الخطة الدراسية لبرنامج "الدرجة الجامعية المتوسطة"

في تخصص الهندسة الكهربائية والالكترونية

(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 الهندسة الكهربائيـــة والكهروميكانيكية / تخصص الهندسة الكهربائية والالكترونية من (72) ساعة معتمدة، موزعـــة 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 فنيين ومشرفين في مجال: تصميم و تركيب الدوائر الالكترونيـــة و الكهربائية و الرقمية المستخدمة في مختلف الاجهزة الكهربائية و الالكترونية، تشـــغيل و صـــيانة الانظمة الصناعية التي يتم التحكم بها بواسطة الحاكمات المنطقية المبرمجة.

المجالات المعرفية للمهارات المتخصصة:

#	الفرع	الساعات المعتمدة		المواد التي تغطي الفرع
		نظري	عملي	
.1	العلوم الكهربائية والالكترونية	17	10	• اساسيات الهندسة الكهربائية والالكترونية • الآلات الكهربائية • الدوائر والاجهزة الكهربائية • اساسيات هندسة الطاقة • الأنظمة الصناعية • الحاكمات المنطقية المبرمجة (PLCs) • اساسيات الهندسة الكهربائية والالكترونية والرقمية • مهارات عملية في الهندسة الكهربائية والإلكترونية • اساسيات الدوائر الرقمية
.2	علوم هندسية عامة	7	2	• الرياضيات الهندسية التطبيقية • علوم هندسية تطبيقية • مبادىء التصميم الهندسي
.3	ادارة صناعية	3	3	• مفاهيم ادارية مهنية • ادارة الجودة
.4	التدريب الميداني		3	
	مجموع الساعات المعتمدة	**27**	**18**	**45 (س.م)**

الخطة الدراسية لتخصص "الهندسة الكهربائية والالكترونية"

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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	
020308111	أساسيات الهندسة الكهربائية والإلكترونية	3	2	3	020307111
020308119	اساسيات الدوائر الرقمي	3	2	3	020308111
020308212	الالات الكهربائية	3	2	3	020308111
020308113	الدوائر والاجهزة الكهربائية	3	2	3	020308111
020307232	ادارة الجودة	3	3	0	
020308221	الرياضيات الهندسية التطبيقية	3	3	0	020000151
020308214	اساسيات هندسة الطاقة	3	2	3	020308113
020206213	الانظمة الصناعية	3	2	3	
020307223	الحاكمات المنطقية المبرمجة	3	2	3	020308212
020308217	اساسيات الهندسة الكهربائية والإلكترونية والرقمية	3	3	0	020308111
020308241	التدريب الميداني	3	0	–	
020308218	مهارات عملية في الهندسة الكهربائية والإلكترونية	3	–	9	
المجموع (س.م)		**45**	**27**	**18**	

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

الخطة الاسترشادية لتخصص "الهندسة الكهربائية والالكترونية "

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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	مهارات التواصل باللغة الإنجليزية	020000122	2
مفاهيم رياضية	020000151	3	أساسيات الهندسة الكهربائية والإلكترونية	020308111	3
مفاهيم فيزيائية	020000161	3	اساسيات الدوائر الرقمي	020308119	3
الرسم الهندسي بالحاسوب	020000171	2	الدوائر والاجهزة الكهربائية	020308113	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.
ريادة الأعمال	020000231	2	اساسيات هندسة الطاقة	020308214	3
الالات الكهربائية	020308212	3	الانظمة الصناعية	020206213	3
الحاكمات المنطقية المبرمجة	020307223	3	اساسيات الهندسة الكهربائية والإلكترونية والرقمية	020308217	3
الرياضيات الهندسية التطبيقية	020308221	3	ادارة الجودة	020307232	3
مبادئ التصميم الهندسي	020307211	3	مهارات عملية في الهندسة الكهربائية والإلكترونية	020308218	3
مفاهيم إدارية مهنية	020307231	3	التدريب الميداني	020308241	3
العلوم العسكرية	020000181	1			
المجموع		**18**	**المجموع**		**18**

الوصف المختصر للمواد التعليمية في "الهندسة الكهربائية والالكترونية "

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) 020307211 The main concepts and theories of management and leadership, fundamentals of risk management, operational management, project and operations management theories.
Electrical and Electronic Principles (3-2 :3) 020308111 fundamental electrical quantities and concepts, circuit laws, mathematical techniques, reactive components, circuits with sinusoidal sources, ideal transformer and rectification, semiconductor material, simple semiconductor devices, analogue concepts and digital concepts.
Digital Circuits Principles(3-2 :3) 020308119 Fundamental digital electronics, combinational and sequential, the fundamental elements of digital Circuits. These include the conventional TTL (Transistor- Transistor Logic) and CMOS (Complementary Metal Oxide Semiconductor).
Electrical Machines(3-2 :3) 020308212 Principles underlying the operation and construction of transformers, induction motors, synchronous machines, electromagnetic transducers, actuators, and generators; and operating characteristics of electrical machines such as voltage, current, speed of operation, power

rating, electromagnetic interference (EMI) and efficiency.
Electronic Circuits and Devices(3-2 :3) 020308113 the use of electronics manufacturers' data to analyze the performance of circuits and devices, the operational characteristics of amplifier circuits, the types and effects of feedback on a circuit performance, and the operation and application of oscillators, the application of testing procedures to electronic devices and circuits, and use the findings of the tests to evaluate their operation.
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.
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.
Energy Engineering Principles(3-2 :3) 020308214 Energy demand, energy auditing, management, costs, requirements, bench marking and optimization, energy and buildings, energy and electric vehicles, control techniques and the impact of renewable resources.
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.
Programmable Logic Controllers (PLCs)(3-2 :3) 020307223 Device interface methods, PLC signal processing and communications with other devices, PLC programming methodology and alternative programmable control devices

Electrical, Electronic and Digital Principles(0-3 :3) 020308217 the preliminary techniques and skills that emphasis in developing a structured approach to the analysis of AC circuit analysis, the expanding use of computers, using specialized software to solve electrical, electronic and digital circuits mathematical techniques, circuit analysis, circuit simulation and laboratory practice.
Field Training (0-0 :3) 020308241 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 Electrical and Electronic Engineering (9-0 :3) 020308218 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	Electrical and Electronics 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	Electrical and Electronics 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	Electrical and Electronics 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 reference to	▪ 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. ▪ Engineering professional behavior	

	ethical frameworks, health and safety requirements and professional standards of behavior in engineering	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 the value	▪ Presentation considerations: Media selection, what to include in the presentation and what outcomes to	

	gained from conducting the project and potential improvements in future projects	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	Electrical and Electronics Engineering
Course Title	Electrical and Electronic Principles
Course Number	020308111
Credit Hours	3
Theoretical Hours	2
Practical Hours	3

Brief Course Description:

fundamental electrical quantities and concepts, circuit laws, mathematical techniques, reactive components, circuits with sinusoidal sources, ideal transformer and rectification, semiconductor material, simple semiconductor devices, analogue concepts and digital concepts.

Course Objectives:

This course aims at:

1. Apply an understanding of fundamental electrical quantities to evaluate simple circuits with constant voltages and currents.
2. Evaluate simple circuits with sinusoidal voltages and currents.
3. Describe the basis of semiconductor action, and its application to simple electronic devices.
4. Explain the difference between digital and analogue electronics, describing simple applications of each.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1	Apply an understanding of fundamental electrical quantities to analyse simple circuits with constant voltages and currents	▪ Fundamental electrical quantities and concepts: Charge, current, electric field, energy in an electrical context, potential, potential difference, resistance, electromotive force, conductors and insulators. ▪ Circuit laws: Voltage sources, Ohm's law, resistors in series and parallel, the potential divider. Kirchhoff's and Thevenin's laws; superposition. ▪ Energy and power: Transfer into the circuit through, for example, battery, solar panel or generator, and out of the circuit as heat or mechanical. Maximum power transfer.	
2	Analyse simple circuits with sinusoidal voltages and curr ents	▪ Fundamental quantities of periodic waveforms: Frequency, period, peak value, phase angle, waveforms, the importance of sinusoids. ▪ Mathematical techniques: Trigonometric representation of a	

		sinusoid. Rotating phasors and the phasor diagram. Complex notation applied to represent magnitude and phase. ▪ Reactive components: Principles of the inductor and capacitor. Basic equations, emphasizing understanding of rates of change (of voltage with capacitor, current with inductor). Current and voltage phase relationships with steady sinusoidal quantities, representation on phasor diagram. ▪ Circuits with sinusoidal sources: Current and voltage in series and parallel RL, RC and RLC circuits. Frequency response and resonance. Mains voltage single-phase systems. Power, root-mean-square power quantities, power factor. ▪ Ideal transformer and rectification: The ideal transformer, half-wave and full-wave rectification. Use of smoothing capacitor, ripple voltage.	
3	Describe the basis of	▪ Semiconductor material: Characteristics of semiconductors;	

	semiconductor action, and its application to simple electronic devices	impact of doping, p–type and n–type semiconductor materials, the p–n junction in forward and reverse bias. ▪ Simple semiconductor devices: Characteristics and simple operation of junction diode, Zener diode, light emitting diode, bipolar transistor, Junction Field Effect Transistor (FET) and Metal Oxide Semiconductor FET (MOSFET). The bipolar transistor as switch and amplifier.	
4	Explain the difference between digital and analogue electronics، describing simple applications of each	▪ Analogue concepts: Analogue quantities, examples of electrical representation of, for example, audio, temperature, speed, or acceleration. The voltage amplifier; gain, frequency response, input and output resistance, effect of source and load resistance (with source and amplifier output modelled as Thevenin equivalent). ▪ Digital concepts: Logic circuits implemented with switches or relays. Use of voltages to represent logic 0 and 1, binary counting.	

		Logic Gates (AND, OR, NAND, NOR) to create simple combinational logic functions. ▪ Truth Tables.	

Textbooks

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

HUGHES, E., HILEY, J., BROWN, K. and MCKENZIE-SMITH, I. (2012) Electrical and Electronic Technology. Pearson.

SINGH, K. (2011) Engineering Mathematics through Applications. Palgrave.

BTEC Higher Nationals Study Guide (2011) Custom Publishing. Pearson.

برنامج الدرجة الجامعية المتوسطة

Specialization	Electrical and Electronics Engineering
Course Title	**Digital Circuits Principles**
Course Number	020308119
Credit Hours	3
Theoretical Hours	2
Practical Hours	3

Brief Course Description:

fundamental digital electronics, combinational and sequential, the fundamental elements of digital Circuits. These include the conventional TTL (Transistor– Transistor Logic) and CMOS (Complementary Metal Oxide Semiconductor).

Course Objectives:

This course aims at:

1. Explain and analyse simple combinational logic circuits.
2. Explain and analyse simple sequential logic circuits.
3. Describe and evaluate the technologies used to implement digital electronic circuits.
4. Describe and analyse a range of digital subsystems, hence establishing the building blocks for larger systems.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1	Explain and analyse simple combinational logic circuits	▪ *Concepts of combinational logic:* Simple logic circuits implemented with electro–mechanical switches and transistors. Circuits built from AND, OR, NAND, NOR, XOR gates to achieve logic functions, e.g. majority voting, simple logical controls, adders. *Number systems, and binary arithmetic:* Binary, Decimal, Hexadecimal number representation, converting between, Applications and relative advantages. Addition and subtraction in binary, range of *n*–bit numbers. ▪ *Analysis of logic circuits:* Truth Tables, Boolean Algebra, de Morgan's theorem, Karnaugh Maps. Simplification and optimisation of circuits using these techniques.	
2	Explain and analyse simple	▪ Sequential logic elements and circuits: SR latch built from NAND or NOR	

	sequential logic circuits	gates. Clocked and edge–triggered bistables, D and JK types. Simple sequential circuits, including shift registers and counters. Timing Diagrams. ▪ Memory technologies: Memory terminology, overview of memory technologies including Static RAM, Dynamic RAM and Flash memory cells. Relative advantages in terms of density, volatility and power consumption. Typical applications, e.g. in memory stick, mobile phone, laptop.	
3	Describe and evaluate the technologies used to implement digital electronic circuits	▪ *Logic values represented by voltages:* The benefit of digital representation of information. The concept of logic input and output values and thresholds. ▪ *Digital technologies:* Introduction to discrete logic families, CMOS and TTL, relative advantages in terms of speed, power consumption, density. Programmable logic, FPGAs, relative advantages and applications.	
4	Describe and analyse a	▪ *User interface:* Examples to include switches, light emitting diodes and	

	range of digital subsystems, hence establishing the building blocks for larger systems	simple displays. ▪ *Digital subsystems:* Examples to be drawn from adders (half, full, *n*–bit), multiplexers and demultiplexers, coders and decoders, counters applied as timers, shift registers applied to serial data transmission, elements of the ALU (Arithmetic Logic Unit). Emphasis on how these can be applied, and how they might fit into a larger system.	

Textbooks

FLOYD, T.L. (2015) Digital Fundamentals. Pearson.

HUGHES, E., HILEY, J., BROWN, K. and MCKENZIE–SMITH, I. (2012) Electrical and Electronic Technology. Pearson.

برنامج الدرجة الجامعية المتوسطة

Specialization	Electrical and Electronics Engineering
Course Title	Electrical Machines
Course Number	020308212
Credit Hours	3
Theoretical Hours	2
Practical Hours	3

Brief Course Description:

principles underlying the operation and construction of transformers, induction motors, synchronous machines, electromagnetic transducers, actuators, and generators; and operating characteristics of electrical machines such as voltage, current, speed of operation, power rating, electromagnetic interference (EMI) and efficiency.

Course Objectives:

This course aims at:

1. Assess the constructional features and applications of transformers.
2. Analyse the starting methods and applications of three–phase induction motors and synchronous machines.
3. Investigate the types of generator available in industry by assessing their practical applications.
4. Analyse the operating characteristics of electromagnetic transducers and actuators

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	Assess the constructional features and applications of transformers	▪ Constructional features: Construction, application, characteristics and testing of transformer types such as: step up, step down, and isolating. Shell and core, windings, connections, efficiency, short circuit and no–load testing, and equivalent circuit.	
2.	Analyse the starting methods and applications of the three–phase induction motors and synchronous machines	▪ *Methods and applications:* Construction, application, characteristics and testing of induction and synchronous motors. ▪ Types of electric motors and their practical applications. Starting methods. Voltages, power, speed, torque, inertia, EMI, and efficiency. Cooling and protection devices.	
3.	Investigate the types of generators available in the industry by assessing their	▪ Types of generators available: Construction, application, characteristics and testing of generators. Types (direct current, alternating current and self–excitation). Practical applications.	

	practical application	Generation methods. Voltages, power, speed, torque, inertia, EMI, efficiency. ▪ Cooling and protection devices.	
4.	Analyse the operating characteristics of electromagnetic transducers and actuators	▪ Operating characteristics: Construction, application, characteristics and testing of electromagnetic transducers and actuators. ▪ Transducer types (active, passive, sensor), actuator types (solenoids, linear, rotary). ▪ Practical applications. ▪ Voltage and current requirements, hysteresis and speed of operation. ▪ Torque. ▪ Insulation Protection (IP) rating. ▪ Contact types. ▪ Back Electromotive Force (EMF), EMI and efficiency.	

Textbooks

DE SILVA, C.W. (2015) Sensors and Actuators: Engineering System Instrumentation. 2nd Ed. CRC Press.

HUGHES, A. (2013) Electric Motors and Drives: Fundamentals, Types and applications. 4th Ed. Newnes.

برنامج الدرجة الجامعية المتوسطة

Specialization	Electrical and Electronics Engineering
Course Title	Electronic Circuits and Devices
Course Number	020308113
Credit Hours	3
Theoretical Hours	2
Practical Hours	3

Brief Course Description:

the use of electronics manufacturers' data to analyze the performance of circuits and devices, the operational characteristics of amplifier circuits, the types and effects of feedback on a circuit performance, and the operation and application of oscillators, the application of testing procedures to electronic devices and circuits, and use the findings of the tests to evaluate their operation.

Course Objectives:

This course aims at:

1. Determine the operational characteristics of amplifier circuits.
2. Investigate the types and effects of feedback on an amplifier's performance.
3. Examine the operation and application of oscillators.
4. Apply testing procedures to electronic devices and circuits.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1	Determine the operational characteristics of amplifier circuits	▪ Operational characteristics: Power amplifiers: class A, B and AB. Operational amplifiers: inverting, non–inverting, differential, summing, integrator, differentiator, comparator, instrumentation, Schmitt trigger, active filters. Gain, bandwidth, frequency response, input and output impedance. Distortion and noise.	
2	Investigate the types and effects of feedback on an amplifier's performance	▪ Types and effects: Types including open, closed, positive and negative feedback. Effect of feedback on gain, bandwidth, distortion, noise, stability, input and output impedance.	
3	Examine the operation and application of oscillators	▪ Operation and application: Types of oscillators such as Wien bridge, Twin–T, R–C ladder, L–C coupled, transistor, operational amplifier, crystal. Frequency, stability, frequency drift, distortion, amplitude and wave shapes.	
4	Apply testing	▪ Testing procedures: Measuring	

	procedures to electronic devices and circuits	performance, using practical results and computer simulations. Voltage gain, current, bandwidth, frequency response, output power, input and output impedance. Distortion and noise. Devices to test: Semiconductors. Integrated circuits. Amplifiers. Oscillators. Filters. Power supplies. Integrated circuit (IC) voltage regulators. Combined analogue and digital IC's. ▪ Component manufacturer's data: Specifications, manuals and circuit diagrams. ▪ Use of testing equipment: Meters, probes and oscilloscopes. Signal generators and signal analysers, logic analysers. Virtual test equipment	

Textbooks

BOYLESTAD, R.L. and NASHELSKY, L. (2013) Electronic Devices and Circuit Theory. 11th Ed. Pearson.

FLOYD, T.L. and BUCHLA, D. (2013) Electronics Fundamentals: Circuits, Devices & Applications. 8th Ed. Pearson.

HOROWITZ, P. and HILL, W. (2015) The Art of Electronics. 3rd Ed. Cambridge University Press.

برنامج الدرجة الجامعية المتوسطة

Specialization	Electrical and Electronics Engineering
Course Title	Practical skills in electrical and electronics Engineering
Course Number	020308218
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 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.

برنامج الدرجة الجامعية المتوسطة

Specialization	Electrical and Electronics 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	Electrical and Electronics 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	Electrical and Electronics Engineering
Course Title	**Energy Engineering Principles**
Course Number	020308214
Credit Hours	3
Theoretical Hours	2
Practical Hours	3

Brief Course Description:

Energy demand, energy auditing, management, costs, requirements, bench marking and optimization, energy and buildings, energy and electric vehicles, control techniques and the impact of renewable resources.

Course Objectives:

This course aims at:

1. Evaluate energy demand to determine the technology and methods of energy production.
2. Discuss current energy efficiency measures, technologies and policies specific to the building and transportation sectors.
3. Analyse the control techniques of power electronics for renewable energy systems.
4. Investigate the impacts of renewable resources to the grid and the various issues associated with integrating such resources to the grid.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	Evaluate the energy demand to determine the technology and methods of energy production	▪ Energy demand: Historical energy production, energy consumption, environmental aspects and global warming. ▪ The need for energy systems and global energy demand over the short to long term. ▪ Environmental effects associated with energy generation and consumption. ▪ Practicality, benefits, drawbacks and effectiveness of renewable energy sources. ▪ Overview of renewable energy technologies (wind, solar, bio, hydro, geothermal) and the associated costs. ▪ Future energy trends, scenarios and sustainable energy sources.	
2.	Explore current energy efficiency measures, technologies	▪ Energy auditing, management, costs, requirements, bench marking and ▪ optimisation: Energy management, planning, monitoring, policy, ecology and environment.	

	and policies specific to the building and transportation sectors	▪ Energy and buildings: ▪ Overview of the significance of energy use and energy processes. ▪ Internal and external factors on energy use and the attributes of the factors. ▪ Status of energy use in buildings and estimation of energy use in a building. ▪ Standards for thermal performance of building envelope and evaluation of the overall thermal transfer. ▪ Measures and technologies to improve energy efficiency in buildings. ▪ Energy and electric vehicles: ▪ Electrical vehicle configurations, requirements, and circuit topology; electric and plug in hybrid vehicles. ▪ Policies, measures and technologies to support more sustainable transportation. ▪ Use of Matlab/Simulink or alternative appropriate software to model, simulate and analyse the energy efficiency of a typical standard house	

		or electric vehicle.	
3.	Analyse the control techniques of power electronics for renewable energy systems	▪ *Control techniques:* Environmental aspects of electrical energy conversion using power electronics. ▪ Introduce design criteria of power converters for renewable energy applications. ▪ Analyse and comprehend the various operating modes of wind electrical generators and solar energy systems. ▪ Introduce the industrial application of power converters, namely AC to DC, DC to DC and AC to AC converters for renewable energy systems. ▪ Explain the recent advancements in power systems using the power electronic systems. Introduction to basic analysis and operation techniques on power electronic systems. ▪ Functional analysis of power converters' main topologies. ▪ Use of Matlab/Simulink to model, simulate and analyse the dynamic behavior of a simple renewable energy system.	

4.	Investigate the impacts of renewable resources to the grid and the various issues associated with integrating such resources to the grid	▪ Impact of renewable resources: Safe and secure operation of a simple power system. ▪ Standalone and grid connected renewable energy systems. ▪ Introduction to smart grid, features, functions, architectures, and distributed generation. Grid interactive systems, grid tied systems, inverters, and application of its devices. ▪ Smart homes, power management, smart grid, intelligent metering. ▪ Communication technologies and power electronics modules for smart grid network, importance of power electronics in smart grid, for example energy storage (electrical, chemical, biological, and heat), and the future of smart grid. ▪ Use of Matlab/Simulink to model, simulate and analyse the dynamic behavior of a standard smart grid	

Text Books & References:

ABU-RUB, H., MALINOWSKI, M. and AL-HADDAD, K. (2014) Power Electronics for Renewable Energy Systems, Transportation and Industrial Applications. John Wiley & Sons.

EKANAYAKE, J. and JENKINS, N. (2012) Smart Grid Technology and Applications. John Wiley & Sons.

RASHID, M.H. (2013) Power Electronics: Circuits, Devices and Applications. 4th Ed. Pearson.

TWIDELL, J. and WEIR, T. (2006) Renewable Energy Resources. 2nd Ed. Taylor & Francis.

برنامج الدرجة الجامعية المتوسطة

Specialization	Electrical and Electronics 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.	Describe the main elements of an electronically controlled industrial system	▪ 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.	Identify and specify the interface requirements between electronic, electrical and mechanical transducers and controllers	▪ 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.	Apply practical and computer–	▪ System modelling and analysis: The use of transfer functions to help predict the behaviour and constancy of an industrial	

	based methods to design and test a measurement system	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.	Apply appropriate 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	Electrical and Electronics Engineering
Course Title	Programmable Logic Controllers (PLCs)
Course Number	020307223
Credit Hours	3
Theoretical Hours	2
Practical Hours	3

Brief Course Description:

Device interface methods, PLC signal processing and communications with other devices, PLC programming methodology and alternative programmable control devices

Course Objectives:

This course aims at:

1. Discuss the selection of a specific PLC for a given industrial application.
2. Evaluate how PLCs exchange information and process signals with other devices.
3. Design a PLC programme to solve an industrial process problem for a given application.
4. Analyse alternative strategies using other types of programmable control devices in industrial applications.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	Discuss the selection of a specific PLC for a given industrial application	▪ *PLC selection:* Common PLC industrial applications. Different PLC types, their features and PLC manufacturers. ▪ External input and output devices: analogue and digital. ▪ PLC operational characteristics: speed, current, voltages, memory. ▪ Alternative PLC modules available: Relay, Triac, Transistor, Analogue to Digital.	
2.	Evaluate how PLCs exchange information and process signals with other devices	▪ PLC signal processing and communications with other devices: Communication links and standards. Networked bus systems. Supervisory Control and Data Acquisition (SCADA) systems and Human Machine Interfaces (HMIs).	
3.	Design a PLC programme to solve an industrial process problem for a	▪ PLC programming methodology: Fundamentals of logic–ladder diagrams and other programming structures. PLC programming methods used of PLCs in accordance with IEC 61131. Logic functions: AND, OR, NOT, EXOR.	

	given application	▪ Number systems used by PLCs: Binary, Hexadecimal, Octal, BCD. System input and output allocation data. ▪ Advanced functions: registers, Analogue to Digital (AtoD), performing calculations, high-speed counters and timers. Program test and debug software functions. Fault-finding of systems using PLC software remotely. Software toolbox elements. Virtual PLC simulations.	
4.	Analyse alternative strategies for using other types of programmable control devices in industrial applications	▪ Alternative programmable control devices: Programmable Logic Device (PLD). Peripheral Interface Controller (PIC). Microcontrollers. Industrial computers. ▪ Programmable device interface methods: Relays and solid state relays. Opto couplers. Opto isolators. Motor driver interface integrated circuits.	

Text Books & References:

BOLTON, W. (2015) Programmable Logic Controllers. 5th Ed. Newes.

KAMEL, K. and KAMEL, E. (2013) Programmable Logic Controllers: Industrial Control. McGraw-Hill Education.

برنامج الدرجة الجامعية المتوسطة

Specialization	Electrical and Electronics Engineering
Course Title	Electrical, Electronic and Digital principles
Course Number	020308217
Credit Hours	3
Theoretical Hours	3
Practical Hours	0

Brief Course Description:

the preliminary techniques and skills that emphasis in developing a structured approach to the analysis of AC circuit analysis, the expanding use of computers, using specialized software to solve electrical, electronic and digital circuits mathematical techniques, circuit analysis, circuit simulation and laboratory practice.

Course Objectives:

This course aims at:

1. Use appropriate mathematical techniques to solve a range of electrical and electronic problems.
2. Apply appropriate circuit theorems to solve problems in electrical networks.
3. Use appropriate laboratory and computer simulation techniques to investigate both analogue and digital circuits and interpret the results.
4. Explain the characteristics of non–linear circuits to predict their behavior under a variety of conditions.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1	Use appropriate mathematical techniques to solve a range of electrical and electronic problems	▪ Formal steady state circuit analysis: Determinants, mesh analysis and nodal analysis (and their comparison). Analysis using ideal sources, superposition theorem. ▪ AC circuit analysis: Complex notation, polar and Cartesian coordinates, RLC circuits. Advanced use of phasor diagrams. ▪ Power: instantaneous power, power factor, apparent power, the power triangle.	
2	Apply appropriate circuit theorems to solve problems in electrical networks	▪ Three–phase theory: Application of trigonometric methods to solution of phasor diagrams. Application of complex numbers to represent quantities in AC circuits. Single–phase representation. Solution of balanced three–phase circuits. Complex notation applied to three–phase, unbalanced loads, unconnected neutral point. Power, reactive power and power factor correction for three–phase systems.	

3	Use appropriate laboratory and computer simulation techniques to investigate both analogue and digital circuits and interpret the results	▪ ECAD: Use of computer modelling and simulation techniques to analyse and solve electronic, electrical and digital circuits, such as filters and amplifiers using operational amplifiers and discrete devices; digital logic circuit elements; and simple combination and sequential circuits.	
4	Explain the characteristics of non–linear circuits to predict their behaviour under a variety of conditions	▪ Non–linear circuits: Characteristics of linear and non–linear circuits, mathematical modelling of a number of semiconductor devices, including diodes, bipolar and Field Effect Transistors and how this can be used to predict their 'real' behaviour in practice. Mathematically modelling the behaviour of semiconductor diodes, bipolar transistors and Field Effect Transistors.	

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.