الخطة الدراسية لبرنامج "الدرجة الجامعية المتوسطة"

في تخصص الهندسة الميكانيكية

(برنامج دولي)

تم اعتماد هذه الخطة الدراسية بموجب قرار مجلس عمداء جـــامعة البلقاء التطبيقية رقم 750/ 2017/ 2018 تاريخ 2018/4/24م (الجلسة السادسة والعشرون) وتطبق اعتباراً من مطلع العام الجامعي (2018/2017)

تتكون الخطة الدراسية لنيل الدرجة الجامعية المتوسطة في برنامج تكنولوجيا التصنيع والانتـــاج والهندسة الميكانيكية/ تخصص الهندسة الميكانيكية من (72) ساعة معتمدة، موزعة على النحـــو الآتي:

الرقم	المتطلب	ساعة معتمدة
.1	المهارات العامة	12
.2	مهارات التشغيل	6
.3	العلوم المساندة	9
.4	المهارات المتخصصة	45
المجموع		**72**

وصف لمخرجات التخصص:

يهدف هذا التخصص الى اعداد تقنيين ومشرفين للعمل في مجال الاشراف على عمل الالات الميكانيكية و خاصة الالات الميكانيكية الحرارية مثل العمل في محطات توليد و توزيع الطاقة. بالاضافة الى قدرته على فهم المبادئ الاساسية لطرق التصميم المحوسب باستخدام CAD ثلاثي و ثنائي الابعاد. وقدرته على الفهم و التعامل مع المفاهيم الاساسية لادارة الجودة و الادراة المهنية.

المجالات المعرفية للمهارات المتخصصة:

#	الفرع	ساعات معتمدة		المواد التي تغطي الفرع
		نظري	عملي	
.1	علوم هندسية	10	2	• مبادىء التصميم الهندسي • علوم هندسية تطبيقية • هندسة انظمة التحكم • الرياضيات الهندسية التطبيقية
.2	علوم حرارية	6	3	• مبادئ في الديناميكا الحرارية و محركات الحرارة • ميكانيكا الموائع • الديناميكا الحرارية المتقدمة
.3	علوم الميكانيكا التطبيقية	9	6	• مبادىء الميكانيكا التطبيقية1 • ورش العمل الميكانيكية • مبادىء الميكانيكا التطبيقية2 • الهندسة الافتراضية • مهارات عملية في الهندسة الميكانيكية
.4	ادارة صناعية	3	3	• ادارة الجودة • مفاهيم ادارية مهنية
.5	التدريب الميداني	–	3	
	مجموع الساعات المعتمدة	**28**	**17**	**45 (س.م)**

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أولاً: المهارات العامة، (12) ساعات معتمدة موزعة على النحو الآتي:

رقم المادة	اسم المادة	س.م	نظري	عملي	المتطلب السابق
020000111	المواطنة الإيجابية ومهارات الحياة	3	3	0	
020000121	الثقافة الإسلامية	3	3	0	
020000131	التربية الوطنية	2	2	0	
020000181	العلوم العسكرية	1	1	0	
020000101	مهارات لغوية/ انجليزي	3	3	0	
المجموع (س.م)		**12**	**12**	**0**	

ثانياً: مهارات التشغيل ، (6) ساعات معتمدة موزعة على النحو الآتي:

رقم المادة	اسم المادة	س.م	نظري	عملي	المتطلب السابق
020000122	مهارات التواصل باللغة الإنجليزية	2	2	0	
020000231	ريادة الأعمال	2	2	0	
020000141	الصحة والسلامة والبيئة المهنية	2	2	0	
المجموع (س.م)		**6**	**6**	**0**	

ثالثاً: المهارات المساندة، (9) ساعات معتمدة موزعة على النحو الآتي:

رقم المادة	اسم المادة	س.م	نظري	عملي	المتطلب السابق
020000151	مفاهيم رياضية	3	3	0	
020000161	مفاهيم فيزيائية	3	3	0	
020000162	مختبر مفاهيم فيزيائية	1	0	3	020000161*
020000171	الرسم الهندسي بالحاسوب	2	0	6	
المجموع (س.م)		**9**	**6**	**3**	

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رابعاً: المهارات المتخصصة، (45) ساعة معتمدة، موزعة على النحو الآتي:

رقم المادة	اسم المادة	س.م	نظري	عملي	المتطلب السابق
020307211	مبادئ التصميم الهندسي	3	2	3	
020307111	علوم هندسية تطبيقية	3	2	3	020000161
020307231	مفاهيم إدارية مهنية	3	0	9	
020307113	مبادئ الميكانيكا التطبيقية	3	3	0	020000161
020207221	مبادئ في الديناميكا الحرارية و محركات الحرارة	3	2	3	020307113
020207132	ورش العمل الميكانيكية	3	0	9	020207231
020207122	ميكانيكا الموائع	3	2	3	020307113
020307232	إدارة الجودة	3	3	0	
020207231	مبادئ الميكانيكا التطبيقية 2	3	3	0	020307113
020206214	الهندسة الافتراضية	3	3	0	
020308221	الرياضيات الهندسية التطبيقية	3	3	0	020000151
020207223	الديناميكا الحرارية المتقدمة	3	2	3	
020207213	هندسة انظمة التحكم	3	3	0	
020207251	التدريب الميداني	3	–	*	
020207235	مهارات عملية في الهندسة الميكانيكية	3	0	9	
المجموع (س.م)		**45**	**28**	**17**	

*** – تدريب عملي متواصل لمدة (8) أسابيع.**

الخطة الاسترشادية لتخصص "الهندسة الميكانيكية "

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الفصل الدراسي الأول			الفصل الدراسي الثاني		
اسم المادة	رقم المادة	س.م.	اسم المادة	رقم المادة	س.م.
مهارات التواصل باللغة الإنجليزية	020000122	2	المواطنة الإيجابية ومهارات الحياة	020000111	3
الثقافة الإسلامية	020000121	3	مهارات لغوية /انجليزي	020000101	3
مفاهيم رياضية	020000151	3	التربية الوطنية	020000131	2
مفاهيم فيزيائية	020000161	3	ورش العمل الميكانيكية	020207132	3
الرسم الهندسي بالحاسوب	020000171	2	مبادئ الميكانيكا التطبيقية	020307113	3
الصحة والسلامة والبيئة المهنية	020000141	2	ميكانيكا الموائع	020207122	3
علوم هندسية تطبيقية	020307111	3	مختبر مفاهيم فيزيائية	020000162	1
المجموع		**18**	**المجموع**		**18**

الفصل الدراسي الثالث			الفصل الدراسي الرابع		
اسم المادة	رقم المادة	س.م.	اسم المادة	رقم المادة	س.م.
ريادة الاعمال	020000231	2	الهندسة الافتراضية	020206214	3
مبادئ في الديناميكا الحرارية و محركات الحرارة	020207221	3	الديناميكا الحرارية المتقدمة	020207223	3
مبادئ الميكانيكا التطبيقية 2	020207231	3	هندسة انظمة التحكم	020207213	3
الرياضيات الهندسية التطبيقية	020308221	3	مفاهيم إدارية مهنية	020307231	3
مبادئ التصميم الهندسي	020307211	3	مهارات عملية في الهندسة الميكانيكية	020207235	3
إدارة الجودة	020307232	3	التدريب الميداني	020207251	3
العلوم العسكرية	020000181	1			
المجموع		**18**	**المجموع**		**18**

الوصف المختصر للمواد التعليمية لتخصص "الهندسة الميكانيكية"

أولاً: الثقافة العامة

المواطنة الإيجابية ومهارات الحياة020000111 (3: 3-0) يوضح المساق مفهوم المواطنة ومهارات الحياة وأهميتهما في اكتساب مهارات قيمه، والعمل على استخدام هذه المهارات في سعيهم للحصول على تعليم افضل ونتائج ايجابيه في العمل، حيث ان المساق يراعي بناء المعرفه في الموضوعات التي يتضمنها البرنامج كما ويبني المهارة عند الشباب لاستخدامها في تطبيق المعرفه كما ويبني الثقه في قدرات الشباب على استخدام هذه المعرفه والمهارة بالاضافه الى توفير الدعم الشخصي والبيئي لتغيير السلوك من خلال تعزيز قيم المواطنة الايجابية والثقافة المجتمعية البناءة والعمل المجتمعي التطوعي.
الثقافة الإسلامية 020000121 (3: 3-0) 1. تعريف الثقافة الإسلامية وبيان معانيها وموضوعاتها والنظم المتعلقة بها – وظائفها وأهدافها. 2. مصادر ومقومات الثقافة الإسلامية والأركان والأسس التي تقوم عليها. 3. خصائص الثقافة الإسلامية. 4. الإسلام والعلم، والعلاقة بين العلم والإيمان 5. التحديات التي تواجه الثقافة الإسلامية. 6. رد الشبهات التي تثار حول الإسلام. 7. الأخلاق الإسلامية والآداب الشرعية في إطار الثقافة الإسلامية. 8. النظم الإسلامية.
التربية الوطنية 020000131 (2: 2-0) يعد مساق التربية الوطنية من المتطلبات الإجبارية لجميع طلبة كليات المجتمع الأردنية وامتدادا عضويا لفلسفة التربية الوطنية والتعليم باعتبارها بعدا من أبعاد الإستراتيجية الوطنية للتعليم العالي، وينطلق مساق "التربية الوطنية" من مجموعة الثوابت الأردنية وعلى رأسها العقيدة الإسلامية السمحة، ومبادئ الثورة العربية الكبرى، والدستور الأردني والتجربة الوطنية.

علوم عسكرية 020000181 (1: 1-0)

المحور الأول: نشأة وتطور القوات المسلحة/ الجيش العربي، أسلحة المناورة، أسلحة الإسناد، أسلحة الخدمات

المحور الثاني: الثورة العربية الكبرى، الحروب العربية الإسرائيلية (حروب 1948، 1967، معركة الكرامه 1968، حرب تشرين 1973)، دور القوات المسلحة الأردنية- الجيش العربي في التنمية الوطنية الشامله

المحور الثالث: الأمن العام، المخابرات العامة، قوات الدرك، الدفاع المدني

مهارات لغوية/ انجليزي 020000101 (3: 3-0)

The course consists of 8 units. Each unit has speaking activities that deal with dialogues, introducing oneself, talking about families. Also the units include pronunciation and listening with intonation activities. The reading and writing activities concentrate on question writing biography, E-mail, and writing blog post.

ثانياً: مهارات التشغيل والاستخدام

مهارات التواصل باللغة الإنجليزية 020000122 (2: 2-0)

This is a communication skills course which aims at improving learners' oral and written communication skills by providing learners with the language needed to naturally and confidently communicate in an English speaking workplace environment and real life situations.

ريادة الأعمال 020000231 (2: 2-0)

يوضح المساق مفهوم ريادة الأعمال، تأثيرها في الإقتصاد الوطني ودورها في القضاء على البطالة، وكيفية استحداث أفكار ريادية ومبتكرة لتوائم احتياجات المجتمع و مواجهة المخاطر والتحديات التي تعترضها، وتقييم فرص نجاحها من خلال دراسة الجدوى، وكيفية حساب كلفتها وتمويلها وإدارة شؤؤونها المالية، وكيفية عمل تسويق لها، والطبيعة القانونية لها وخطة العمل اللازمة للبدء بها مع التركيز على التجربة الأردنية في هذا المجال.

الصحة والسلامة والبيئة المهنية 020000141 (2: 2-0)

اهداف الصحة والسلامة في بيئة العمل وطرق حماية المتواجدين والمتأثرين. دراسة أهم الاخطار وأكثرها إنتشارا في مختلف مجالات العمل ، تمييز المخاطر الكيماوية والبيولوجية والسقوط من المرتفعات والمخاطر الفيزيائية في بيئة العمل و الحريق والكهرباء والمخاطر الناتجة من الملائمة، تمييز مصادر المخاطر وتأثيرتها على الصحة وسلامة العمل وطرق ضبط المخاطر لتخفيف إحتمالية حدوثها والتخفيف من نتائجها في حالة حدوثها. مناقشة التسلسل الهرمي للسيطرة على المخاطر وطرق إختيار معدات الحماية الشخصية وتطبيق الاسعافات الاولية في حالات الاصابات البشرية.

التعرف على المتطلبات القانونية الاردنية الرئيسية لحماية العاملين.

ثالثاً: العلوم المساندة

مفاهيم رياضية 020000151 (3: 3-0) يعتبر هذا المساق تمهيدا لعلم التفاضل والتكامل حيث يبدأ بمجموعات الاعداد والمجموعات والعمليات عليها ومعادلة الخط المستقيم وحل انواع من المعادلات والمتباينات، ومن ثم الاقترانات (كثيرات الحدود والجذرية والنسبية والمثلثية والاسية واللوغريتمية) اضافة للتطرق للمتطابقات المثلثية الاساسية وحل معادلات مثلثية وبعد ذلك التعرف على المفهوم الهندسي للمشتقة وقواعد وقوانين الاشتاق لبعض الاقترانات وكذلك مفهوم النهايات واخيرا قواعد وقوانين تكامل الاقترانات الاساسية والمحددة في الاهداف الخاصة.
مفاهيم فيزيائية 020000161 (3: 3-0) • شرح وتوضيح لمفاهيم و تطبيقات الفيزياء الميكانيكيه (الحركه و القوه و الطاقه الميكانيكيه) • توضيح المفاهيم الأساسيه في الضوء و خصائصه. • تعريف الطالب باساسيات الفيزياء الحراريه و مفاهيمها. • مفاهيم في الكهرباء السكونيه و المكهرباء المتحركه .(القوه الكهربائيه، المجال الكهربائي، الجهد الكهربائي ،. التيار و المقاومه الكهربائيه) • التعريف بمفاهيم الفيزياء المفناطيسيه الأساسيه و تطبيقاتها .(الحث المغناطيسي، النفاذيه المغناطيسيه.المواد المغناطيسيه)
مختبر مفاهيم فيزيائية 020000162 (1: 0-3) يشمل المختبر التجارب الفيزيائية الاساسية في مجال الميكانيكا و الكهرباء و المغناطيسيه لتعزيز المفهوم الفيزيائي النظري
الرسم الهندسي بالحاسوب 020000171 (2: 0-6) Introduction to AutoCAD, application of AutoCAD, commands, geometric entities. geometric construction. dimensioning, free –hand sketching, object representation, orthographic drawing and projections.

رابعاً: المهارات المتخصصة

Principles of Engineering Design (3-2 :3) 020307211 Gantt charts and critical path analysis, stakeholder requirements, market analysis, design process management, modelling and prototyping, manufacturability, reliability life cycle, safety and risk, management, calculations, drawings and concepts and ergonomics.
Applied Engineering Sciences(3-2 :3) 020307111 International system of units, interpreting data, static and dynamic forces, fluid mechanics and thermodynamics, material properties and failure, and A.C./D.C. circuit theories. interpret and present qualitative and quantitative data using computer software, calculate unknown parameters within mechanical systems, explain a variety of material properties and use electromagnetic theory in an applied context.
Professional Management Concepts(9-0 :3) 020307231 The main concepts and theories of management and leadership, fundamentals of risk management, operational management, project and operations management theories.
Principles of Applied Mechanics (0-3 :3) 020307113 behavioural characteristics of static, dynamic and oscillating engineering systems including shear forces, bending moments, torsion, linear and angular acceleration, conservation of energy and vibrating systems; and the movement and transfer of energy by considering parameters of mechanical power transmission systems.
Fundamentals of Thermodynamics and Heat Engines(3-2 :3) 020207221 Fundamental systems , First law of thermodynamics , The gas laws , Polytrophic processes ,

Energy equations , energy transfer and the calculations for specific plant equipment e.g. boilers, super–heaters, turbines, pumps and condensers , Principles of heat transfer , conduction, convection ,radiation , heat engines , heat engine cycles, efficiency improvements to heat engines.
Mechanical Workshop Practices (9–0 :3) 020207132 Safe working practice, Risk assessment, machining operations, lathe and milling machine, Speeds and feeds, work–holding jigs and fixtures, tolerances. , engineering drawing , measuring tools , quality control and inspection reports , quality control metrology equipment , CNC , Data collection, analysis and product improvement.
Fluid Mechanics(3–2 :3) 020207122 Hydrostatic pressure , manometers , hydraulic devices , immersed surfaces , Moments of area and parallel axis theorem , Centre of pressure , Viscosity in fluids , viscometers , Bernoulli's Equation , Reynolds numbers , flow within pipelines , Viscous drag , Aerodynamics , water turbine , Reciprocating and centrifugal pump , hydraulic machinery.
Quality Management(0–3 :3) 020307232 Engineering strategy and services delivery planning, the role of sustainability, Total Quality Management (TQM), engineering management tools, managing people and becoming a professional engineer.
Principles of Applied Mechanics 2(0–3 :3) 020207231 Poisson's Ratio and typical values of common materials; the relationship between the elastic constants such as Bulk Modulus, Modulus of Elasticity, Modulus of Rigidity; the relationship between bending moment, slope and deflection in beams; calculating the slope and deflection for loaded beams using Macaulay's method; analyzing the stresses in thin–walled pressure vessels; and stresses in thick–walled cylinders, flat and v–section belt drive theory. Determine the behavioral characteristics of materials subjected to complex loading; assess the strength of loaded beams and pressurized vessels; determine specifications of power transmission system elements; and examine operational constraints of dynamic rotating

systems.
Virtual Engineering(0-3 :3) 020206214 Dimensioning and tolerances , Manufacturing processes: capability, cost issues and selection , Design tools: 2D and 3D CAD , Solid modelling , Finite element formulation , Finite element method , Fundamentals of CFD (Computational Fluid Dynamics) , CFD simulation and analysis , Simulation results.
Applied Engineering Mathematics(0-3 :3) 020308221 Number theory, complex numbers, matrix theory, linear equations, numerical integration, numerical differentiation, and graphical representations of curves for estimation Within an engineering context, solving engineering problems using first and second order differential equations.
Thermodynamics(3-2 :3) 020207223 Heat pumps and refrigeration , Second law of thermodynamics , Economics of heat pumps , Theoretical and realistic cycles , Isothermal and adiabatic work , Volumetric efficiency , Intercoolers, dryers and air receivers , Steam power plant , Carnot and Rankine cycle , Gas turbines , Brayton (Joule) cycle , Intercooling, reheat and regeneration.
Control Systems Engineering(0-3 :3) 020207213 Control system terminology and identification, including plant, process, system, disturbances, inputs and outputs, initial time, additivity, homogeneity, linearity and stability , Block diagram representation , Principles of Transfer Function (TF) for open and closed loop systems , Simple mathematical models of electrical, mechanical and electro-mechanical systems , Transient and steady behavior of simple open loop and closed loop control systems , Routh-Hurwitz stability criterion , computational tools (e.g. Matlab, Simulink) to model.
Practical skills in Mechanical Engineering(9-0 :3) 020207235 Project proposal , Selection of project approach , resource requirements , project key objectives , collecting data , Data analysis , Literature review , Independent thinking , Project management and key milestones , Research purpose , Project written presentation , Writing

research report , Project oral presentation
Field Training (*-* :3) 020207251 Equivalent to 8 weeks of field training targeted to emphasize the ability of students to apply the theories in the real world of the profession.

برنامج الدرجة الجامعية المتوسطة

Specialization	Mechanical engineering
Course Title	**Principles of Engineering Design**
Course Number	**020307211**
Credit Hours	3
Theoretical Hours	2
Practical Hours	3

Brief Course Description:

Gantt charts and critical path analysis, stakeholder requirements, market analysis, design process management, modelling and prototyping, manufacturability, reliability life cycle, safety and risk, management, calculations, drawings and concepts and ergonomics.

Course Objectives:

This course aims at:

1. Will be able to prepare an engineering design specification in response to a stakeholder's design brief and requirements.
2. Will be able to Formulate possible technical solutions by using prepared examples of engineering design specifications
3. Will be able to prepare an engineering industry standard technical design report by using appropriate design calculations, drawings and concepts.
4. Will be able to present, to an audience, a recommended technical design solution by using real examples of stakeholder briefs.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	engineering design specification	▪ Planning techniques used to prepare a design specification: Definition of client's/users objectives, needs and constraints. Definition of design constraints, function, specification, milestones. Planning the design task: Flow charts, Gantt charts, network and critical path analysis necessary in the design process. ▪ Design process: Process development, steps to consider from start to finish. The cycle from design to manufacture. Three–and five–stage design process. Vocabulary used in engineering design. ▪ Stage of the design process which includes: Analyzing the situation, problem statement, define tasks and outputs, create the design concept, research the problem and write a specification.	

		Suggest possible solutions, select a preferred solution, prepare working drawings, construct a prototype, test and evaluate the design against objectives, design communication (write a report). ▪ Customer/stakeholder requirements: Converting customer request to a list of objectives and constraints. Interpretation of design requirements. Market analysis of existing products and competitors. Aspects of innovation and performance management in decision–making.	
2.	examples of engineering design specifications	▪ Conceptual design and evaluating possible solutions: Modelling, prototyping and simulation using industry standard software, (e.g. AutoCAD, Catia, SolidWorks, Creo) on high specification computers. Use of evaluation and analytical tools, e.g. cause and effect diagrams, CAD, knowledge–based engineering.	
3.	engineering industry standard	▪ Managing the design process: Recognizing limitations including cost, physical processes, availability of	

	technical design report by using appropriate design calculations, drawings and concepts	material/components and skills, timing and scheduling. ▪ Working to specifications and standards, including: The role of compliance checking, feasibility assessment and commercial viability of product design through testing and validation. ▪ Design for testing, including: Material selection to suit selected processes and technologies. Consideration of manufacturability, reliability, life cycle and environmental issues. The importance of safety, risk management and ergonomics. ▪ Conceptual design and effective tools: Technologies and manufacturing processes used in order to transfer engineering designs into finished products.	
4.	recommended technical design solution by using real examples of	▪ Communication and post–presentation review: Selection of presentation tools. Analysis of presentation feedback. Strategies for improvement based on feedback.	

	stakeholder briefs		

Text Books & References:

DUL, J. and WEERDMEESTER, B. (2008) Ergonomics for beginners. 3rd Ed. Boca Raton: CRC Press.

DYM, C.L., LITTLE, P. and ORWIN, E. (2014) Engineering Design: a Project Based Introduction. 4th Ed. Wiley.

GRIFFITHS, B. (2003) Engineering Drawing for Manufacture. Kogan Page Science.

REDDY, K.V. (2008) Textbook of Engineering Drawing. 2nd Ed. Hyderabad: BS Publications.

برنامج الدرجة الجامعية المتوسطة

Specialization	Mechanical engineering
Course Title	Applied Engineering Sciences
Course Number	**020307111**
Credit Hours	3
Theoretical Hours	2
Practical Hours	3

Brief Course Description:

International system of units, interpreting data, static and dynamic forces, fluid mechanics and thermodynamics, material properties and failure, and A.C./D.C. circuit theories. interpret and present qualitative and quantitative data using computer software, calculate unknown parameters within mechanical systems, explain a variety of material properties and use electromagnetic theory in an applied context.

Course Objectives:

This course aims at:

1. Examine scientific data using computational methods.
2. Determine parameters within mechanical engineering systems.
3. Explore the characteristics and properties of engineering materials.
4. Analyze applications of electromagnetic principles and properties.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	scientific data using computational methods	▪ International system of units: The basic dimensions in the physical world and the corresponding SI base units. SI derived units with special names and symbols. SI prefixes and their representation with engineering notation. ▪ Interpreting data: Investigation using the scientific method to gather appropriate data. Summarizing quantitative and qualitative data with appropriate graphical representations. Using presentation software to present data to an audience.	
2.	mechanical engineering systems	▪ Static and dynamic forces: Representing loaded components with space and free body diagrams. Calculating support reactions of objects subjected to concentrated and distributed loads. Newton's laws of motion, D'Alembert's principle and the principle of conservation of energy. ▪ Fluid mechanics and thermodynamics: Archimedes' principle and hydrostatics. Continuity of volume and mass flow for an	

		incompressible fluid. Heat transfer due to temperature change and the thermodynamic process equations	
3.	characteristics and properties of engineering materials	▪ Material properties: Atomic structure of materials and the structure of metals, plastics and composites. Mechanical and electromagnetic properties of materials. ▪ Material failure: Destructive and non–destructive testing of materials. The effects of gradual and impact loading on a material. Degradation of materials and hysteresis.	
4.	applications of electromagnetic principles and properties	▪ D.C. circuit theory: Voltage, current and resistance in D.C. networks. Exploring Ohm's law and Kirchhoff's voltage and current laws. ▪ A.C. circuit theory: Waveform characteristics in a single–phase A.C. circuit. RLC circuits. ▪ Magnetism: Characteristics of magnetic fields and electromagnetic force. The principles and applications of electromagnetic induction.	

Text Books & References:

BIRD, J. (2012) Science for Engineering. 4th Ed. London: Routledge.

BOLTON, W. (2006) Engineering Science. 5th Ed. London: Routledge.

TOOLEY, M. and DINGLE, L. (2012) Engineering Science: For Foundation Degree and Higher National. London: Routledge.

برنامج الدرجة الجامعية المتوسطة

Specialization	Mechanical engineering
Course Title	**Professional Management Concepts**
Course Number	**020307231**
Credit Hours	3
Theoretical Hours	0
Practical Hours	9

Brief Course Description:

the main concepts and theories of management and leadership, fundamentals of risk management, operational management, project and operations management theories.

Course Objectives:

This course aims at:

1. Formulate and plan a project that will provide a solution to an identified engineering problem, with reference to national and international engineering regulatory regimes and ethical frameworks.
2. Conduct planned project activities to generate outcomes which provide a solution to the identified engineering problem, with reference to ethical frameworks, health and safety requirements and professional standards of behavior in engineering.
3. Produce a project report analyzing the outcomes of each of the project processes and stages.
4. Present the project report and reflect on the value gained from conducting the project and potential improvements in future projects.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	Formulate and plan a project that will provide a solution to an identified engineering problem, with reference to national and international engineering regulatory regimes, and ethical frameworks	▪ Examples of realistic engineering based problems: Crucial considerations for the project. How to identify the nature of the problem through vigorous research. Feasibility study to identify constraints and produce an outline specification. ▪ Develop an outline project brief and design specification: Knowledge theories, calculations and other relevant information that can support the development of a potential solution. ▪ Ethical frameworks: The Engineering Council and Royal Academy of Engineering's Statement of Ethical Principles The National Society for Professional Engineers' Code of Ethics ▪ Regulatory bodies: Global, European and national influences on engineering and the role of the engineer, in particular: The Royal Academy of Engineering and the UK Engineering Council. The role and responsibilities of the UK Engineering Council and the Professional Engineering	

		Institutions (PEIs). The content of the UK Standard for Professional Engineering Competence (UKSPEC). Chartered Engineer, Incorporated Engineer and Engineering Technician. ▪ International regulatory regimes and agreements associated with professional engineering: European Federation of International Engineering Institutions. European Engineer (Eur Eng). European Network for Accreditation of Engineering Education. European Society for Engineering Education. Washington Accord. Dublin Accord. Sydney Accord. International Engineers Alliance. Asia Pacific Economic Cooperation (APEC) Engineers Agreement.	
2.	planned project activities to generate outcomes which provide a solution to the identified engineering problem, with	▪ Project execution phase: Continually monitoring development against the agreed project plan and adapt the project plan where appropriate. Work plan and time management, using Gantt chart or similar. Tracking costs and timescales. Maintaining a project diary to monitor progress against milestones and timescales.	

	reference to ethical frameworks, health and safety requirements and professional standards of behavior in engineering	▪ Engineering professional behavior sources: Professional responsibility for health and safety (UK–SPEC). Professional standards of behavior (UK–SPEC). ▪ Ethical frameworks: The Engineering Council and Royal Academy of Engineering's Statement of Ethical Principles. The National Society for Professional Engineers' Code of Ethics.	
3.	project report analyzing	▪ Convincing arguments: All findings/outcomes should be convincing and presented logically where the assumption is that the audience has little or no knowledge of the project process. ▪ Critical analysis and evaluation techniques: Most appropriate evaluation techniques to achieve a potential solution. Secondary and primary data should be critiqued and considered with an objective mindset. Objectivity results in more robust evaluations where an analysis justifies a judgement.	
4.	project report and reflect on	▪ Presentation considerations: Media selection, what to include in the	

	the value gained from conducting the project and potential improvements in future projects	presentation and what outcomes to expect from it. Audience expectations and contributions. Presentation specifics. Who to invite: project supervisors, fellow students and employers. Time allocation, structure of presentation. Reflection on project outcomes and audience reactions. Conclusion to report, recommendations for future work, lessons learned, changes to own work patterns. ▪ Reflection for learning and practice: The difference between reflecting on performance and evaluating a project – the former considers the research process, information gathering and data collection, the latter the quality of the research argument and use of evidence. ▪ The cycle of reflection: To include reflection in action and reflection on action. How to use reflection to inform future behavior, particularly directed towards sustainable performance. The importance of Continuing Professional Development (CPD) in refining ongoing professional practice. ▪ Reflective writing: Avoiding generalization	

		and focusing on personal development and the research journey in a critical and objective way.	

Text Books & References:

PUGH, P. S. (1990) Total Design: Integrated Methods for Successful Product Engineering. Prentice Hall.

STRIEBIG, B., OGUNDIPE, A. and PAPADAKIS, M. (2015) Engineering Applications in Sustainable Design and Development. Cengage Learning.

ULRICH, K. and EPPINGER, S. (2011) Product Design and Development. 5th Ed. McGraw-Hill Higher Education.

برنامج الدرجة الجامعية المتوسطة

Specialization	Mechanical Engineering
Course Title	Fundamentals of Thermodynamics and Heat Engines
Course Number	020207221
Credit Hours	3
Theoretical Hours	2
Practical Hours	3

Brief Course Description:

Fundamental systems , First law of thermodynamics , The gas laws , Polytrophic processes , Energy equations , energy transfer and the calculations for specific plant equipment e.g. boilers, super–heaters, turbines, pumps and condensers , Principles of heat transfer , conduction, convection ,radiation , heat engines , heat engine cycles, efficiency improvements to heat engines.

Course Objectives:

This course aims at:

1. Investigate fundamental thermodynamic systems and their properties
2. Apply the Steady Flow Energy Equation to plant equipment
3. Examine the principles of heat transfer to industrial applications.
4. Determine the performance of internal combustion engines.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	fundamental thermodynamic systems and their properties	▪ Fundamental systems: Forms of energy and basic definitions. Definitions of systems (open and closed) and surroundings. ▪ First law of thermodynamics. The gas laws: Charles' Law, Boyle's Law, general gas law and the Characteristic Gas Equation. The importance and applications of pressure/volume diagrams and the concept of work done. ▪ Polytrophic processes: constant pressure, constant volume, adiabatic and isothermal systems.	
2.	Steady Flow Energy Equation to plant equipment	▪ Energy equations: Conventions used when describing the behavior of heat and work. The Non–Flow Energy Equation as it applies to closed systems. Assumptions, applications and examples of practical systems. Steady Flow Energy Equation as applied to open systems. Assumptions made about the conditions around, energy transfer and the calculations for specific plant equipment e.g. boilers, super–heaters,	

		turbines, pumps and condensers.	
3.	principles of heat transfer to industrial applications	▪ Principles of heat transfer: Modes of heat transmission, including conduction, convection & radiation. Heat transfer through composite walls and use of U and k values. Application of formulae to different types of heat exchangers, including recuperate and evaporative. Regenerators. Heat losses in thick and thin walled pipes, optimum lagging thickness	
4.	performance of internal combustion engines	▪ Performance: Application of the second law of thermodynamics to heat engines. Comparison of theoretical and practical heat engine cycles, including Otto, Diesel and Carnot. Explanations of practical applications of heat engine cycles, such as compression ignition (CI) and spark ignition engines, including their relative mechanical and thermodynamic efficiencies. Describe possible efficiency improvements to heat engines.	

Text Books & References:

DUNN, D. (2001) Fundamental Engineering Thermodynamics. Longman. EASTOP, T.D. and MCCONKEY, A. (1996) Applied Thermodynamics for Engineering Technologists. 5th Ed. Prentice Hall.

EASTOP, T.D. and MCCONKEY, A. (1997) Applied Thermodynamics for Engineering Technologists Student Solution Manual. 5th Ed. Prentice Hall.

RAYNER, J. (2008) Basic Engineering Thermodynamics. 5th Ed. Pearson.

ROGERS, G.F.C. and MAYHEW, Y.R. (1994) Thermodynamic and Transport Properties of Fluids: S. I. Units. 5th Ed. Wiley–Blackwell.

برنامج الدرجة الجامعية المتوسطة

Specialization	Mechanical Engineering
Course Title	Principles of Applied Mechanics
Course Number	**020307113**
Credit Hours	3
Theoretical Hours	3
Practical Hours	0

Brief Course Description:

behavioural characteristics of static, dynamic and oscillating engineering systems including shear forces, bending moments, torsion, linear and angular acceleration, conservation of energy and vibrating systems; and the movement and transfer of energy by considering parameters of mechanical power transmission systems.

Course Objectives:

This course aims at:

1. Identify solutions to problems within static mechanical systems.
2. Illustrate the effects that constraints have on the performance of a dynamic mechanical system.
3. Investigate elements of simple mechanical power transmission systems.
4. Analyse natural and damped vibrations within translational and rotational mass–spring systems.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	Identify solutions to problems within static mechanical systems	▪ Shafts and beams: The effect of shear forces on beams. Bending moments and stress due to bending in beams. Selection of appropriate beams and columns to satisfy given specifications. The theory of torsion in solid and hollow circular shafts.	
2.	Illustrate the effects that constraints have on the performance of a dynamic mechanical system	▪ Energy and work: The principle of conservation of energy and work–energy transfer in systems. Linear and angular velocity and acceleration. Velocity and acceleration diagrams of planar mechanisms. Gyroscopic motion.	
3.	Investigate elements of simple mechanical power	▪ Simple systems: Parameters of simple and compounded geared systems. Efficiency of lead screws and screw jacks.	

	transmission systems	▪ Couplings and energy storage: Universal couplings and conditions for constant–velocity. Importance of energy storage elements and their applications.	
4.	Analyse natural and damped vibrations within translational and rotational mass–spring systems	▪ Types of motion: Simple harmonic motion. Natural frequency of vibration in mass–spring systems. ▪ Damped systems: Frequency of damped vibrations in mass–spring–damper systems. The conditions for an external force to produce resonance.	

Text Books & References:

BIRD, J. and ROSS, C. (2014) Mechanical Engineering Principles. 3rd Ed. London: Routledge.

TOOLEY, M. and DINGLE, L. (2012) Engineering Science: For Foundation Degree and Higher National. London: Routledge.

برنامج الدرجة الجامعية المتوسطة	
Specialization	Mechanical Engineering
Course Title	Mechanical Workshop Practices
Course Number	**020207132**
Credit Hours	3
Theoretical Hours	0
Practical Hours	9

Brief Course Description:

Safe working practice, Risk assessment, machining operations, lathe and milling machine, Speeds and feeds, work–holding jigs and fixtures, tolerances. , engineering drawing , measuring tools , quality control and inspection reports , quality control metrology equipment , CNC , Data collection, analysis and product improvement.

Course Objectives:

This course aims at:

1. Identify the potential hazards that exist when operating machine tools and bench fitting equipment, with reference to the appropriate health and safety regulations and risk assessment criteria.
2. Operate a manual lathe and milling machine to produce dimensionally accurate engineering components.
3. Interpret information from engineering drawings and operate measuring tools and work–holding equipment to check dimensional accuracy of machined components.
4. Explain mechanical measurement and quality control processes.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	potential hazards that exist when operating machine tools and bench fitting equipment	▪ Safety compliance: Importance of, and responsibility for, safe working practice. Safe working practices when operating machining equipment in the mechanical machine workshop. Workshop safety legislation and regulations, and how they are met in practice. Risk assessment of bench fitting and machining activities.	
2.	manual lathe and milling machine to produce dimensionally accurate engineering components	▪ Operation: Factors influencing machining operations. Set–up and use of a manual lathe and milling machine following all safety procedures. Most appropriate cutting tools, work and tool holding methods for multiple applications. Speeds and feeds to suit material properties and application. Use of work–holding jigs and fixtures. Removing material within dimensional tolerances.	
3.	engineering drawings and operate measuring tools and	▪ Drawings function: Types of engineering drawing and their use. Developing proficiency in reading and extracting information from mechanical engineering drawings. Types of measuring tools.	

	work–holding equipment to check dimensional accuracy of machined components	Characteristics of measurement tools for inspecting parts. Preparing quality control and inspection reports.	
4.	mechanical measurement and quality control processes	▪ Control processes: Types of production quality control processes, metrology techniques. Importance of quality checks on machined components. Function of quality control metrology equipment, including CNC controlled coordinate measuring machines, mobile measuring arms and touch probes, contact scanning probes and non–contact sensors (optical). Importance of the process for data collection, analysis and product improvement.	

Text Books & References:

BADADHE, A.M. (2006) Metrology and Quality Control. Tathawade: Technical Publications.

BLACK, B.J. (2015) Workshop Processes, Practices and Materials. Routledge. JOHN, K.C. (2010) Mechanical Workshop Practice. 2nd Ed. Prentice–Hall.

برنامج الدرجة الجامعية المتوسطة

Specialization	Mechanical Engineering
Course Title	Fluid Mechanics
Course Number	**020207122**
Credit Hours	3
Theoretical Hours	2
Practical Hours	3

Brief Course Description:

Hydrostatic pressure , manometers , hydraulic devices , immersed surfaces , Moments of area and parallel axis theorem , Centre of pressure , Viscosity in fluids , viscometers , Bernoulli's Equation , Reynolds numbers , flow within pipelines , Viscous drag , Aerodynamics , water turbine , Reciprocating and centrifugal pump , hydraulic machinery.

Course Objectives:

This course aims at:

1. Determine the behavioral characteristics of static fluid systems.
2. Examine the operating principles and limitations of viscosity measuring devices.
3. Investigate dynamic fluid parameters of real fluid flow.
4. Explore dynamic fluid parameters of real fluid flow.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	behavioral characteristics of static fluid systems	▪ Pressure and force: How Pascal's laws define hydrostatic pressure. Pressure with the use of manometers. Transmission of force in hydraulic devices. ▪ Submerged surfaces: Determining thrust on immersed surfaces. Moments of area and parallel axis theorem. Calculating center of pressure with moments of area.	
2.	operating principles and limitations of viscosity measuring devices	Viscosity in fluids: Dynamic and kinematic viscosity definitions. Characteristics of Newtonian fluids. Temperature effects on viscosity. Classification of non–Newtonian fluids. Operating principles and limitations: Operating principles of viscometers. Converting results acquired from viscometers into viscosity values.	
3.	dynamic fluid parameters of real fluid flow	Fluid flow theory: Energy present within a flowing fluid and the formulation of Bernoulli's Equation. Classification of fluid flow using Reynolds numbers. Calculations of flow within pipelines. Head losses that	

		occur within a fluid flowing in a pipeline. Viscous drag resulting from fluid flow and the formulation of the drag equation. Aerodynamics: Application of prior theory of fluid flow to aerodynamics. Principles of aero foils and how drag induces lift. Flow measuring devices and their operating principles.	
4.	operating principles and efficiencies of hydraulic machines	▪ Hydraulic machinery: Operating principles of different types of water turbine. Reciprocating and centrifugal pump theory. Efficiencies of these different types of hydraulic machinery. Environmental concerns surrounding hydraulic machines.	

Text Books & References:

MASSEY, B.S. and WARD-SMITH, J. (2011) Mechanics of Fluids. 9th Ed. Oxford: Spon Press.

برنامج الدرجة الجامعية المتوسطة

Specialization	Mechanical Engineering
Course Title	Quality Management
Course Number	**020307232**
Credit Hours	3
Theoretical Hours	3
Practical Hours	0

Brief Course Description:

engineering strategy and services delivery planning, the role of sustainability, Total Quality Management (TQM), engineering management tools, managing people and becoming a professional engineer.

Course Objectives:

This course aims at:

1. Evaluate the risk evaluation theories and practices associated with the management of projects for the production of current and developing technology.
2. Produce an engineering services delivery plan that meets the requirements of a sector–specific organization.
3. Develop effective leadership, individual and group communication skills.
4. Develop personal commitment to professional standards and obligations to society, the engineering profession and the environment.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	risk evaluation theories and practices associated with the management of projects	▪ The engineering business environment: Organizational structures and functional elements. Strategic planning and deployment. Engineering strategy and services delivery planning. The role of sustainability. Total Quality Management (TQM). Logistics and supply chain management. New product development strategies. Legal obligations and corporate responsibility. ▪ Engineering relationships: The relationship between engineering and financial management, marketing, purchasing, quality assurance and public relations.	
2.	engineering services delivery plan	▪ Engineering management tools: Problem analysis and decision-making, risk management, change management, performance management, product and process improvement, project management	

		and earned value analysis.	
3.	effective leadership, individual and group communication skills	▪ Managing people: Describe the most effective leadership styles. Techniques to effectively manage teams. Steps to follow for delivering effective presentations. Meeting management skills. Communication and listening skills. Negotiating skills. Human error evaluation. Coaching and mentoring.	
4.	personal commitment to professional standards and obligations to society, the engineering profession and the environment	▪ Becoming a professional engineer: Engineering social responsibility. Importance of being active and up to date with the engineering profession, new developments and discoveries. Methods of Continuing Professional Development (CPD).	

Text Books & References:

BURNS, B. (2014) Managing Change. 6th Ed. Pearson.

DEARDEN, H. (2013) Professional Engineering Practice: Reflections on the Role of the Professional Engineer. CreateSpace Independent Publishing Platform.

KARTEN, N. (2010) Presentation Skills for Technical Professionals. IT Governance Ltd.

LOCK, D. (2013) Project Management. 10th Ed. Routledge.

برنامج الدرجة الجامعية المتوسطة

Specialization	Mechanical Engineering
Course Title	Principles of applied machine 2
Course Number	**020207231**
Credit Hours	3
Theoretical Hours	3
Practical Hours	0

Brief Course Description:

Poisson's Ratio and typical values of common materials; the relationship between the elastic constants such as Bulk Modulus, Modulus of Elasticity, Modulus of Rigidity; the relationship between bending moment, slope and deflection in beams; calculating the slope and deflection for loaded beams using Macaulay's method; analyzing the stresses in thin–walled pressure vessels; and stresses in thick–walled cylinders, flat and v–section belt drive theory.
Determine the behavioral characteristics of materials subjected to complex loading; assess the strength of loaded beams and pressurized vessels; determine specifications of power transmission system elements; and examine operational constraints of dynamic rotating systems.

Course Objectives:

This course aims at:

1. Determine the behavioral characteristics of materials subjected to complex loading.
2. Assess the strength of loaded beams and pressurized vessels.
3. Analyze the specifications of power transmission system elements.
4. Examine operational constraints of dynamic rotating systems.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	behavioral characteristics of materials subjected to complex loading	▪ Characteristics of materials: Definition of Poisson's Ratio and typical values of metals, plastics and composite materials. The relationship between the elastic constants such as Bulk Modulus, Modulus of Elasticity, Modulus of Rigidity and Poisson's Ratio. Characteristics of two–dimensional and three–dimensional loading. Calculation of volumetric strain and volume changes.	
2.	strength of loaded beams and pressurized vessels	▪ Strength: The relationship between bending moment, slope and deflection in beams. Calculating the slope and deflection for loaded beams using Macaulay's method. Analyzing the stresses in thin–walled pressure vessels and stresses in thick walled cylinders.	
3.	specifications of power transmission system elements	▪ Specifications: Flat and v–section belt drive theory. Operation of friction clutches with uniform pressure and uniform wear theories. Principles of both epicycles and differential gearing, and the torque required to accelerate these systems.	

		Areas of failure when transmitting power mechanically.	
4.	dynamic rotating systems	▪ Operational constraints: Design of both radial plate and cylindrical cams to meet operating specifications. Operating principles of flywheels to store mechanical energy. Balancing of rotating mass systems. The effects of coupling on freely rotating systems.	

Text Books & References:

BIRD, J. and ROSS, C. (2014) Mechanical Engineering Principles. 3rd Ed. London: Routledge.

KHURMI, R.S. and GUPTA, J.K. (2005) Textbook of Machine Design. New Delhi: S. Chand Publishing.

TOOLEY, M. and DINGLE, L. (2012) Engineering Science: For Foundation Degree and Higher National. London: Routledge.

برنامج الدرجة الجامعية المتوسطة

Specialization	Mechanical Engineering
Course Title	Virtual Engineering
Course Number	**020206214**
Credit Hours	3
Theoretical Hours	3
Practical Hours	0

Brief Course Description:

Dimensioning and tolerances , Manufacturing processes: capability, cost issues and selection , Design tools: 2D and 3D CAD , Solid modelling , Finite element formulation , Finite element method , Fundamentals of CFD (Computational Fluid Dynamics) , CFD simulation and analysis , Simulation results

Course Objectives:

This course aims at:

1. Explore the capabilities and limitations of computer–based models in meeting design fundamentals and their use in solving problems in engineering.
2. Analyze finite element product and system models in order to find and solve potential structural or performance issues.
3. Perform CFD simulations to evaluate pressure and velocity distributions within an engineering setting.
4. Determine faults in the application of simulation techniques to evaluate the modelling method and data accuracy.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	computer–based models in meeting design fundamentals	▪ Engineering design fundamentals: Dimensioning and tolerances. Standardization and regulatory compliance (BS, ASTM, ISO, etc.). How to manufacture and what to manufacture: Material properties and selection. Manufacturing processes: capability, cost issues and selection. ▪ Design tools: 2D and 3D CAD. Solid modelling. File types, export and compatibility. Interpretation and presentation of results through a series of guided exercises: Results obtained, comparison of data, benefits and limitations. Generalization of provided information, recommendations on current and future applications.	
2.	finite element product and system models	▪ Finite element formulation: One–dimensional problems. Multi–dimensional problems. Beams. ▪ Finite element method: Define the problem: simplify an engineering problem into a problem that can be solved using FEA. Define material properties and boundary	

		conditions; choose appropriate functions, formulate equations, solve equations, visualize and explain the results.	
3.	pressure and velocity distributions within an engineering setting	▪ Fundamentals of CFD (Computational Fluid Dynamics): CFD and the finite volume method background. Meshing and boundary conditions. Applications, advantages and limitations of CFD. ▪ CFD simulation and analysis: Apply CFD to simple design/aerodynamics problems: define the problem, provide initial boundary conditions for the problem, set-up a physical model, define material properties and operating conditions. Interpretation of CFD results. Examine the solution using graphical and numerical tools; suggest and make revision of the models.	
4.	application of simulation techniques	▪ Simulation results: Extracting relevant information from simulation-based exercises. Interpretation and presentation of results through a series of guided exercises.	

Text Books & References:

DATE, A.W. (2005) Introduction to Computational Fluid Dynamics. Cambridge University Press.

FISH, J. and BELYTSCHKO, T. (2007) A First Course in Finite Elements. Wiley.

TREVOR, H. and BECKER, A.A. (2013) Finite Element Analysis for Engineers. A Primer, National Agency for Finite Element Methods & Standards.

برنامج الدرجة الجامعية المتوسطة

Specialization	Mechanical Engineering
Course Title	Applied Engineering Mathematics
Course Number	**020308221**
Credit Hours	3
Theoretical Hours	3
Practical Hours	0

Brief Course Description:

Number theory, complex numbers, matrix theory, linear equations, numerical integration, numerical differentiation, and graphical representations of curves for estimation within an engineering context, solving engineering problems using first and second order differential equations.

Course Objectives:

This course aims at:

1. Use applications of number theory in practical engineering situations.
2. Solve systems of linear equations relevant to engineering applications using matrix methods.
3. Approximate solutions of contextualized examples with graphical and numerical methods.
4. Review models of engineering systems using ordinary differential equations.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	theory in practical engineering situations	▪ Number theory: Bases of a number (Denary, Binary, Octal, Duodecimal, Hexadecimal) and converting between bases. Types of numbers (Natural, Integer, Rational, Real, Complex). The modulus, argument and conjugate of complex numbers. Polar and exponential forms of complex numbers. The use of de Mover's Theorem in engineering. Complex number applications e.g. electric circuit analysis, information and energy control systems.	
2.	systems of linear equations	▪ Matrix methods: Introduction to matrices and matrix notation. The process for addition, subtraction and multiplication of matrices. Introducing the determinant of a matrix and calculating the determinant for a 2x2 matrix. Using the inverse of a square matrix to solve linear equations. Gaussian elimination to solve systems of linear equations (up to 3x3).	
3.	contextualized examples	▪ Graphical and numerical methods: Standard curves of common functions, including quadratic, cubic, logarithm and exponential	

		curves. Systematic curve sketching knowing the equation of the curve. Using sketches to approximate solutions of equations. Numerical analysis using the bisection method and the Newton–Raphson method. Numerical integration using the mid–ordinate rule, the trapezium rule and Simpson's rule.	
4.	differential equations	▪ Differential equations: Formation and solutions of first–order differential equations. Applications of first–order differential equations e.g. RC and RL electric circuits, Newton's laws of cooling, charge and discharge of electrical capacitors and complex stresses and strains. Formation and solutions of second–order differential equations. Applications of second–order differential equations e.g. mass–spring–damper systems, information and energy control systems, heat transfer, automatic control systems and beam theory and RLC circuits. Introduction to Laplace transforms for solving linear ordinary differential equations. Applications involving Laplace transforms such as electric circuit theory, load frequency control, harmonic vibrations of beams, and engine governors.	

Text Books & References:

BIRD, J. (2014) Higher Engineering Mathematics. 7th Ed. London: Routledge.

SINGH, K. (2011) Engineering Mathematics Trough Applications. Basingstoke, Palgrave Macmillan.

STROUD, K.A. and BOOTH, D.J. (2013) Engineering Mathematics. 7th Ed: Basingstoke, Palgrave Macmillan.

برنامج الدرجة الجامعية المتوسطة

Specialization	Mechanical Engineering
Course Title	Thermodynamics
Course Number	**020207223**
Credit Hours	3
Theoretical Hours	2
Practical Hours	3

Brief Course Description:

Heat pumps and refrigeration , Second law of thermodynamics , Economics of heat pumps , Theoretical and realistic cycles , Isothermal and adiabatic work , Volumetric efficiency , Intercoolers, dryers and air receivers , Steam power plant , Carnot and Rankine cycle , Gas turbines , Brayton (Joule) cycle , Intercooling, reheat and regeneration.

Course Objectives:

This course aims at:

1. Evaluate the performance and operation of heat pumps and refrigeration systems.
2. Review the applications and efficiency of industrial compressors.
3. Determine steam plant parameters and characteristics using charts and/or tables.
4. Examine the operation of gas turbines and assess their efficiency.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1	heat pumps and refrigeration systems	▪ Heat pumps and refrigeration: Reversed heat engines: reversed Carnot and Rankine cycles. Second law of thermodynamics. Refrigeration tables and charts (p–h diagrams). Coefficient of performance of heat pumps and refrigerators. ▪ Refrigerant fluids: properties and environmental effects. Economics of heat pumps.	
2	efficiency of industrial compressors	▪ Performance of air compressors: Theoretical and realistic cycles. Isothermal and adiabatic work. Volumetric efficiency. Intercoolers, dryers and air receivers. ▪ Hazards and faults: safety consideration and associated legislation.	
3	steam plant parameters	▪ Steam power plant: Use of tables and charts to analyse steam cycles. Circuit diagrams showing boiler, super heater, turbine, condenser and feed pump. ▪ Theoretical and actual operation: Carnot and Rankine cycle. Efficiencies and improvements.	
4	operation of	▪ Gas turbines: Single and double shaft gas	

	gas turbines	turbine operation. Property diagrams: Brayton (Joule) cycle. Intercooling, reheat and regeneration. Combined heat and power plants. Self–starting and burner ignition continuation.	

Text Books & References:

EASTOP, T.D. and MCCONKEY, A. (1996) Applied Thermodynamics for Engineering Technologists. 5th Ed. Prentice Hall.

EASTOP, T.D. and MCCONKEY, A. (1996) Applied Thermodynamics for Engineering Technologists. Student Solutions Manual. 5th Ed. Prentice Hall.

RAYNER, J. (2008) Basic Engineering Thermodynamics. 5th Ed. Pearson.

برنامج الدرجة الجامعية المتوسطة

Specialization	Mechanical Engineering
Course Title	Control Systems Engineering
Course Number	**020207213**
Credit Hours	3
Theoretical Hours	3
Practical Hours	0

Brief Course Description:

Control system terminology and identification, including plant, process, system, disturbances, inputs and outputs, initial time, additivity, homogeneity, linearity and stability , Block diagram representation , Principles of Transfer Function (TF) for open and closed loop systems , Simple mathematical models of electrical, mechanical and electro–mechanical systems , Transient and steady behavior of simple open loop and closed loop control systems , Routh–Hurwitz stability criterion , computational tools (e.g. Matlab, Simulink) to model.

Course Objectives:

This course aims at:

1. Discuss the basic concepts of control systems and their contemporary applications.
2. Analyze the elements of a typical, high–level control system and its model development.
3. Analyze the structure and behavior of typical control systems.
4. Explain the application of control parameters to produce optimum performance of a control system.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	control systems	▪ Background, terminology, underpinning principles and system basics: Brief history of control systems and their industrial relevance, control system terminology and identification, including plant, process, system, disturbances, inputs and outputs, initial time, additivity, homogeneity, linearity and stability. Basic control systems properties and configurations, classification and performance criteria of control systems. Block diagram representation of simple control systems and their relevance in industrial application. Principles of Transfer Function (TF) for open and closed loop systems, use of current computational tools for use in control systems (e.g. Mat lab, Simulink, LabVIEW).	
2.	high–level control system	▪ Developing system applications: Simple mathematical models of electrical, mechanical and electro–mechanical systems. Block diagram representation of simple control systems. Introduction of Laplace transform and its properties, simple first and second order systems and their dynamic responses.	

		Modelling and simulation of simple first and second order control system using current computational tool (e.g. Mat lab/Simulink).	
3.	typical control systems	▪ System behavior: Transient and steady behavior of simple open loop and closed loop control systems in response to a unit step input. Practical closed loop control systems and the effect of external disturbances. Poles and zeros and their role in the stability of control systems, steady–state error. Applicability of Routh–Hurwitz stability criterion. Use of current computational tools (e.g. Mat lab, Simulink) to model, simulate and analyses the dynamic behavior of simple open and closed loop control systems.	
4.	optimum performance of a control system	▪ Control parameters and optimum performance: Introduction to the three–term PID controller, the role of a Proportional controller (P), Integral controller (I) and the Derivative controller (D). General block diagram representation and analysis, effects of each term, P–I–D, on first and second order systems. Simple closed loop analysis of the different combinations of the terms in PID controllers, effect of the three terms on disturbance signals and an introduction to	

		simple PID controller tuning methods. Modelling and simulation using current computational tools (e.g. Matlab, Simuliunk, Labview) to analyse the effects of each P–I–D term, individually and in combination on a control system.	

Text Books & References:

DABNEY, J.B. and HARMAN, T.L. (2003) Mastering Simulink. Prentice Hall.

DORF, R.C. and BISHOP, R.H. (2014) Modern Control Systems. 12th Ed. Pearson.

NISE, N.S. (2011) Control Systems Engineering. 6th Ed. John Wiley & Sons.

برنامج الدرجة الجامعية المتوسطة

Specialization	Mechanical Engineering
Course Title	Practical skills in Mechanical Engineering
Course Number	**020207235**
Credit Hours	3
Theoretical Hours	0
Practical Hours	9

Brief Course Description:

- Project proposal , Selection of project approach , resource requirements , project key objectives , collecting data , Data analysis , Literature review , Independent thinking , Project management and key milestones , Research purpose , Project written presentation , Writing research report , Project oral presentation

Course Objectives:

This course aims at:

1. Conduct the preliminary stages involved in the creation of an engineering research project.
2. Examine the analytical techniques used to work on all stages of the project and strategies required to overcome the challenges involved in a research project.
3. Reflect on the impact the research experience could have in enhancing personal or group performance within an engineering context.
4. Explore the communication approach used for the preparation and presentation of the research project's outcomes.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	preliminary stages involved in the creation of an engineering research project	▪ Setting up the research preliminaries: Project proposal. Developing a research question(s). Selection of project approach. Identification of project supervisor. Estimation of resource requirements, including possible sources of funding. Identification of project key objectives, goals and rationale. Development of project specification.	
2.	analytical techniques	▪ Investigative skills and project strategies: Selecting the method(s) of collecting data. Data analysis and interpreting findings. Literature review. Engaging with technical literature. Technical depth. Multi–perspectives analysis. Independent thinking. Statement of resources required for project completion. Potential risk issues, including health and safety, environmental and commercial. Project management and key milestones.	
3.	impact the research experience	▪ Research purpose: Detailed statement of project aims. Relevance of the research. Benefits and beneficiaries of the research.	

4.	communicatio n approach used for the preparation and presentation of the research project's	▪ Reporting the research: Project written presentation. Preparation of a final project report. Writing research report. Project oral presentation such as using short PowerPoint presentation to discuss the work and conclusions.	

Text Books & References:

LEONG, E.C., LEE–HSIA, C.H. and WEE ONG, K.K. (2015) Guide to Research Projects for Engineering Students: Planning, Writing and Presenting. Apple Academic Press Inc.

OBERLENDER, G.D. (2014) Project Management for Engineering and Construction. 3rd Ed. McGraw–Hill Education.