الخطة الدراسية لبرنامج "الدرجة الجامعية المتوسطة"

في تخصص الهندسة الصناعية

(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 التصنيع والتشـــغيل الهندســـة الميكانيكية/ تخصص الهندسة الصناعية من (72) ساعة معتمدة، موزعة على النحو 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 التقنيين والمشرفين المؤهلين للعمل في مجال الاشراف على خطوط الانتاج وكشف الاعطال الممكن حصولها في المنشات الصناعية وايجاد الحلول لها، والقدرة علـــى العمل كمساعد مهندس في مجال ادارة الجودة والإدارة الصناعية.

المجالات المعرفية للمهارات المتخصصة:

#	الفرع	الساعات المعتمدة		المواد التي تغطي الفرع
		نظري	عملي	
1	العلوم الميكانيكية	10	2	• مبادىء الميكانيكا التطبيقية • التصميم بمساعدة الحاسوب والتصنيع • الانظمة الصناعية • الهندسة الافتراضية
2	العلوم الصناعية	11	7	• هندسة الانتاج في التصنيع • تحسين العمليات والجودة • هندسة انظمة التصنيع • التصنيع الخالي من الهدر(الرشيق) • تكنولوجيا التصنيع المتقدمة • مهارات عملية في الهندسة الصناعية
3	علوم هندسية عامة	7	5	• مبادىء التصميم الهندسي • ادارة الجودة • علوم هندسية تطبيقية • مفاهيم ادارية مهنية
4	التدريب الميداني	-	3	
مجموع الساعات المعتمدة		**28**	**17**	**45 (س.م)**

الخطة الدراسية لتخصص "الهندسة الصناعية "

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أولا: 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**	

ثانيا: 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**	

ثالثا: 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**	

الخطة الدراسية لتخصص "الهندسة الصناعية"

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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	
020206221	هندسة الانتاج في التصنيع	3	2	3	020307111
020307113	مبادئ الميكانيكا التطبيقية	3	3	0	
020206222	تحسين العمليات والجودة	3	2	3	020206221
020206212	التصميم بمساعدة الحاسوب والتصنيع	3	2	3	020307211
020307232	إدارة الجودة	3	3	0	020206222
020206123	هندسة انظمة التصنيع	3	2	3	
020206124	التصنيع الخالي من الهدر (الرشيق)	3	3	0	
020206225	تكنولوجيا التصنيع المتقدمة	3	2	3	
020206213	الانظمة الصناعية	3	2	3	020206123
020206214	الهندسة الافتراضية	3	3	0	
020206226	مهارات عملية في الهندسة الصناعية	3	0	9	
020206241	التدريب الميداني	3	0	*	
المجموع (س.م)		**45**	**28**	**17**	

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

**** – متطلب متزامن**

الخطة الاسترشادية لتخصص "الهندسة الصناعية "

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الفصل الدراسي الأول			الفصل الدراسي الثاني		
اسم المادة	رقم المادة	س.م.	اسم المادة	رقم المادة	س.م.
التربية الوطنية	020000131	2	المواطنة الإيجابية ومهارات الحياة	020000111	3
الثقافة الإسلامية	020000121	3	ريادة الاعمال	020000231	2
مفاهيم رياضية	020000151	3	التصنيع الخالي من الهدر (الرشيق)	020206124	3
مفاهيم فيزيائية	020000161	3	مبادئ الميكانيكا التطبيقية	020307113	3
الرسم الهندسي بالحاسوب	020000171	2	هندسة انظمة التصنيع	020206123	3
الصحة والسلامة والبيئة المهنية	020000141	2	مهارات لغوية/انجليزي	020000101	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.
العلوم العسكرية	020000181	1	الهندسة الافتراضية	020206214	3
التصميم بمساعدة الحاسوب والتصنيع	020206212	3	هندسة الانتاج في التصنيع	020206221	3
الانظمة الصناعية	020206213	3	تحسين العمليات والجودة	020206222	3
تكنولوجيا التصنيع المتقدمة	020206225	3	مفاهيم إدارية مهنية	020307231	3
مبادئ التصميم الهندسي	020307211	3	مهارات عملية في الهندسة الصناعية	020206226	3
إدارة الجودة	020307232	3	التدريب الميداني	020206241	3
مهارات التواصل باللغة الإنجليزية	020000122	2			
المجموع		**18**	**المجموع**		**18**

الوصف المختصر للمواد التعليمية لتخصص "الهندسة الصناعية"

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 شؤونها 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.
Production Engineering for Manufacture (3-2 :3) 020206221 The production process for key material types; the various types of machinery used to manufacture products and the different ways of organizing production systems to optimize the production process; consideration of how to measure the effectiveness of a production system within the overall context of the manufacturing system; and an examination of how production engineering contributes to ensuring safe and reliable operation of manufacturing.
Professional Management Concepts(3-2 :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.
Quality and Process Improvement (3-2 :3) 020206222 tools and techniques used to support quality control, attributes and variables, testing processes, costing modules, the importance of qualifying the costs related to quality, international standards for management (ISO 9000, 14000, 18000), European Foundation for Quality Management (EFQM), principles, tools and techniques of Total Quality Management (TQM) and implementation of Six Sigma.
Computer Aided Design and Manufacture (3-2 :3) 020206212 Programming methods, component set-up, tooling, solid modelling, geometry manipulation,

component drawing, importing solid model, manufacturing simulation, data transfer, CNC machine types and inspections.
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.
Manufacturing Systems Engineering (3-2 :3) 020206123 Elements that make up a manufacturing system, including production engineering, plant and maintenance engineering, product design, logistics, production planning and control, forecast quality assurance, accounting and purchasing, all of which work together within the manufacturing system to create products that meet customers' requirements.
Lean Manufacturing (0-3 :3) 020206124 Scoping and defining lean manufacturing, the benefits and challenges of adopting Lean, The Toyota Production System (TPS), common tools and techniques associated with lean manufacturing and process improvement, and the most appropriate improvement tool(s) to tackle a problem.
Advanced Manufacturing Technology (3-2 :3) 020206225 Manufacturing processes; Types of application of industry; Manufacturing technologies; Manufactured product; Next industrial revolution: Internet of Things and Mass customization.
Industrial Systems (3-2 :3) 020206213 Techniques and applications of electrical and electronic engineering, as they apply to various branches of industry, such as component handling, controlling the speed or torque of a motor or responding to change of circumstances in a process.
Virtual Engineering (0-3 :3) 020206214 Dimensioning and tolerances, standardization and regulatory compliance (BS, ASTM, ISO, etc.), material properties and selection, manufacturing processes, 2D, 3D, CAD, solid modelling, one-dimensional and multi-dimensional problems, meshing and boundary

conditions, and the finite volume method.
Field Training (0-3 :3) 020206241 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.
Practical skills in Manufacturing Engineering (0-3 :3) 020206226 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

برنامج الدرجة الجامعية المتوسطة

Specialization	Industrial 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 technical	▪ Managing the design process: Recognizing limitations including cost, physical processes, availability of material/components and skills, timing	

	design report by using appropriate design calculations, drawings and concepts	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 stakeholder	▪ Communication and post–presentation review: Selection of presentation tools. Analysis of presentation feedback. Strategies for improvement based on feedback.	

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	Industrial 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	Industrial 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.	

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	Industrial Engineering
Course Title	Manufacturing Systems Engineering
Course Number	020206221
Credit Hours	3
Theoretical Hours	2
Practical Hours	3

Brief Course Description:

- Elements that make up a manufacturing system, including production engineering, plant and maintenance engineering, product design, logistics, production planning and control, forecast quality assurance, accounting and purchasing, all of which work together within the manufacturing system to create products that meet customers' requirements.

Course Objectives:

This course aims at:

1. Illustrate the principles of manufacturing systems engineering and explain their relevance to the design and enhancement of manufacturing systems.
2. Use a range of analysis tools, including value stream mapping, to determine the effectiveness and efficiency of a manufacturing system, and then develop an appropriate future state for that system.
3. Outline the impact of different production planning approaches on the effectiveness of a manufacturing system.
4. Define the responsibilities of manufacturing systems engineering and review how they enable successful organisations to remain competitive.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	Manufacturing systems elements:	▪ Elements to be considered include quality, cost, delivery performance and optimising output. ▪ Problem–solving and managing complexity, maintenance scheduling and planning, resource planning and productivity. ▪ Effect of testing and data analysis on performance	
2.	analysis tools	▪ Introduction to value stream mapping, and the value of both current state mapping and future state mapping. ▪ Bottle–neck analysis, by using process improvement tools and techniques e.g. value stream analysis, simulation, kanban. ▪ Using key performance indicators to understand the performance of a manufacturing system e.g. overall equipment effectiveness, lead–time, cycle time, waiting time, yield, delivery performance, safety metrics. ▪ Reviewing key performance indicators; methods for presenting metrics and	

		performance e.g. balanced scorecards, performance dashboards, Andon boards, Gemba walks.	
3.	Production planning approaches:	▪ Examples of production planning strategy: push vs pull factors, Kanban systems, make to stock, make to order and engineer to order. ▪ Production planning approaches such as batch and queue, pull/kanban, justin– time, modular design, configuration at the final point, and master scheduling.	
4.	Effectiveness of manufacturing systems:	▪ Plant layout design, planning and control, productivity and continuous improvement, quality control and equipment effectiveness. ▪ Return on investment and capital expenditure, control of the cost of planned maintenance. ▪ Manufacturing information technology: the supply of data from the process to decision–makers e.g. failure modes for both product and system, maintenance and down time data, standard times for production, material control, energy usage.	

Text Books & References:

BICHENO, J. and HOLWEG, M. (2009) *The Lean Toolbox*. 4th Ed. PICSIE Books.

CHOPRA, S. and MEINDL, P. (2015) *Supply Chain Management: Strategy, Planning, and Operation (Global Edition).* 6th Ed. Pearson.

SLACK, N. (2013) *Operations Management*. 7th Ed. Pearson.

WOMACK, J., JONES, D. and ROOS, D. (1990) *The Machine That Changed the World*. Free Press.

برنامج الدرجة الجامعية المتوسطة

Specialization	Industrial 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	Industrial Engineering
Course Title	Computer Aided Design and Manufacture
Course Number	020206212
Credit Hours	3
Theoretical Hours	2
Practical Hours	3

Brief Course Description:

- Programming methods, component set–up, tooling, solid modelling, geometry manipulation, component drawing, importing solid model, manufacturing simulation, data transfer, CNC machine types and inspections.

Course Objectives:

This course aims at:

1. Describe the key principles of manufacturing using a CAD/CAM system.
2. Produce 3D solid models of a component suitable for transfer into a CAM system.
3. Use CAM software to generate manufacturing simulations of a component.
4. Design and produce a dimensionally accurate component on a CNC machine using a CAD/CAM system.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	the key principles of manufacturing using a CAD/CAM system	▪ Hardware: CAD workstation, printers, USB flash drives and network cables. ▪ Software: Operating systems, hard disk requirements, processor, CAD software e.g. SolidWorks, Autodesk Inventor, CATIA; CAM software e.g. Edgecam, Delcam, GibbsCAM, SolidCAM. ▪ Inputs: CAD model, material specifications, tooling data, spindle speeds and feed rate data calculations. ▪ Outputs: CAM files, program code and coordinates, manufacturing sequences, tooling requirements, auxiliary data. ▪ Programming methods: CAD/CAM, manual programming, conversational programming. ▪ Component set-up: Zero datum setting, tool set-up and offsets, axis of movements. ▪ Work-holding: Machine vice, chuck, fixtures, clamping, jigs. ▪ Tooling: Milling cutters, lathe tools, drills, specialist tooling, tool holders, tool	

		turrets and carousels.	
2.	3D solid models of a component suitable for transfer into a CAM system	▪ Solid modelling: Extrude, cut, fillet, chamfer, holes, sweep, revolve, lines, arcs, insert planes, properties of solid models e.g. mass, centre of gravity, surface area. ▪ Geometry manipulation: Mirror, rotate, copy, array, offset. ▪ Component drawing: Set–up template, orthographic and multi–view drawings, sections, scale, dimensions, drawing. Attributes e.g. material, reference points, tolerances, finish.	
3.	CAM software to generate manufacturing simulations of a component	▪ Import solid model: Set–up, model feature and geometry identification, stock size, material. ▪ Manufacturing simulation: Operations e.g. roughing and finishing, pockets, slots, profiling, holes, tool and work change positions, tool sizes and IDs, speeds and feeds, cutter path simulations, program editing.	
4.	dimensionally accurate component	▪ CNC machine types: Machining centres, turning centres, MCUs e.g. Fanuc, Siemens, and Heidenhain. ▪ Data transfer: Structured data between	

		CAD and CAM software e.g. datum position and model orientation; file types e.g. SLDPRT, parasolid, STL, IGES, DXF; transfer to CNC machine e.g. network, USB, Ethernet. ▪ Inspection: Manual inspection e.g. using Vernier gauges, bore micrometres. Automated inspection e.g. co-ordinate measuring machine (CMM), stages of inspection throughout manufacturing process.	

Text Books & References:

KUNWOO, L. (2000) *Principles of CAD/CAM/CAE*. Pearson.

McMAHAN, C. and BROWNE, J. (1999) *CADCAM: Principles, Practice and Manufacturing Management*. Prentice Hall.

برنامج الدرجة الجامعية المتوسطة

Specialization	Industrial Engineering
Course Title	Quality and Process Improvement
Course Number	020206222
Credit Hours	3
Theoretical Hours	2
Practical Hours	3

Brief Course Description:

tools and techniques used to support quality control, attributes and variables, testing processes, costing modules, the importance of qualifying the costs related to quality, international standards for management (ISO 9000, 14000, 18000), European Foundation for Quality Management (EFQM), principles, tools and techniques of Total Quality Management (TQM) and implementation of Six Sigma.

Course Objectives:

This course aims at:

1. Illustrate the applications of statistical process control when applied in an industrial environment to improve efficiency.
2. Analyse cost effective quality control tools.
3. Determine the role of standards in improving efficiency, meeting customer requirements and opening up new opportunities for trade.
4. Analyse the importance of Total Quality Management and continuous improvement in manufacturing environments.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	Quality control:	▪ The tools and techniques used to support quality control. ▪ Attributes and variables. ▪ Testing processes. ▪ Quality tools and techniques, including SPC. ▪ Designing quality into new products and processes using Quality Function Deployment (QFD).	
2.	Quality costing:	▪ Costing modules. ▪ The importance of qualifying the costs related to quality. ▪ How costs can be used to improve business performance.	
3.	Standards for efficiency:	▪ The history of standards. ▪ The role of standards and their importance in enabling and supporting trade and industry. ▪ Standards for measurement. ▪ International Standards for management (ISO 9000, 14000, 18000). ▪ European Foundation for Quality Management (EFQM) as an aid to	

		developing strategic competitive advantage.	
4.	Overview and function of quality:	▪ The importance of quality to industry: how it underpins the ability to improve efficiency, meet customer requirements and improve competitiveness. ▪ Principles, tools and techniques of Total Quality Management (TQM). ▪ Understanding and implementation of Six Sigma.	

Text Books & References:

OAKLAND, J.S. (2003) *Total Quality Management: Text with Cases*. 3rd Ed. Butterworth–Heinemann.

SLACK, N., CHAMBERS, S. and JOHNSTON, R. (2016) *Operations Management*. 8th Ed. Essex: Pearson Education Limited.

برنامج الدرجة الجامعية المتوسطة

Specialization	Industrial 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.

برنامج الدرجة الجامعية المتوسطة

Specialization	Industrial Engineering
Course Title	Production Engineering for Manufacture
Course Number	020206123
Credit Hours	3
Theoretical Hours	2
Practical Hours	3

Brief Course Description:

- This unit introduces students to the production process for key material types; the various types of machinery used to manufacture products and the different ways of organising production systems to optimise the production process; consideration of how to measure the effectiveness of a production system within the overall context of the manufacturing system; and an examination of how production engineering contributes to ensuring safe and reliable operation of manufacturing.

Course Objectives:

This course aims at:

1. Illustrate the role and purpose of production engineering and its relationship with the other elements of a manufacturing system.
2. Select the most appropriate production processes and associated facility arrangements, for manufacturing products of different material types.
3. Analyse how a production system can incorporate a number of different production processes for a given product or assembly.
4. Explore the effectiveness of a production system in terms of its operation within the wider manufacturing system.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	Production engineering activities:	▪ Common practices for manufacturing. ▪ Research and develop tools, processes, machines, and equipment. ▪ Integrate facilities and systems for producing quality products. ▪ Design, implement and refine products, services, processes and systems. ▪ Combination of manufacturing technology and management science.	
2.	Production processes:	▪ Common ceramics, composite, metals manufacturing processes. ▪ Bonding and jointing technologies, including welding, adhesives, snap fits, ▪ interference fits and mechanical assemblies	
3.	different production processes	▪ *Function of the range of production facilities within a manufacturing plant:* ▪ Production design for manufacture and assembly. ▪ Cellular and flexible manufacturing systems. ▪ Component production using CNC machining centres and automated	

		production processes. ▪ Automated materials handling equipment, conveyor systems, automatic guided vehicle servicing, product assembly and production lines. ▪ Heat treatment facilities, paint and coating plants. ▪ Warehouse, stock storage equipment. ▪ The purpose, operation and effects of incorporating concepts such as lean manufacturing and just–in–time (JIT) supply to the production process.	
4.	Production systems:	▪ Production performance criteria, through–put rates, yield rates, cost effectiveness, sustainability, flexibility and reliability. ▪ Optimising supply chain performance and management. ▪ Essential collaboration between manufacturer, supplier and retailer. ▪ *Production errors and rectification:* ▪ Cost in terms of time, material waste, product recall, reputation and litigation. ▪ Production data collection, critical evaluation and analysis.	

		▪ The human component: ▪ Cultural openness to new ideas and continuous improvement. ▪ Collaboration and information sharing	

Text Books & References:

KALPAKJIAN, S. and SCHMID, S. (2009) *Manufacturing Engineering and Technology*. 6th Ed. Prentice Hall.

برنامج الدرجة الجامعية المتوسطة

Specialization	Industrial engineering
Course Title	Virtual Engineering
Course Number	020206214
Credit Hours	3
Theoretical Hours	3
Practical Hours	0

Brief Course Description:

Dimensioning and tolerances, standardisation and regulatory compliance (BS, ASTM, ISO, etc.), material properties and selection, manufacturing processes, 2D, 3D, CAD, solid modelling, one–dimensional and multi–dimensional problems, meshing and boundary conditions, and the finite volume method.

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.

برنامج الدرجة الجامعية المتوسطة

Specialization	Industrial engineering
Course Title	Lean Manufacturing
Course Number	020206124
Credit Hours	3
Theoretical Hours	3
Practical Hours	0

Brief Course Description:

- Scoping and defining lean manufacturing, the benefits and challenges of adopting Lean, The Toyota Production System (TPS), common tools and techniques associated with lean manufacturing and process improvement, and the most appropriate improvement tool(s) to tackle a problem.

Course Objectives:

This course aims at:

- Examine the common principles of lean manufacturing and how the implementation of a lean production system contributes to business success.
- Evaluate the Toyota Production System against the now more widely adopted generic approaches to lean manufacturing.
- Specify a range of the process improvement tools used within lean manufacturing.
- Demonstrate effective communication skills in order to lead the process of continuous improvement across an organisation.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	the common principles of lean manufacturing	▪ *Scoping and defining lean manufacturing:* The common principles of lean manufacturing philosophy. Origins of lean. ▪ Defining lean and its importance to the customer. ▪ Identifying and eliminating material and process waste that adds no value from the customer's perspective. ▪ *Benefits and challenges of adopting lean:* Why an organisation would consider adopting a lean philosophy. Productivity, quality, customer satisfaction, delivery performance. ▪ The benefits of a lean organisation to the customer, the employees, and the shareholders. ▪ Outline the benefits of lean in terms of cost, quality, delivery, customer satisfaction, management complexity and cost to serve. ▪ Challenges of implementation: change management, managing expectation, empowerment, motivation, 'burning platform', investment, supply chain.	

2.	Toyota Production System:	▪ Research the Toyota Production System (TPS) and identify the fundamental elements of the TPS and the motivation behind creating the TPS. ▪ Compare TPS with the recognised theory and production systems publicized by other global manufacturers: how do they differ and how they are similar? ▪ How the common principles are now being adopted outside manufacturing.	
3.	the process improvement tools	▪ *Common tools and techniques associated with lean manufacturing and* ▪ *process improvement:* ▪ Seven Wastes, continuous flow, kanban (pull System), just–in–time (JIT), lean simulation activities, value stream mapping, Poke Yoke, 5 Whys (Root Cause Analysis), Total Preventive Maintenance. ▪ Plan–do–check–act (PDCA), Single Minute Exchange of Die (SMED), A3 Reporting, Visual Management. ▪ *Selecting the most appropriate improvement tool to tackle a problem:* ▪ Tools for improving quality and delivery.	
4.	Communicati on:	▪ Facilitate a small group in the application and use of one of the lean tools (e.g. 5	

		Whys technique, A3 Report). ▪ Identify factors that influence engagement within a group, facilitation skills and change management.	

Text Books & References:

BICHENO, J. and HOLWEG, M. (2009) *The Lean Toolbox*. 4th Ed. PICSIE Books.

LIKER, J. and MEIER, D. (2006) *The Toyota Way Fieldbook*. McGraw-Hill.

WOMACK, J., JONES, D. and ROOS, D. (1990) *The Machine That Changed the World*. Free Press.

برنامج الدرجة الجامعية المتوسطة	
Specialization	Industrial engineering
Course Title	Advanced Manufacturing Technology
Course Number	020206225
Credit Hours	3
Theoretical Hours	2
Practical Hours	3

Brief Course Description:

- Manufacturing processes; Types of application of industry; Manufacturing technologies; Manufactured product; Next industrial revolution: Internet of Things and Mass customization.

Course Objectives:

This course aims at:

1. Recognise a range of advanced manufacturing processes and cite examples of where they are most effective.
2. Analyse advanced manufacturing technologies to determine their appropriateness for an application or process.
3. Analyse an existing manufactured product and associated process to introduce proposals for possible improvements based on the introduction of advanced manufacturing technologies.
4. Evaluate the concept of the next industrial revolution to determine the impact on both manufacturers and the consumer.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1	advanced manufacturing processes	▪ Manufacturing processes: Pressing and forming, casting and moulding, joining and soldering, mixing, final assembly, packaging, material handling, quality control/inspection. ▪ Advanced manufacturing processes: Additive manufacturing technology (e.g. replacing forming, moulding, pressing), 3D printing, impact on rapid prototyping, availability of spares/obsolete parts, medical components available and customised. Mass customisation through 3D printing, opening up a self-serve market Robotics/human interface and automation, high-precision technology and productivity e.g. aerospace, automotive, electronics assembly. ▪ Types of application or industry: Industry examples: aerospace, automotive, healthcare, electronics, food and beverage, chemical and pharmaceutical, minerals, oil and gas, retail, fashion. Application examples: assembly, joining, moulding, soldering.	
2	advanced	▪ High precision robotics and automation:	

	manufacturing technologies	healthcare (components and processes), aerospace, automotive, process control and visualisation through automation technology. ▪ Improvement in productivity through greater automation. ▪ Quality of manufacturing processes improved through integration of robotics. ▪ Examples of using 3D printing and other forms of additive manufacturing to produce medical equipment, spares parts for items that may have become obsolete, mass customisation; what the customer wants, when they want it.	
3	Next industrial revolution:	▪ Internet of Things: over time industry has transformed from being local-based to communication-based technology; the possibilities for connected technology and connected factories are ever increasing. ▪ Cyber-physical systems: collaborative robotics and highly integrated manufacturing systems. ▪ Mass customisation: there is a growing demand and desire for individual products. In 1908, referring to the Model T, Henry Ford said, "You can have any colour, as long as it's black." In 2015 you can have trillions of	

		variations of the Ford F150; advanced manufacturing technology and the ability to manage complexity is key to that realisation. ▪ Digitalisation and increased automation; the ability to simulate and create a digital twin has the potential to dramatically reduce time to market. ▪ The drive to increase efficiency requires innovation and innovative technology; 25% of all energy used is required by industry alone. ▪ Big data; the development of an ever connected production environment alongside cloud computing presents a challenge of having a stream of production data and the need to analyse this in order to make timely informed decisions.	
4	Manufactured product:	▪ Research the traditional methods used to manufacture an existing product, determine the associated processes required to bring it to market and identify the limitations of these methods and processes. ▪ Explore how advanced manufacturing technology could be applied to produce this product and suggest how applying such processes would influence its production, costs, time to market and customer	

		satisfaction (e.g. healthcare/medical such as hip joint, traditional method vs mass customisation and the possible use of 3D printing). ▪ 3D printing and its availability is opening up new markets, but also new business models for organisations; explore the future possibilities for self-serve/or selfproduction of items.	

Text Books & References:

LEFTERI, C. (2012) Making It: Manufacturing Techniques for Product Design. 2nd Ed. Laurence King.

WRIGHT, P.K. (2000) 21st Century Manufacturing. New Jersey: Prentice-Hall Inc.

برنامج الدرجة الجامعية المتوسطة

Specialization	Industrial Engineering
Course Title	Industrial Systems
Course Number	020206213
Credit Hours	3
Theoretical Hours	2
Practical Hours	3

Brief Course Description:

- Techniques and applications of electrical and electronic engineering, as they apply to various branches of industry, such as component handling, controlling the speed or torque of a motor or responding to change of circumstances in a process.

Course Objectives:

This course aims at:

1. Describe the main elements of an electronically controlled industrial system.
2. Identify and specify the interface requirements between electronic, electrical and mechanical transducers and controllers.
3. Apply practical and computer–based methods to design and test a measurement system.
4. Apply appropriate analytical techniques to predict the performance of a given system.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	Fundamental concepts of industrial systems:	▪ Discrete control. ▪ Input and output devices; open and closed loop systems. ▪ Describe the system elements and the principles and applications of important and representative AC and DC motors.	
2.	Interfacing and transducers:	▪ Discrete automation using relays and solenoids, AC and DC motors, pneumatic, hydraulic and electrical actuators, and other transducers and devices for measuring and comparing physical parameters. ▪ Interfacing between electrical, electronic and mechanical transducers. ▪ Practical measurement using sensors and transducers, process actuators for temperature and pressure control.	
3.	System modelling and analysis:	▪ The use of transfer functions to help predict the behaviour and constancy of an industrial process, including accuracy, resolution and tolerances, repeatability and stability, sensitivity and response time. ▪ Dealing with error and uncertainty in industrial systems.	

		▪ Use of computer packages in measurement and control, and dealing with uncertainty and errors in systems.	
4.	analytical techniques to predict the performance of a given system	Consideration of current trends in technology, including the future of industrial systems, the impact of digital developments, the increase of wireless and remote control and the Internet of Things.	

Text Books & References:

BIRD, J. (2013) Electrical Circuit Theory and Technology. Routledge.

HUGHES, E. et al. (2012) Electrical and Electronic Technology. Pearson.

REHG, J.A. and SARTORI, G.J. (2005) Industrial Electronics. Prentice–Hall.

WILAMOWSKI, B.M. and IRWIN, J.D. (2011) The Industrial Electronic Handbook: Fundamentals of Industrial Electronics. CRC Press.

برنامج الدرجة الجامعية المتوسطة

Specialization	Industrial engineering
Course Title	Practical skills in Manufacturing Engineering
Course Number	020206226
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.	communication approach used for the preparation and	▪ Reporting the research: Project written presentation. Preparation of a final project report. Writing research report. Project oral presentation such as using short PowerPoint	

	presentation of the research project's	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.