should be able to:

1. Present written report and presentation on the industrial training experience.
2. Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
3. Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
4. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
5. Apply reasoning informed by contextual knowledge to assess societal, and the consequent responsibilities relevant to professional engineering practice.
6. Understand the impact of professional engineering solutions in societal.

Reference

-Not applicable-

COURSE CODE : EMM 3642
COURSE NAME : ENGINEERING MANAGEMENT
PENGURUSAN KEJURUTERAAN

2 Credit Hours
Pre-requisite : None

Course Synopsis

The Engineering Management (EM) course is aimed at providing management theories that can be applied during an engineering profession upon the student's graduation. It is also to enable the students to "put on their management hat skill" in simulated engineering applications by exploring into real case studies on related management issues that are commonly faced. To obtain adequate significant, this course emphasizes the basic management functions, planning, organizing, leading and controlling in areas related to effective decision making. Projects tasks deliverables, responsibilities and timing requirement needed to manage project on time and within budget will be elaborated. The course will enable student to be equipped with real – life doses of management skills as the future practicing managers.

Course Outcomes

At the end of the course students should be able to:

1. Apply knowledge and understand principles of EM in today's organization.
2. Analyze EM theories and tools on contemporary issues.
3. Apply the knowledge of EM in preparing case study
4. Presenting outcome based on the EM case study.
5. Evaluate the EM and finance case study

References

1. Chang, C.M, Engineering Management: Meeting the Global Challenges, 2nd Ed. CRC Press, 2016.
2. Chang, C.M, Engineering Management: Challenges in the New Millennium, Prentice Hall, 2005.
3. Lucy C. Morse and Daniel L. Babcock, Managing Engineering and Technology, 6th Edition, Pearson, 2013.

COURSE CODE : EMM 3652
COURSE NAME : ENGINEERS IN SOCIETY
JURUTERA KEMASYARAKATAN

2 Credit Hours

Course Synopsis

All engineers do not work alone but they are part of society and they fulfill the needs of the society in many ways; as manager, as consultant/expert, as project/product designer, as academician, as legal enforcer etc. As a young engineer, knowledge of the economic, industrial and social contexts of engineering is on equal footing as the core engineering knowledge. Most of the time, engineers must be able to identify some of the non-technical decisions which do not relate to any engineering facts but instead have significant impact to society. To strengthen this requirement, an adequate knowledge on relevant aspects of engineering practice in society is vital for senior engineering student prior to their graduation as young engineers. In undertaking these tasks and roles, young engineers shall portray their professionalism to the society they are serving. Concepts of ethics, inclusive of engineer's code of ethic, sustainable development, related legal/ law requirement in implementing their responsibilities will be covered. Students will also be exposed to seminars delivered by invited professionals who will deliver talks on relevant and specific subjects of their professions.

Course Outcomes

At the end of the course students should be able to:

1. Understand the role and responsibility as an engineer in the society.
2. Apply rules & regulation, codes, standards and acts & laws set by authorized bodies when working as an engineer.
3. Solving the important issue related to safety & Health and sustainability.
4. Investigate real case engineering problems and evaluate the outcomes.
5. Function effectively as an individual, and /or as a member or leader in investigation of engineering cases to evaluate the solution.
6. Recognize the need for, and have the preparation and ability to engaged investigation of engineering cases to evaluate the solution.

References

1. Engineers in Society, Arazi et al, McGrawHill (Malaysia), 2010.
2. Occupational Safety and Health Management, Ahmad Azan, Ungku Azly, UPNM Press, 2016
3. Engineering Professionalism and Ethics 4th Edition, The Institution of Engineers, Malaysia(IEM).
4. Engineering Ethics 4th edition, Charles B. Fledderman, Pearson Prentice Hall, 2012.
5. Factories and Machinery Acts with Regulation, MCD Publisher Sdn. Bhd. 1997.
6. Occupational Safety and Health Act 1994.
7. Factories and Machinery Acts 1967.
8. IEM Constitution & IEM By Laws.

COURSE CODE : EMM 3662
COURSE NAME : OPERATIONS MANAGEMENT
PENGURUSAN OPERASI

2 Credit Hours
Pre-requisite : None

Course Synopsis

The Operations Management (OM) Course presents an overview of management that deals with the design and management of products, processes, services and supply chains. It considers the acquisition, development, and utilization of resources that firms need to deliver the goods and services their clients want. The OM ranges from strategic to tactical and operational levels. Representative strategic issues include determining the size and location of manufacturing plants, deciding the structure of service or telecommunications networks, and designing technology supply chains. Tactical issues include plant layout and structure, project management methods, and equipment selection and replacement. Operational issues include production scheduling and control, inventory management, quality control and inspection, traffic and materials handling, and equipment maintenance policies.

Course Outcomes

At the end of the course students should be able to:

1. Acquire knowledge and understand the underlying principle of Operations Management and concept of Logistics.
2. Analyze OM theories and tools on contemporary issues.
3. Investigate Project Management and evaluate its outcome.
4. Function effectively as individual and as team member in conducting experimental work.
5. Comprehend and write effective reports and make effective presentations of case studies for further analysis.

Reference

1. Russel &Taylor, Operations Management, 9th Edition, John Wiley & Sons, 2017
2. William J. Stevenson and Chee Chuong Sum, Operations Management: An Asian Perspective, 9th Edition, McGraw Hill, 2010.
3. Heizer, J. and Render B, Operations Management, 10th Edition, Pearson-Prentice Hall, 2011

COURSE CODE : EMT 3612
COURSE NAME : FINAL YEAR PROJECT I
PROJEK TAHUN AKHIR I

2 Credit Hours
Pre-requisite : Taken
Mechanical Engineering Design EMM 3573
Mechanics of Machines EMM 3533
Strength of Materials II EMM 3433
Fluid Mechanics II EMM 3523
Thermodynamics II EMM 3513

Course Synopsis

This course introduces students how to do research, identify problems, propose solution to problems and gather relevant information to the problem. It will teach students to do literature survey in order to understand the nature of the problem and investigate work done by other researchers in line with their research. This course will also provide the ability for the students to plan and manage their work in certain amount of time.

Course Outcomes

At the end of the course students should be able to:

1. Identify and formulate engineering problem.
2. Research and review relevant information of scientific literatures.
3. Strategise and design method for solving the identified problems.
4. Analyze, evaluate, interpret and synthesize relevant data/information/results.
5. Behave ethically and professionally.
6. Communicate effectively both orally and in written form.
7. Plan and manage projects tasks independently.
8. Effectively conduct project and perform task individually.

Reference

(Refer to any subject course references related to project and research methodology guidance)

(To be provided by the respective supervisors)

COURSE CODE : EMT 3624
COURSE NAME : FINAL YEAR PROJECT II
PROJEK TAHUN AKHIR II

4 Credit Hours

Pre-requisite : Final Year Project I EMT 3612

Course Synopsis

This course introduces students how to do research, identify problems, propose solution to problems and gather relevant information to the problem. It will teach students to do literature survey in order to understand the nature of the problem and investigate work done by other researchers in line with their research. This course will also provide the ability for the students to plan and manage their work in certain amount of time.

Course Outcomes

At the end of the course students should be able to:

1. Analyze problems and draw relevant conclusion.
2. Research and review relevant information of scientific literatures.
3. Design and establish solutions for the identified problems.
4. Analyze, evaluate, interpret and synthesize relevant data/information/results.
5. Utilize modern tools as an aid to solve problems.
6. Behave ethically and professionally.
7. Communicate effectively both orally and in written form.
8. Plan and manage projects tasks independently.
9. Effectively conduct project and perform task individually.

Reference

(Refer to any subject course references related to project and research methodology guidance)

(To be provided by the respective supervisors)

SYNOPSIS OF ELECTIVE CORE COURSES (TECHNICAL SPECIALIZATION) BACHELOR OF MECHANICAL ENGINEERING PROGRAM (ZK08)

COURSE CODE : EME 3713
COURSE NAME : COMPOSITE MATERIALS
BAHAN KOMPOSIT

3 Credit Hours
Pre-requisite : None

Course Synopsis

This course introduces students to some major views and theories in the area of composite materials especially in the polymer based composite learning with emphasis on the types of materials, production methods, quality assurance, failure analysis, test methods and the mechanics of laminated composites. It will examine some key issues in the mechanics of laminated composites with special, focus on the stress-strain relationship and interaction to the extensional, coupling and bending stiffness matrices in promoting learning. The course will also provide a visit to industries dealing with polymer based composite materials in order the students to understand more regarding the practical sides of the subject.

Course Outcomes

At the end of the course students should be able to:

1. Explain types of materials and production methods used to form various fibrous composites.
2. Analyze the micromechanical and macromechanical properties of the lamina and laminate for fiber reinforced composite materials.
3. Investigate different types of failure criteria in laminated composites.

References

1. Jones, R.M., 1999, Mechanics of Composite Materials, 2nd Edition, Taylor &Francis.
2. V.V. Vasiliev and E.V. Morozov, 2001, Mechanics and Analysis of Composite Materials, Elsevier.
3. D. Gay, Composite Materials – Design and Applications, CRC Press LLC. 2014,
4. Autar K. Kaw, 2006, Composite Materials, 2nd Edition, Taylor & Francis.

COURSE CODE : EME 3723
COURSE NAME : SYSTEM, STRUCTURE AND DYNAMICS OF GROUND VEHICLES
SISTEM, STRUKTUR AND DINAMIK KENDERAAN

3 Credit Hours
Pre-requisite : None

Course Synopsis

This course introduces the basic system and structure of automotive vehicles and studies the dynamic and handling characteristics of the vehicle at theoretical and computational approaches. Topics covered include: ride model, handling model, tyre model, location of vehicle CG, tyre normal forces, vehicle loads, systems and structure of automotive vehicle. Matlab-SIMULINK software and CarSimEd will be used throughout the course for modeling and analysis.

Course Outcomes

At the end of the course students should be able to:

1. Understand the basic system and structure of automotive vehicles as well as the fundamentals of the vehicle dynamics and handling.
2. Analyze the concept of vehicle system and structure.
3. Investigate the concept of vehicle system and structure.

References

1. Hans Pacejka. Tire and Vehicle Dynamics. Butterworth-Heinemann, 2012
2. Dean Karnopp. Vehicle Dynamics, Stability, and Control. CRC Press, 2016.
3. Bruce P. Minaker. Fundamentals of Vehicle Dynamics and Modelling. John Wiley & Sons Ltd, 2019

COURSE CODE : EME 3733
COURSE NAME : TURBOMACHINERY
MESIN TURBO

3 Credit Hours
Pre-requisite : None

Course Synopsis

Turbomachines are devices in which energy is transferred either to, or from a continuously flowing fluid by the dynamic of one or more moving blade rows. So, main categories of turbomachine are identified as absorb or produce power to the flowing fluid. Pumps and compressors are used to give energy/power to incompressible and compressible fluid respectively. Turbines, on the other hand, absorb power from both incompressible fluid (hydraulic turbines) and compressible fluid (gas or steam turbines). Pumps, compressors and turbines were design to handle radial, axial or mixed flow of the fluid. In most applications, such as jet engine, compressor and turbine were attached together on the same shaft. This is due to the almost infinite range of service requirements which needs to provide optimum conditions of operation.

Course Outcomes

At the end of the course students should be able to:

1. Apply principle and theories in all topics as given in the lecture contents and syllabus regarding hydraulic and compressible fluid flow machines.
2. Formulate and analyses the engineering problems related to hydraulic flow machines (Pumps and turbines) and Compressible flow machine such as centrifugal compressor, radial gas turbines, axial flow compressor and axial flow gas turbine (by using Mollier chart).
3. Investigate and case study involving turbomachines.

References

1. A.T. Sayers, Hydraulic & Compressible Flow Turbomachines, McGraw-Hill 1990.
2. S. M. Yahya, Turbines, Compressors and Fans, 4th Edition. McGraw-Hill, 2011.

COURSE CODE : EME 3743
COURSE NAME : NON DESTRUCTIVE TESTING
UJIAN TANPA MUSNAH

3 Credit Hours
Pre-requisite : None

Course Synopsis

This course shall cover the basic theory of NDT and the methods of NDT that are widely use in the industry. This course also covers the execution, evaluation and interpretation of each NDT techniques. The advantages, limitations and main application of NDT techniques are also provided. At the end of the course, students should be able to acquire knowledge on the fundamentals of NDT, relate and describe the operating principle and application of various techniques that are typically used in industry, design system for quality assurance, engineering inspection, maintenance testing, product certification or intended industrial applications and solve problems related to basic testing system.

Course Outcomes

At the end of the course students should be able to:

1. Explain the basic principle of NDT techniques.
2. Apply NDT techniques to asses defect in engineering components.
3. Investigate the strength, limitations and select the appropriate NDT techniques in relation with industrial problem.

References

1. Mix, P.E., Introduction to NDT:aining guide, 2nd edition,John Wiley New York, 1987.
2. Raj, B. Jayakumar, T., and Thavasimuthu, M., Practical Non-Destructive Testing, 2nd edition.Woodhead Publishing Limited, Cambridge, 1996.
3. Boving, K. G., NDE Handbook: Non-Destructive Examination Methods for Conditioning Monitoring, 2nd Edition, Woodhead Publishing Limited, Cambridge, 2000.
4. Honeyman, G., Non-Destructive Testing: Characterisation of High-Temperature Materials, 1st Edition, The Institute of Metals, London, 1989.
5. Shull, P.J, Nondestructive Evaluation: Theory, Techniques, and Applications, Marcel Dekker Inc, 2002.
6. Bray, D.E. and R.K. Stanley, Nondestructive Evaluation: A Tool for Design, Manufacturing and Service; CRC Press, 1997.
7. ASTM International, ASTM Volume 03.03 Nondestructive Testing.

COURSE CODE : EME 3753
COURSE NAME : AIR-CONDITIONING AND REFRIGERATION
PENYAMANAN UDARA DAN PENYEJUKBEKUAN

3 Credit Hours
Pre-requisite : None

Course Synopsis

In this course, students will be exposed to the knowledge of air conditioning and refrigeration systems. It introduces students the basic elements and operation principles of both systems. In air-conditioning system, it covers type of systems, psychrometric chart analysis, comfort design condition, heat and cooling load calculation and ducted system. The students also learn on the real application and equipment of air-conditioning system with the latest technology in the market.

Course Outcomes

At the end of the course students should be able to:

1. Explain an air conditioning and refrigeration system.
2. Analyze the performance of the refrigeration cycles, psychrometric chart, cooling load and ducted system.
3. Investigate the application of air-conditioning system and related equipment.

References

1. McQuiston,F.C, Parker J.D, Spitler, J.D, Heating, Ventilating and Air Conditioning Analysis and Design ,6th edition, Wiley, 2004.
2. Pita E.G, Air Conditioning Principles and Systems, 4th Edition, Prentice Hall, 2002.
3. Eastop, T.D and McConkey, A, Applied Thermodynamics for Engineering Technologists, 5th Edition, Longman Scientific & Technical, 1995.
4. Carrier Air Conditioning Company, Handbook of Air Conditioning System Design, McGraw Hill.
5. ASHRAE, Fundamentals Handbook, 2001.
6. Arora C.P, Refrigeration and Air Conditioning, 2nd Edition, McGraw Hill, 2001.
7. Lemmon, E.W., Bell, I.H., Huber, M.L., McLinden, M.O. NIST Standard Reference Database 23: Reference Fluid Thermodynamic and Transport Properties-REFPROP, Version 10.0, National Institute of Standards and Technology, Standard Reference Data Program, Gaithersburg, 2018.

COURSE CODE : EME 3763
COURSE NAME : ENERGY EFFICIENT BUILDINGS
BANGUNAN CEKAP TENAGA

3 Credit Hours
Pre-requisite : None

Course Synopsis

This course introduces the mechanical and electrical systems in a building. These include air-conditioning, heating, pumping, cooling towers, lighting etc. Students will be exposed to the function of these systems and its energy saving measures. Building envelopes and indoor air quality for creating energy efficient building are also included in this course.

Course Outcomes

At the end of the course students should be able to:

1. Explain the mechanical and electrical systems available in a building.
2. Analyze the energy saving measures in a building.
3. Investigate energy consumption and possible energy saving measures of a selected building.

References

1. Lal Jayamaha, Energy- Efficient Building Systems, Green Strategies for Operation and Maintenance, McGraw Hill, Singapore, 2006.
2. Craig B. Smith and Kelly E. Parmenter, Energy Management Principles, Applications, Benefits, Saving (2nd Edition), Elsevier, Singapore, 2016
3. ANSI/ASHRAE Standard 62.1-2016 Ventilation for Acceptable Indoor Air Quality.

COURSE CODE : EME 3773
COURSE NAME : AERODYNAMICS
AERODINAMIK

3 Credit Hours
Pre-requisite : None

Course Synopsis

This course introduces the basic concepts of aerodynamics, as an extension and more focused from the fluid mechanics courses. The course starts with a review of the basic fluid mechanics theory, followed by inviscid flows. The geometry and aerodynamics analysis of airfoil, wings, thin airfoil theory in incompressible flows as well as flows on finite wings are given. The second half of the course will cover the concepts of aerodynamics in viscous flow, involving the boundary layer flows followed by compressible subsonic and supersonic flows past airfoils and wings.

Course Outcomes

At the end of the course students should be able to:

1. Explain the basic aerodynamic concepts in inviscid and viscous flow.
2. Analyze the airfoil and wing aerodynamic performances in incompressible and compressible flow.
3. Investigate and solve real aerodynamics problem in engineering by applying the aerodynamics concepts.

References

1. Anderson, J.D. Jr., Fundamental of Aerodynamics, 5th Edition. New York: McGraw-Hill Inc, 2010.
2. Bertin, J.J. & Cummings, R.M., Aerodynamics for Engineers, 5th Edition. Upper Saddle River: Pearson Prentice-Hall, 2009.
3. Antonio, F., Elements of Aerodynamics of Supersonic Flows. New York: Dover Publications, 2005.
4. Schlichting, H. & Gersten, K. Boundary Layer Theory, 8th Edition. Dordrecht: Springer-Verlag.

COURSE CODE : EME 3783
COURSE NAME : COMBUSTION
PEMBAKARAN

3 Credit Hours
Pre-requisite : None

Course Synopsis

Combustion is a critical issue impacting energy utilization, sustainability, and climate change. The challenge is to design safe and efficient combustion systems for many types of fuels in a way that protects the environment and enables sustainable lifestyles. Emphasizing the use of combustion fundamentals in the engineering and design of combustion systems, this course provides detailed coverage of gaseous, liquid and solid fuel combustion, including focused coverage of biomass combustion, which will be invaluable to new entrants to the field.

Course Outcomes

At the end of the course students should be able to:

1. Explain the differences between premixed and diffusion flame.
2. Analyze the combustion of gaseous, liquid and solid.
3. Investigate a selected combustion system and impact to the environment.

References

1. Chung K. Law, Combustion Physics, Cambridge University Press, 2010.
2. Irvin Glassman and Richard A. Yetter, Combustion, 4th Edition, Academic Press, 2008.
3. Thierry Poinsot and Denis Veynante, Theoretical and Numerical Combustion, 2nd Edition, Edwards, 2005.
4. Dougal Drysdale, An Introduction to Fire Dynamics, 3rd Edition, Wiley, 2011.

COURSE CODE : EME 3793
COURSE NAME : TURBOCHARGING
PENGECASTURBO

3 Credit Hours
Pre-requisite : None

Course Synopsis

This course introduces the working principles of turbocharger and basic turbocharging components in facilitating an internal combustion engine to achieve more power density. The approach used is by applying knowledge of thermodynamics and fluid mechanics to develop Euler turbomachinery equation, besides understanding performance characteristics of turbines and compressors. Apart from that, compressible flow theory is introduced to appreciate the flow phenomena in the radial turbines and compressors. Main losses which contributes to penalty in turbine efficiency is also emphasized. This course also covers various multiple entry turbines designed to accommodate pulsating flow emanating from exhaust of an internal combustion engine. Finally, turbochargers-internal combustion engine matching analysis is explored at both design and off-design operating points.

Course Outcomes

At the end of the course students should be able to:

1. Describe the main components and working principles in turbocharging system.
2. Analyze one dimensional flow in turbines and compressors.
3. Investigate suitability of turbocharging components for different engine conditions.

References

1. Moustapha, H., Zelesky, M.F., Baines, N.C., Japikse, D., Axial and Radial Turbines. Concepts ETI, 2003.
2. Japikse, D., and Baines, N.C., Introduction to turbomachinery. Norich Vt and Oxford UK: Concepts ETI, 1994.
3. Heywood, J.B., Internal Combustion Engine Fundamental. McGraw-Hill Book Company, 1988.
4. Watson, N., And Janota, M.S., Turbocharging the Internal Combustion Engine. London. The Maxmillan Press Ltd, 1982.

COURSE CODE : EME 3803
COURSE NAME : MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE
PEMBELAJARAN MESIN DAN KECERDASAN BUATAN

3 Credit Hours

Course Synopsis

This course will provide students with an understanding of the machine learning concept and techniques. It will emphasize on the study and construction of algorithms that can learn from and make predictions using data. Tom M Mitchell, an expert in Machine Learning said "A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E." Broad concepts of "supervised", "unsupervised" and "reinforced" learning methods will be discussed and explored. This course is structured according the task to be achieved and various techniques commonly used to finish that task will be introduced. The tasks are typically, regression, classification, clustering, and pathfinding (reinforcement learning). The various techniques introduced in this course include decision tree algorithm, nearest-neighbour, naïve-bayes, support vector machine, association rule learning and artificial neural network (ANN). An essential element of computer vision, specifically, convolutional neural network (CNN) will also be introduced. The student will be exposed to real engineering data taken from various industries. At the end of the course, the student should be able to demonstrate an ability to analyse and make predictive models from raw engineering data.

Course Outcomes

At the end of the course students should be able to:

1. Explain basic principles of machine learning, artificial intelligence, deep learning and the difference between supervised, unsupervised and reinforced learning philosophies.
2. Analyze raw and pre-processed data using machine learning algorithms.
3. Investigate visual pattern and image data using convolutional neural network (CNN).

References

1. Brett Lantz, Machine Learning with R, Packt Publishing, 1st Edition, 2013. (Reference for most topics in this course).
2. Robert I. Kabacoff. R in Action: Data Analysis and Graphics with R, Manning Publications Co. 1st Edition, 2011. (Reference for general introduction into R and basic statistical methods).
3. Micheal J. Crawley. The R Book. 2nd Edition. John Wiley and Sons, 2013 (Reference for general intro into R, basic statistical methods and time series data analysis).
4. Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach. Prentice Hall 3rd Edition (Reference for Artificial Intelligence, computer vision, supervised, unsupervised and reinforcement learning).