جامعة المرقب

كلية الهندسة الخمس

قسم الهندسة المدنية

الدراسات العليا

- الرؤية:

- رؤيتنا المستقبلية أن يكون قسم الهندسة المدنية من الاقسام الرائدة والمتميزة في مجال البحوث العلمية التي تساهم في خدمة وتنمية المجتمع.

- الرسالة:

رسالتنا هي إعداد كوادر وكفاءات متخصصة في كافة مجالات الهندسة المدنية، وذلك باستخدام البرامج التعليمية المعدة المتميزة والمتطورة، واكساب الخريجين مهارات القدرة على البحث العلمي وتأهيلهم لتلبية احتياجات سوق العمل بما يكفل التنمية الشاملة والمستدامة.

- الأهداف:

- ترسيخ وتنمية قاعدة البحث العلمي لدى طلاب القسم وإعداد متخصصين في مجال الهندسة المدنية، وذلك عن طريق اتباع طرق تدريس وبحث حديثة ومتطورة للوصول إلى إضافات علمية وتطبيقية مبتكرة.
- تشجيع الكفاءات العلمية على مواكبة التقدم السريع للعلم والتقنية ودفعها إلى الإبداع والابتكار والتميز.
- تقديم الاستشارات العلمية والهندسية والخدمات الفنية في مجال الهندسة المدنية للمؤسسات العامة والخاصة في الدولة وتنمية الاتجاهات العلمية لمعالجة قضايا المجتمع.
- تبنى المؤتمرات العلمية والحلقات الدراسية وورش العمل التي يمكن أن تساهم في تطوير الأساليب والمناهج المعتمدة في مجالات الهندسة المدنية.
- إتاحة فرص التعليم العالي والتخصصي في مجالات الهندسة المدنية المختلفة وتمكين الراغبين من مواصلة دراساتهم العليا محليا.
- تزويد القطاعات الخدمية والإنتاجية والصناعية بكوادر وكفاءات عالية التأهيل للرفع من مستوى خدماتها للمجتمع.

- البرامج المتاحة:

- برنامج درجة الإجازة العالية (الماجستير) في هندسة الانشاءات.
- برنامج درجة الإجازة العالية (الماجستير) في هندسة المواصلات والمساحة.
- برنامج درجة الإجازة العالية (الماجستير) في هندسة المياه والبيئة.

- قائمة أعضاء هيئة التدريس ببرامج الدراسات العليا:

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برنامج درجة الإجازة العالية (الماجستير) في الهندسة المدنية

Master of Science Degree Program in Civil Engineering

الخطة الدراسية لبرنامج هندسة الإنشاءات

Study Plan of the Structural Engineering Division Program

رمز المقرر	الاسم العربي	Course title	Credits
مقررات عامة إلزامية (9 وحدات):			
GH601	طرق ومناهج البحث	Research Methods and Methodologies	3
GH610	رياضيات هندسية متقدمة	Advanced Engineering Mathematics	3
GH620	تحليل عددي متقدم	Advanced Numerical Analysis	3
مقررات تخصصية إلزامية (12 وحدة):			
CIE601	تحليل إنشائي متقدم	Advanced Structural Analysis	3
CIE605	ميكانيك المواد الصلبة المتقدمة	Advanced Mechanics of Solids	3
CIE609	تصميم خرسانة مسلحة متقدمة	Advanced Reinforced Concrete Design	3
CIE613	تكنولوجيا خرسانة متقدمة	Advanced Concrete Technology	3
مقررات تخصصية اختيارية (9 وحدات):			
CIE606	نظرية الصفائح والقشريات	Theory of Plates and Shells	3
CIE612	تصميم جسور متقدمة	Advanced Bridge Design	3
CIE614	تصميم خرسانة سابقة الإجهاد متقدم	Advanced Pre-stressed Concrete	3
CIE615	مواضيع متقدمة في الخرسانة المسلحة	Advanced Topics in Reinforced Concrete	3
CIE617	تصميم فولاذ متقدم	Advanced Steel Design	3
CIE621	أساسات عميقة	Deep Foundations	3
CIE624	نظرية المرونة	Theory of Elasticity	3
CIE625	تصميم المنشآت الخرسانية لمقاومة الزلازل	Seismic Design of Concrete Structures	3
مرحلة رسالة الماجستير (6 وحدات):			
GR698	مقترح الرسالة والعرض المبدئي	Proposal and Seminar	-
GR699	رسالة الماجستير	Master Thesis	6

الخطة الدراسية لبرنامج المواصلات والمساحة

Study Plan of the Survey and Transportation Division Program

رمز المقرر	الاسم العربي	Course title	Credits
مقررات عامة إلزامية (9 وحدات):			
GH601	طرق ومناهج البحث	Research Methods and Methodologies	3
GH610	رياضيات هندسية متقدمة	Advanced Engineering Mathematics	3
GH630	الإحصاء الهندسي المتقدم	Advanced Engineering Statistics	3
مقررات تخصصية إلزامية (12 وحدة):			
CIE662	النظم العالمية للتموقع بالأقمار الصناعية	Global Navigation Satellite Systems	3
CIE663	تطبيقات في نظم المعلومات المكانية	Applications in GIS	3
CIE668	مواد رصف طرق متقدمة	Advanced Road Pavement Materials	3
CIE678	تحليل وتخطيط النقل بالمدن	Analysis and Planning of Urban Transportation	3
مقررات تخصصية اختيارية (9 وحدات):			
CIE667	تصميم قطاع الرصف متقدم	Advanced Pavement Design	3
CIE672	نظم إدارة المرور	Traffic Management Systems	3
CIE674	مساحة جيوديسية متقدمة	Advanced Geodetic Surveying	3
CIE679	التحليل الإحصائي لحوادث الطرق	Statistical Analysis of Road Accidents	3
CIE680	إنشاء وصيانة الطرق الاسفلتية	Construction and Maintenance of Asphaltic Roads	3
CIE682	تحليل وتعديل البيانات متقدمة	Advanced Analysis and Adjustment of Data	3
CIE683	التحليل المكاني في نظم المعلومات المكانية	Spatial Analysis in GIS	3
CIE684	البنية التحتية للبيانات المكانية	Spatial Data Infrastructure	3
مرحلة رسالة الماجستير (6 وحدات):			
GR698	مقترح الرسالة والعرض المبدئي	Proposal and Seminar	-
GR699	رسالة الماجستير	Master Thesis	6

الخطة الدراسية لبرنامج شعبة المياه والبيئة

Study Plan of the Water and Environmental Engineering Division Program

رمز المقرر	الاسم العربي	Course title	Credits
مقررات عامة إلزامية (9 وحدات):			
GH601	طرق ومناهج البحث	Research Methods and Methodologies	3
GH610	رياضيات هندسية متقدمة	Advanced Engineering Mathematics	3
GH630	الإحصاء الهندسي المتقدم	Advanced Engineering Statistics	3
مقررات تخصصية إلزامية (12 وحدة):			
CIE638	تصميم محطات معالجة مياه الصرف	Wastewater Treatment Plants Design	3
CIE641	إدارة المخلفات الصلبة	Solid Waste Management	3
CIE647	قنوات مفتوحة	Open Channels	3
CIE651	هيدرولوجيا تطبيقية متقدمة	Advanced Applied Hydrology	3
مقررات تخصصية اختيارية (9 وحدات):			
CIE639	تقييم الأثر البيئي	Environmental Impact Assessment	3
CIE644	معالجة مياه المخلفات الصناعية	Industrial Wastewater Treatment	3
CIE645	إدارة نظم الموارد المائية	Water Resources Systems Management	3
CIE650	هندسة سدود	Dam Engineering	3
CIE653	منشآت هيدروليكية متقدمة	Advanced Hydraulic Structures	3
CIE655	هيدرولوجيا إحصائية	Statistical Hydrology	3
CIE659	المحاكاة والنمذجة الهيدروليكية	Hydraulic Simulation and Modeling	3
CIE660	هيدرولوجيا مياه جوفية متقدمة	Advanced Ground Water Hydrology	3
مرحلة رسالة الماجستير (6 وحدات):			
GR698	مقترح الرسالة والعرض المبدئي	Proposal and Seminar	-
GR699	رسالة الماجستير	Master Thesis	6

Courses Syllabus

1. Courses syllabus of the Structural Engineering Division

Research Methods and Methodologies	GH601	3 hours	3 Units

Concepts, Research methods, Initial research procedure, Finalization of scope, Research Problem, Sources of Knowledge, Review of Literature, Correlations of problem and scope with literature review, Main research methodology, Research Hypotheses, Research Approach, Research Strategies, Sampling, Realization of findings. Formal construction, Customization, Types of manuscripts, Main and auxiliary contents, Formal writing, Formats of referencing. Presentation skills, Scientific search engines, Applications and projects.

Advanced Engineering Mathematics	GH610	3 hours	3 Units

Ordinary first, second and higher order differential equations: power series solutions for differential equations; extended power series; Bessel's equation; Legendere's equation; SturLiouville problems; power series: Taylor series and Laurent series; Laplace transformations; Fourier series and integrals; partial differential equation; applications.

Advanced Numerical Analysis	GH620	3 hours	3 Units

Modeling by computer and error analysis; roots of equations; linear and non-linear algebraic equations; optimization; curve fitting; numerical solution of differentiation and integration; solution of ordinary differential equations; solution of partial differential equations; finite difference and finite element methods; implementation of the numerical methods on civil engineering problems using computer programming.

Advanced Structural Analysis	CIE601	3 hours	3 Units

Review of direct stiffness method; Brief introduction to finite element method; Analysis of space trusses; Analysis of grids: approximate method, stiffness method; Analysis of folded plates: approximate stress distribution method, using available computer programs; Suspension roofs; Structures with curved members; Axisymmetric domes: shells of revolution ribbed; Structures with members of variable cross sections.

Advanced Mechanics of Solids	CIE605	3 hours	3 Units

Analysis of stress and strain; Constitutive equations for elastic materials; Plane stress and strain; Torsion; Thermal stresses; Yield criteria; Constitutive equations for elasto-plastic stress analysis; Visco-elasticity and creep.

Advanced Reinforced Concrete Design	CIE609	3 hours	3 Units

Behavior, analysis and design of reinforced concrete members and structures, working stress, ultimate strength, and limit states methods of design, strength, serviceability, Equivalent frame method of the ACI Code. Crack control. Immediate and long-term deflections. Curvature-bending relationships for concrete beams. Limit analysis method for beams. Yield line method for slabs. Shear walls for resisting lateral loads (e.g. earthquakes). Composite structures.

Advanced Concrete Technology	CIE613	3 hours	3 Units

Mix design for high strength concrete; Admixtures: types, use of admixtures; High performance concrete: polymer concrete, light weight concrete, fiber reinforced concrete; Concrete durability; Concrete porosity: factors affecting concrete porosity, effect of porosity on concrete (attack of chemicals, chlorides, phosphates, sea water); Non-destructive tests: nature, importance and use of non-destructive tests; Stiffness test: rebound method, use of Schmith hammer; Extraction test; Penetration test; Vibration method: sound waves, ultra sound waves, resonance; Magnetic method; Electric method; Radiation method: X-ray, Gama ray, Neutron ray.

Theory of Plates and Shells	CIE606	3 hours	3 Units

Cylindrical bending of long plates; Bending of rectangular plates with various edge conditions and loads: Mohr's circle of moments; Navier solution, Levy's solution; Fourier series representation of loads; Use of superposition; Continuous plates using moment distribution; Circular plates: axi-symmetric and non-symmetric bending; Large deflection of rectangular plates; Combined lateral and in-plane loads.

Introduction to shell geometry and differential geometry, membrane and bending theories of shells, analysis of shell of revolution and axisymmetric loading on cylinders and domes, analysis of cylindrical shell roofs, shallow shell theory, analysis of transitional shell roofs.

Advanced Bridge Design	CIE612	3 hours	3 Units

Classification of bridges; Load and stress specifications for bridges; Analysis and design of isolated and continuous slabs; Bridges with rectangular and I-shaped sections; Box bridges; Suspension bridges; Brackets; Pears and foundations of bridges.

Advanced Pre-stressed Concrete	CIE614	3 hours	3 Units

General principles: Structural behavior and failure modes; pre-stress losses; design for flexure, shear and torsion; Check of deflections; Simple beams; Continuous beams; Slabs.

Advanced Topics in Reinforced Concrete	CIE615	3 hours	3 Units

New and current updated topics in structural engineering and in design of concrete and prestressed concrete; Development of codes of practice and changes; Design of R.C. deep beams, corbels and shear walls.

Advanced Steel Design	CIE617	3 hours	3 Units

Plastic analysis and design of continuous beams and frames. Design for torsion; Design of bracing members; Design of column bases; Composite construction. Design of steel tubular members.

Deep Foundations	CIE621	3 hours	3 Units

Piles and drilled shafts: ultimate capacity and load-deflection due to compressive loads, tensile loads and lateral loads; Effects of load duration, soil-structure inter-action; Analysis of pile groups in two and three dimensions; Effects of installation; Inspection of deep foundations; Full scale field tests.

Theory of Elasticity	CIE624	3 hours	3 Units

General equations of elasticity, plane stress and plane strain, two-dimensional problems in rectangular and polar coordinates. Energy principles and variational methods. Torsion of various shaped bars. Behavior of bars under forces and bending moments acting simultaneously.

Seismic Design of Concrete Structures	CIE625	3 hours	3 Units

Introduction to the design of earthquake-resistant building structures in relation to the characteristics of different structural forms in reinforced concrete, Assessment of curvature, rotational and displacement ductility supply and demand in reinforced concrete members, Design and detailing of concrete members and joints in moment frames, Behavior and design of reinforced-concrete shear wall systems under seismic loading conditions, Estimation of the flexural stiffness of concrete elements under seismic loading, Introduction to displacement-based seismic design.

2. Courses syllabus of the Transportation and Survey Division

Research Methods and Methodologies	GH601	3 hours	3 Units

Concepts, Research methods, Initial research procedure, Finalization of scope, Research Problem, Sources of Knowledge, Review of Literature, Correlations of problem and scope with literature review, Main research methodology, Research Hypotheses, Research Approach, Research Strategies, Sampling, Realization of findings. Formal construction, Customization, Types of manuscripts, Main and auxiliary contents, Formal writing, Formats of referencing. Presentation skills, Scientific search engines, Applications and projects.

Advanced Engineering Mathematics	GH610	3 hours	3 Units

Ordinary first, second and higher order differential equations: power series solutions for differential equations; extended power series; Bessel's equation; Legendere's equation; SturLiouville problems; power series: Taylor series and Laurent series; Laplace transformations; Fourier series and integrals; partial differential equation; applications.

Advanced Engineering Statistics	GH630	3 hours	3 Units

Introduction to Statistics; Variables, Measures of central tendency, Measures of dispersion, Correlation and regression. Statistical intervals for a single sample, Hypothesis testing for a single sample, Statistical inference for two samples, Simple linear regression and correlation, Multiple linear regression, Design and analysis of single-factor experiments: The analysis of variance, Design of experiments with several factors. Applications using Microsoft Excel, Applications using statics software; (SPSS - Minitab - RStudio - EViews).

Global Navigation Satellite Systems	GH662	3 hours	3 Units

A Brief History of GNSS: Sputnik, Transit, PARUS and TSIKADA, TIMATION, NAVSTAR GPS, GLONASS, Galileo, BeiDou, IRNSS, QZSS. Revision of basic geodesy, WGS84, Heighting, GNSS concept, Atomic time, components of GPS, signal structure, Navigation Message Format, Satellite Orbits, Kepler's Laws Of Orbital Motion, Broadcast Ephemeris Elements, Fundamentals of Quality Measures and Integrity, Satellite Geometry Effects on Accuracy. Autonomous Point Positioning, Pseudo-Range observation Equation, Least Squares Implementation, Differential Positioning, LADGPS and WADGPS, Positioning Using Carrier Phase, Pure Phase Observation Equation, Cycle Slips, Combination of Observables, Dual Frequency Data Processing Strategy Systematic Biases and Errors: satellite related, atmospheric related, station related Observation ethods, static and kinematic, Ambiguity search technique, RTN and VRS GLONASS, Galileo, BeiDou, Constellation, signals, Interoperability, future of GNSS.

Applications in GIS	GH663	3 hours	3 Units

Understand the core principles and functionality of GIS, Explore practical applications of GIS in various fields, Develop skills in data analysis, spatial modeling, and map-making using GIS software. Definition and importance of GIS, Components of GIS: hardware, software, data, people, and methods, Real-world applications of GIS, Spatial vs. attribute data, Vector and raster data formats, Sources of GIS data: satellite imagery, census data, open-source databases, Overview of popular GIS software (ArcGIS), Installation and interface navigation, Basic operations: loading and viewing spatial data, Importance of coordinate systems, Common map projections (e.g., UTM, WGS84), Transformations and re-projections, Principles of cartography, Creating thematic maps, Symbolization and labeling techniques.

Advanced Road Pavement Materials	CIE668	3 hours	3 Units

Introduction: Review of the engineering behavior of pavement materials, their properties, and testing methods to meet the technical requirements for road construction. Analysis and Design of Asphalt Mixtures: Based on aggregate gradation – Study of volumetric and mechanical properties. Bitumen Classification Systems: Advances in asphalt technology, including pavement performance tests in the Superpave system. Chemical Analysis: To determine the components of bitumen and its rheological properties. Sustainable Additives: Enhancing bitumen properties (organic additives, polymer technology, chemical additives, foamed bitumen) and their effects on mix properties to meet road construction requirements. Comparison of the environmental impacts between flexible and rigid pavements. Recycling of Asphalt Mixtures: Advancements in green road construction (SMA, WMA, RAP). Nanotechnology in Asphalt Mixes. Geopolymer Technology: To enhance the properties of rigid pavements.

Analysis and Planning of Urban Transportation	CIE678	3 hours	3 Units

The Historical Development of Transportation - Transportation before the 20th century – Transportation in the 20th century - The Concept of Transportation and Its Role in Comprehensive Development - Definition of transportation and its importance – The importance of the transportation sector and its role in national planning and comprehensive development - Types of Transportation - General classification of transportation types – Main types of transportation - Transportation Planning: Its Concept, Goals, and Requirements - Transportation planning – Goals and requirements of transportation planning - Urban and Rural Roads - The historical development of roads – Classification of urban roads - Problems Related to the Transportation and Traffic Sector in Cities - Public and Private Transportation - Concept of public and private transportation – Comparison between public and private transportation – Rapid transit within urban areas - Urban and Regional Traffic Movement - Spatial analysis of urban and regional traffic movement – Traffic and its types – Factors and variables affecting urban transportation movement – Efficiency of the urban transportation system - Sustainable Urban Transportation and the Environment - Energy and transportation – Basic principles of sustainable transportation.

Advanced Pavement Design	CIE667	3 hours	3 Units

Introduction: Components of road pavement such as subgrade, Sub base, Base course and wearing course and their functions. Comparison of flexible and rigid pavements highway and airport pavements. Principles of Pavement Design: Types of Pavements, Concept of Pavement Performance, Design Factors. Structural and Functional Failures of Pavements. Vehicle Types. Axle Configurations. Contact Area Shapes and Contact Stress Distributions. Concept of Standard Axle Load. Vehicle Damage Factor. Estimation of Design Traffic. Flexible Pavement Analysis: Stress, Strain and Deflection in Flexible Pavement, One Layer System, Point loading, Circular Loading, Methods of solutions. Layard Systems, Two Layers System, Three Layers System. Equivalent Thickness Method. Rigid Pavement Analysis: Stress, Strain and Deflection in Rigid Pavement. Type of Stresses. Due to Temperature Variations. Due to Load, Effect of Dual Tires, Due to Subgrade Friction. Steel Stress. Tie-Bars. Design of Dowel-Bars. Design of Joints. Flexible Pavement Design Methods: (AASHTO 1993 Method) and Mechanistic Empirical Design Method (ME-Method): Design Considerations. Pavement Performance (Loss of Serviceability). Traffic. Roadbed Soil Properties. Materials for Construction. Environmental Effects. Drainage. Reliability. Flexible Pavement Design Solved Example. Flexible Pavement Overlay Design. Rigid pavement design methods for Rigid pavement: Design Considerations. Thickness design methods such as P.C. A. design method F.A.A. methods etc. Design of distributed steel reinforcement, design of dowels, design of spacing of joints. Pavement Drainage: The function of pavement drainage, Pavement drainage design. Impacts of water on driving safety, Impacts of water on pavement performance. Pavement evaluation.

Traffic Management Systems	CIE672	3 hours	3 Units

Module I: (Traffic Engineering)

1 Traffic stream characteristics: Introduction to traffic engineering: Road user characteristics, human and vehicle characteristics; Fundamental parameters and relations of traffic flow: speed, density, volume, travel time, headway, spacing, time-space diagram, time mean speed, space mean speed and their relation, relation between speeds, flow, density, fundamental diagrams; Traffic stream models: Green shield's model, Greenberg's logarithmic model, Underwood's exponential model, pipe's generalized model, multi-regime models; Moving observer method: Concepts and derivation, illustration, Calibration of Greenhill's model .

2 .Traffic measurement procedures: Measurement at a point: Traffic volume measurement, equipment for flow measurements, data analysis, concepts of ADT, AADT; Measurement over a short section: Speed measurements, design speed, speed distributions; Measurement along a length of road: Density measurement, travel time measurement; Automated traffic measurement: GPS devices, loop detectors, video analysis, and other technologies .

3 .Traffic intersection control: Principles of traffic control: Requirements, basic driving rules, priority movements, principles of traffic control, intersections conflicts; Traffic signs and road markings: Regulatory, warning, and information signs; longitudinal, transverse, and object marking; Uncontrolled intersection: Level of service concept, priority streams, conflicting traffic, critical gap and follow-up time, capacity, queue length, control delay; Channelization: channelizing devices, geometrical aspects, turning radius ;Traffic rotary: Conflict resolution in a rotary, geometric layout, design elements, capacity of rotary; Grade separated intersection: Road over bridges, under pass, overpass, trumpet interchange, diamond interchange, fully and partial clover leaf intersection.

4 .Transportation surveys: O-Surveys, spot-speed survey (using endoscope and radar speedometer) traffic volume counts, travel time, parking survey, interaction volume count and delay surveys, methods analysis and interpretation.

5. Specialized traffic studies: Parking Studies: Parking inventory, statistics, parking surveys; input, license palate, on-street and off-street parking; Accident Studies: Accident data collection, statistics, safety audit, safety measures; Fuel consumption and emission studies: Consumption models, pollutants, air quality models, mitigation measures.

Module II: (Traffic Management)

1. Highway capacity analysis: Level of service concept, HCM Methods, IRC recommendations.

2. Demand Management: Staggered work hours, flexible work hours, high peak period tolls, shuttle services, circulation services, extended routes. Regulations: Engineering, enforcement, education, environment measures.

3. Traffic control devices : Signs, markings, islands ,channelization, one-way streets, speed breakers, bus stop locations, and bus ways, segregations, tidal flow arrangements, area traffic control, parking, pedestrian flow control .

4. Management techniques : Traffic regulations ,driver, vehicle ,flow and general controls traffic devices control ,types of parking design principles ,parking restrictions, one way streets, zebra crossing, railings, pedestrian signal foot over bridges ,traffic management authorities, road lighting.

Advanced Geodetic Surveying	CIE674	3 hours	3 Units

Coordinates, coordinate reference systems, reference frames and datums, datum transformation, map projection (types, properties, mathematical transformation), radii of curvature, convergence of meridians, geodesic, computation of length, direction and coordinates on the ellipsoid (direct method and inverse method), spherical trigonometry (concepts, mathematical formulation), spherical excess.

Statistical Analysis of Road Accidents	CIE679	3 hours	3 Units

Statistical Methods for Traffic Engineering: Need, Elementary concepts of Probability, Mean, Standard Deviation and Variance, Poisson and Binomial Distribution, Normal Distribution, Sampling Theory and Significance Testing, Linear Regression and Correlation. Multiple Linear Regression Traffic Flow Theory: Introduction, Fundamentals of Traffic Flow, Uninterrupted Traffic Flow – Stream Characteristics, Data Collection, Microscopic and Macroscopic Traffic flow Models, Capacity and LOS, Fundamentals of Interrupted Traffic flow, Shock waves, Traffic flow at signalized and Un

Design Of Traffic Facilities: Introduction, Freeways, Intersections – Un signalized Intersections, Signalized Intersections, Interchanges – Warrants for Interchanges, Design of Interchanges, Parking Facilities – Parking Demand, On street parking, Off street Parking, Parking stalls, Vehicle Circulation, Road Signs . Traffic Safety: Road Accidents, Accident Situation in National & International, Road, Weather and its effect on accidents, Speed in relation of Safety, Pedestrian Safety, Parking and its Influence, Traffic Management Measures and its Influence, Legislation, Enforcement, Education and Propaganda, Cost of Road Accidents, Road Safety Audit . Traffic and the Environment: Introduction, Detrimental Effects of traffic on the environment – Noise, Air pollution, Vibration, Visual Intrusion and degrading the aesthetics, Severance and Land Consumption, Evaluation Procedures, Environmental Areas.

Construction and Maintenance of Asphaltic Roads	**CIE680**	**3 hours**	**3 Units**

1. Introduction and description of pavements (importance and functions).
2. Process for Asphalt Road Construction: included Planning ,Design, and compaction and construction of embankments, materials specifications, construction methods and field control checks for base and subbase to ensure proper compaction and grade, Asphalt contractors typically use different mix types for surface course .
3. Soil Stabilized Pavement Layers: Principles of gradation/proportioning of soil-aggregate mixes and compaction; Design factors, mix design, construction control and quality control checks for mechanical, soil-cement, soil-bitumen and soil-lime stabilization methods. Geo Synthetics for stabilized pavements layers.
4. Process for Rigid Pavement construction: components and layers – Earthwork, compaction and construction of embankments, specifications of materials, construction methods and field control checks for various types of Specifications and method of cement concrete pavement construction; Construction of interlocking block pavements, Quality control tests; Construction of various types of joints; Thin White Topping – Fibers in cement concrete pavement construction.
5. Identification of flexible pavement evaluation.
6. Pavement maintenance and rehabilitations.
7. Maintenance activities and maintenance decisions using Pavement Management System.
8. Economic evaluation of pavement maintenance alternatives (Recycling Methods).

Advanced Analysis and Adjustment of Data	**CIE682**	**3 hours**	**3 Units**

Survey Measurements And Errors, Review Of Matrices And Matrix Operations , Solution Of Equations, Linearization Of Equations, Propagation Of Errors In Surveying Measurement, The Least Squares Method, The Concept Of Observation Equations , The Concept Of Condition Equations, The Concept Of Combined Adjustment, Introduction To Statistical Analysis, Normal, Chi-Square And "T" Distributions, Confidence Intervals And Statistical Tests, Error Ellipses, Introduction To Kalman Filtering.

Spatial Analysis in GIS	**CIE683**	**3 hours**	**3 Units**

This course is designed to help students develop a comprehensive and systematic understanding of spatial analysis methods and learn practical skills in using GIS and spatial analysis to discover features of spatial distribution. The class covers the methods of spatial analysis including measuring aspects of geometric features and identifying spatial patterns of geospatial objects that are represented as points, lines, networks, and areal data. The material will be presented in lectures, lab assignments, and a final project.

Spatial Data Infrastructure	**CIE684**	**3 hours**	**3 Units**

Describe the core SDI principles, Identify the necessary components required to support the development of SDIs, including technical and institutional arrangements and the basis of effective and efficient design, describe a range of technologies and technological concepts applicable for developing and maintaining SDIs, Analyze the range of approaches to SDI development in both developed and developing countries Model, design and evaluate SDI initiatives and spatial enablement platform.

9. Courses syllabus of the Water Resources and Environmental Engineering Division

Research Methods and Methodologies	GH601	3 hours	3 Units

Concepts, Research methods, Initial research procedure, Finalization of scope, Research Problem, Sources of Knowledge, Review of Literature, Correlations of problem and scope with literature review, Main research methodology, Research Hypotheses, Research Approach, Research Strategies, Sampling, Realization of findings. Formal construction, Customization, Types of manuscripts, Main and auxiliary contents, Formal writing, Formats of referencing. Presentation skills, Scientific search engines, Applications and projects.

Advanced Engineering Mathematics	GH610	3 hours	3 Units

Ordinary first, second and higher order differential equations: power series solutions for differential equations; extended power series; Bessel's equation; Legendere's equation; SturLiouville problems; power series: Taylor series and Laurent series; Laplace transformations; Fourier series and integrals; partial differential equation; applications .

Advanced Engineering Statistics	GH630	3 hours	3 Units

Introduction to Statistics; Variables, Measures of central tendency, Measures of dispersion, Correlation and regression. Statistical intervals for a single sample, Hypothesis testing for a single sample, Statistical inference for two samples, Simple linear regression and correlation, Multiple linear regression, Design and analysis of single-factor experiments: The analysis of variance, Design of experiments with several factors. Applications using Microsoft Excel, Applications using statics software; (SPSS - Minitab - RStudio - EViews).

Wastewater Treatment Plants Design	CIE638	3 hours	3 Units

Introduction to Wastewater Treatment, Process Selection, Design, preliminary treatment process, secondary treatment process, advanced treatment processes Fundamentals of Biological Treatment, Biological Treatment of Suspended Growth (activated sludge process), Biological Treatment of Attached Growth (Trickling filter, rotating biological contactor, oxidation ponds, sequencing batch reactor), aeration equipment in wastewater treatment, Sludge Processing and Treatment, Advanced Wastewater Treatment.

Solid Waste Management	CIE641	3 hours	3 Units

Integrated Solid Waste Management, Environmental Impacts, Governance and Legislation, Solid waste resources and generation, Solid waste characterization: measurement, 5R concepts, Solid waste separation and segregation, collection route, transportation and transfer station, Material Recover Facility, composting, anaerobic digestion, thermal treatment and energy recovery, solid waste disposal, sanitary landfill.

Open Channels	CIE647	3 hours	3 Units

Classification, Discharge measurements in open channels, Steady flow resistance equations, Velocity distribution, Boundary shear stress, Non-uniform flow, Channel bed variations, Design of open channel cross section, Gradually varied flow, Hydraulic jump and specific energy diagram.

Advanced Applied Hydrology	CIE651	3 hours	3 Units

Meteorological stations: Hydrologic cycle, Meteorological stations, Humidity, Atmospheric pressure, Temperature, Winds, precipitation, Evapotranspiration, Solar radiation, Satellites. Flash floods: Elements of flash flood study, Factors effecting flash flood motion, Surface run off, Prediction of flash floods, Estimation of peak flow, Protection against flash floods. Groundwater measurements: Measurement of groundwater level, Well discharge, estimation of permeability, Pump test, Well efficiency. Dewatering: Site drainage, Dewatering methods, Estimation of seeping water.

Environmental Impact Assessment	CIE639	3 hours	3 Units

Introduction to environmental impact assessment (EIA), roles of EIA, legal requirements, project authorities, introduction to environment; atmosphere, hydrosphere, lithosphere, biosphere, resource management and sustainable development, environmental pollution, EIA procedures: preliminary assessment, detailed assessment, review, Terms of Reference, scoping, data requirement, data analysis, impacts assessment procedures, socio-economic impacts, protective/preventive measures, EIA clearance, challenges in EIA.

Industrial Wastewater Treatment	CIE644	3 hours	3 Units

Industrial scenario in Libya– Industrial activity and Environment - Uses of Water by industry – Sources and types of industrial wastewater – Nature and Origin of Pollutants – Industrial wastewater and environmental impacts – Regulatory requirements for treatment of industrial wastewater – Industrial waste survey – Industrial wastewater monitoring and sampling -generation rates, characterization and variables –Toxicity of industrial effluents and Bioassay tests – Major issues on water quality management.

Water Resources Systems Management	CIE645	3 hours	3 Units

Overview of water resources management, integrated water resources management (IWRM), water scarcity, Hydrologic cycle, rainfall, flood, drought, river basin modelling, water quality modelling, urban water systems, water economics.

Dam Engineering	CIE650	3 hours	3 Units

Introduction, functions of dams, classification, choice of dam type, choice of dam site, Design and construction of earth dams, Design and construction of roc fill dams, Design and construction of gravity dams, Dam 's spillway.

Advanced Hydraulic Structures	CIE653	3 hours	3 Units

Dam and Reservoirs, Types of Dams, River Diversion, Dam Safety, Dam Break, Reservoirs, Culverts and Bridge Opening, Weirs, Barrage, Dam Appurtenances, Hydroelectric Facilities, Hydraulic Machinery, Pump and Turbines, River structures, Canals, Coastal structures, Breakwater, Environmental Impacts.

Statistical Hydrology	CIE655	3 hours	3 Units

Statistical analyses: Moments, expected values, distributions, frequency analysis, hypotheses testing, regression, time series analysis, error theory, geo statistics. Modeling theory. Runoff models: Concepts and equations, building, calibration and application of own model. Stochastic models: Reservoir theory. Model application: Runoff models, parameter optimization, flooding, channel flow. Application of statistics and probability to uncertainty in the description, measurement, and analysis of hydrologic variables and processes, including extreme events, error models, simulation, and sampling.

Hydraulic Simulation and Modeling	CIE659	3 hours	3 Units

Open channel hydraulics, dimensional analysis, physical modeling, numerical modeling, fundamentals of computation: 2D and 3D flows, validation and calibration processes, sensitivity analysis, open channel modeling, hydraulic structures modeling, flood modelling, data presentation, risk analysis, field trip (if, possible), project: case studies.

Advanced Ground Water Hydrology	CIE660	3 hours	3 Units

Introduction, Darcy's Law. Energy Balance, Properties of Porous media. Aquifer Types and Definition. Flow Equations – Confined and Unconfined Aquifers. Solution Techniques – Flow Nets. Anisotropy and Heterogeneity, Seepage Forces. Erosion and Piping. Steady State Flow to Wells. Transient Flow to Wells. Multiple Wells and Superposition. Well Test Analysis Techniques. Aquifer Tests. Laboratory Measurement of Hydraulic Conductivity. Regional Hydrogeology. Flow Models – Numerical Modeling. Solute Transport in Groundwater. Flow in Vadose Zone. Multiphase Flow.