



دليل
كلية الهندسة
2020

قسم الهندسة المدنية

Civil Engineering Department



The 1st: List of General courses

أولاً:- قوائم مسميات المقررات الدراسية للمرحلة العامة :-

Humanities courses

العلوم الإنسانية

Course No.	Course name	Pre request	Credit s	اسم المقرر	رقم المقرر
		المتطلبات	الوحدات		
GH141	English I	Nil	3	اللغة الإنجليزية 1	ع 141
GH142	English II	GH141	3	اللغة الإنجليزية 2	ع 142
GH150	Arabic I	Nil	2	اللغة العربية 1	ع 150
GH151	Arabic II	GH150	1	اللغة العربية 2	ع 151
GH152	Technical Writing in Arabic	GH151	1	كتابة التقارير الفنية	ع 152
Total Credits			10	إجمالي عدد الوحدات	

General Science Courses العلوم الأساسية العامة

Course No.	Course name	Pre request	Credits	اسم المقرر	رقم المقرر
		المتطلبات	الوحدات		
GS101	Mathematics I	Nil	3	الرياضيات 1	ع 101
GS102	Mathematics II	GS101	4	الرياضيات 2	ع 102
GS111	Physics I	Nil	3	الفيزياء 1	ع 111
GS112	Physics II	GS111	3	الفيزياء 2	ع 112
GS112L	Physics Lab	GS111	1	فيزياء معمل	ع 112 م
GS115	Chemistry	Nil	3	الكيمياء العامة	ع 115
GS115L	Chemistry Lab	Nil	1	الكيمياء معمل	ع 115 م
GS108 GS200	Computer Programming	Nil	3	برمجة حاسوب	ع 108 ع 200
GS203	Mathematics III	GS102	3	الرياضيات 3	ع 203
GS204	Mathematics IV	GS102	3	الرياضيات 4	ع 204
Total Credits			27	إجمالي عدد الوحدات	



General Engineering Courses العلوم الهندسية العامة

Course No.	Course name	Pre request	Credits	اسم المقرر	رقم المقرر
		المتطلبات	الوحدات		
GE121	Engineering Mechanics I	Nil	3	ميكانيكا هندسية 1	هـ ع 121
GE127	Engineering Drawing	Nil	2	الرسم الهندسي	هـ ع 127
GE129	Workshop Technology	Nil	2	تقنية الورش	هـ ع 129
GE129 L	Workshop Technology Lab	Nil	1	معمل تقنية الورش	هـ ع 129 م
GE222	Engineering Mechanics II	GE121	3	ميكانيكا هندسية 2	هـ ع 222
Total Credits			11	إجمالي عدد الوحدات	

ثانياً :- قائمة مسميات المقررات الدراسية الملزمة لجميع طلبة القسم 2 . List of departmentalnd

Course No.	Course name	Pre request	Credits	اسم المقرر	رقم المقرر
		المتطلبات	الوحدات		
CE133	Properties of Materials	-	3	خواص مواد	هـ مد 133
CE203	Structure Analysis 1	GE121	3	تحليل إنشائي 1	هـ مد 203
CE221	Fluid Mechanics 1	GE121	3	ميكانيكا الموائع 1	هـ مد 221
CE231	Surveying 1	-	3	مساحة 1	هـ مد 231
CE232	Surveying 2	CE232	3	مساحة 2	هـ مد 232
CE242	Geotechnical Eng.	-	3	هندسة جيوتقنية	هـ مد 242
CE264	Materials of Construct.	CE133	3	مواد بناء	هـ مد 264
CE301	Solid Mechanics	CE133, CE203	3	ميكانيكا الجوامد	هـ مد 301
CE303	Structure Analysis 2	CE203	3	تحليل إنشائي 2	هـ مد 303
CE305	R. C. Design 1	CE 264, CE303, CE301	3	خرسانة مسلحة 1	هـ مد 305
CE307	Steel Design 1	CE303, CE301	3	منشآت حديدية 1	هـ مد 307
CE311	Transportation Eng.	-	3	هندسة نقل	هـ مد 311



CE312 GS206	Engineering Statistics	GS203	2	إحصاء هندسي	هـ مد 312 ع 206
CE314	Highway Eng.	CE311	3	هندسة طرق	هـ مد 314
CE322	Fluid Mechanics 2	CE221	3	ميكانيكا الموائع 2	هـ مد 322
CE325	Hydrology	CE221	3	هيدرولوجيا	هـ مد 325
CE342T	Soil Mech. Theoretical 1	CE242, CE301	3	ميكانيكا التربة نظري 1	هـ مد 342 ن 342
CE342L	Soil Mech. Lab.	CE342T	1	تربة عملي	هـ مد 342 م 342
CE372	Environmental Eng. 1	CE322	3	هندسة بيئية 1	هـ مد 372
CE403	Structure Analysis 3	CE303	3	تحليل إنشائي 3	هـ مد 403
CE405	R. C. Design 2	CE305	3	خرسانة مسلحة 2	هـ مد 405
CE407	Steel Design 2	CE307	3	منشآت حديدية 2	هـ مد 407
CE414	Pavement Design	CE314	2	رصف الطرق	هـ مد 414
CE416	Highway Geometric Design	CE232, CE311	2	التصميم الهندسي للطرق	هـ مد 416
CE424	Hydrolic Structures	CE322, CE325	3	منشآت هيدروليكية	هـ مد 424
CE427	Harbor & Marine Eng.	CE322	2	هندسة مواني	هـ مد 427
CE442	Soil Mech. 2	CE342T	3	ميكانيكا التربة 2	هـ مد 442
CE462	Building Construction	CE405	3	تشبيد مباني	هـ مد 462
CE463	Contr., Spec., Quant	-	2	عقود ومواصفات وكميات	هـ مد 463
CE472	Environmental Eng. 2	CE372	3	هندسة بيئية 2	هـ مد 472
CE599	B. Sc. Project	Pass 117 Units	3	المشروع	هـ مد 599
Total Credits			86	إجمالي عدد الوحدات	

ثالثاً :- قوائم مسميات المقررات الدراسية الاختيارية 3 rd List of the Elective courses

The student has to select 4 courses From the List below which about 12 Credits

Course No.	Course name	Pre request	Credits	اسم المقرر	رقم المقرر
		المتطلبات	الوحدات		
CE501	Adv. Solid Mechanics	CE301	3	ميكانيكا الجوامد	هـ مد 501



CE502	Dynamics of Structures	CE222, CE403	3	ميكانيكا المنشآت	همد 502
CE503	Matrix Structural Analysis	CE403	3	التحليل الإنشائي بالمصفوفات	همد 503
CE504	Introduction to Plates and Shells	-	3	مقدمة في الصفائح والقشريات	همد 504
CE505	Reinforces Concrete Design 3	CE405	3	تصميم خرسانة مسلحة 3	همد 505
CE506	Pre-stressed Concrete	CE405	3	تصميم خرسانة سابقة الإجهاد	همد 506
CE07	Steel Design 3	CE403, CE407	3	منشآت حديدية 3	همد 507
CE508	Structural Model analysis	CE303	3	التحليل الإنشائي باستخدام النماذج	همد 508
CE509	Bridges Design	CE403, CE405	3	تصميم جسور	همد 509
CE512	Planning and Design of Airports	CE416	3	تخطيط وتصميم مطارات	همد 512
CE513	Traffic Engineering	CE416	3	هندسة نقل	همد 513
CE514	Economics of Transportation	CE416	3	اقتصاديات النقل	همد 514
CE515	Traminals	CE416	3	المخططات الطرفية	همد 515
CE516	Highway Materials	CE314	3	مواد الطرق	همد 516
CE517	Pavement Design	CE314	3	تخطيط وتصميم الطرق	همد 517
CE518	Transportation Planning	CE316	3	تخطيط النقل	همد 518
CE519	Design of Asphalt Mixtures	CE314	3	تصميم الخلطات الإسفلتية	همد 519
CE521	Special Study	-	3	دراسات خاصة	همد 521
CE522	Wind Mechanics	CE322	3	ميكانيكا الرياح	همد 522
CE523	Ground Water Hydrology	CE325	3	هيدرولوجيا المياه الجوفية	همد 523
CE524	Offshore Structure	CE427	3	منشآت الشواطئ	همد 524
CE525	Sediment Transport	CE424	3	انتقال الترسيب	همد 525
CE526	Unsteady flow in pipelines	CE322	3	الإنسياب غير المستقر في الأنابيب	همد 526
CE527	Coastal Engineering	CE427	3	هندسة الشواطئ	همد 527



CE528	Flow Analysis in Pipe Network	GE108, CE322	3	تحليل الإنسياب في شبكة الأنابيب	هـ مد 528
CE529	Irrigation and Drainage	CE325	3	الري والصرف	هـ مد 529
CE531	Photogrammetry	CE232	3	المساحة التصويرية	هـ مد 531
CE532	Geodetic Surveying	CE232	3	المساحة الجيوديسيا	هـ مد 532
CE533	Remote Sensing	CE232	3	الاستشعار عن بعد	هـ مد 533
CE534	Data Analysis and Adjustment	GE108, GS206, CE232	3	تحليل وتعديل البيانات	هـ مد 534
CE535	Photo-Interpretation	CE232	3	تفسير الصور	هـ مد 535
CE536	Astronomy	CE5232	3	علم الفلك	هـ مد 536
CE537	GIS	-	3	نظم المعلومات الجغرافية	هـ مد 537
CE538	The Electromagnetic distance measurement	CE232	3	أجهزة قياس المسافة الكهرومغناطيسية	هـ مد 538
CE539	Route Surveying	CE416	3	مسح المسارات	هـ مد 539
CE541	Foundation Engineering	CE442	3	هندسة الأساسات	هـ 541
CE545	Rock Mechanics	CE442	3	ميكانيكا الصخور	هـ مد 545
CE546	Engineering Properties of Soil	CE442	3	الخواص الهندسية للتربة	هـ مد 546
CE547	Soil Improvement	CE442	3	تحسين التربة	هـ مد 547
CE563	Construction Methods	CE462	3	طرق الإنشاء	هـ مد 563
CE564	Concrete Technology	CE405	3	تكنولوجيا الخرسانة	هـ مد 564

الجدول التالي يبين تفاصيل متطلبات عدد الوحدات التخرج للطلاب بقسم هندسة المدنية:



المحتوى العلمي للمقررات الدراسية الملزمة لجميع طلبة القسم

CE133	Properties of Materials	3 Credits
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Pre-requisite:

Mechanical and Physical Properties of engineering materials. Introduction to material science. Laboratory experiments including stress and strain measurements, properties of materials in tension, compression, shear, bending, torsion and hardness impact, creep and fatigue.

CE203	Structure Analysis 1	3 Credits
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Pre-requisite: GE121

Analysis of determinate structures. Plane trusses: methods of joint and sections. Axial force, shear force and bending moment diagram for beam, plane frames and arches. Deflection of plane trusses, beams and frames using virtual work, conjugate beam and double integration methods. Influence lines for beams and trusses.

CE221	Fluid Mechnices 1	3 Credits
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Pre-requisite: GE121

Dimension and units; properties of fluid, fluid static's, stability of floating bodies, Kinematics of fluid flow, continuity, energy, energy loss, momentum, forces on immersed bodies, basic hydrodynamics.

CE231	Surveying 1	3 Credits
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Pre-requisite:

Introduction; theory of measurements and errors, type of measurements, type of errors, error propagation, survey field notes, linear measurement, taping, EDM, leveling, curvature and refraction, instruments, differential leveling, trigonometric leveling, angles, bearing, azimuths, the



compass survey, theodolite instrument, field operations with theodolite, traversing, traverse computations, areas and volumes.

CE232	Surveying 2	3 Credits
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Pre-requisite: CE231

Introduction, stadia survey; plane table survey, topographic survey, methods and control, control survey, methods, accuracy standards, point description; boundary survey; construction survey, earthwork; mapping and map projection, map scales horizontal and vertical curves, photogrammetry; geodesy; remote sensing.

CE242	Geotechnical Engineering	3 Credits
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Pre-requisite:

Common Rock Forming Minerals, Rock Types and Nature, Superficial Deposits (Residual and Transported Soils), Ground Water, An Introduction to Structural Geology, Engineering Properties of Rocks. Soil Origin, Geological Cycle, Phase Relations, Grain Sizes of Soils and Gradation, Index Properties of Soils, Soil Classifications, Permeability and Flow net.

CE264	Materials of Construction	3 Credits
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Pre-requisite: CE133

Different type of building materials their uses, Bricks, tiles and stones classifications; Properties and tests Cements manufacturing, type sand properties. Aggregate sources. Properties and classification Concrete mixes. types, properties and testing, laboratory experimental testing.

CE301	Mechanics of Solids	3 Credits
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Pre-requisite: CE133, CE203

Stress, strain and their relationship, axial stress for determinate and undetermined Members. Compound normal stresses. Shear stresses. Torsion of circular hollow and solid shafts for determinate and indeterminate



members. Transformation of stresses, shear flow and shear center for thin walled sections Energy method, Elastic stability of columns.

CE303	Structure Analysis 2	3 Credits
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Pre-requisite: CE 203

Analysis of intermediate structures: plane trusses using force method. Beams and Plane frames using force method, slope deflection method, Approximate analysis of structures, Portal and cantilever methods.

CE305	Reinforced Concrete Design 1	3 Credits
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Pre-requisite: CE264, CE301, CE303

Flexural analysis and design of rectangular and T- section with single and double reinforcement. Design for shear. Development length and splices, bar cut – off points. Serviceability. Design of continuous beams and solid and ribbed one-way slabs. (Ultimate strength design method is to be followed).

CE307	Steel Design 1	3 Credits
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Pre-requisite: CE301

Types of steel structures, Properties of steel ; Load and specification . Design of Tension and compression members: Single and built - up sections. Design of Fasteners and connections: Simple riveted, bolted and welded. Design of simply Supported beams: bending and torsion. Applications Design of a roof truss.

CE311	Transportation Engineering	3 Credits
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Pre-requisite:

Introduction to transportation functions in a socio- economic environment. Transportation technology, transportation network , control of vehicular flow , Fundamental flow relationships; Capacity and level of service; Design criteria for road transport facilities; environmental considerations.

CE314	Highway Materials	3 Credits
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Pre-requisite: CE311

Introduction , highway location and type of survey used, principles of pavement design, road traffic assessment, soil subgrade evaluation methods, traditional pavement materials, bituminous mix design, empirical methods of pavement design, maintenance of flexible and rigid pavement, surface and subsurface drainage.

CE322	Fluid Mechanics 2	3 Credits
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Pre-requisite: CE221

Pipe flow, pipe network, Pumps, pumped pipe line, System analysis, tank emptying, open channel flow, similitude and dimensional analysis, fluid measurements.

CE325	Hydrology	3 Credits
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Pre-requisite: CE221

Hydrologic cycle; hydrologic equation; Precipitation and its measurements; Infiltration; Evaporation; surface water; movement of ground water; Discharge of wells; Run off, Hydrographs; Unit hydrograph; Sea water intrusion. Methods of irrigation; Sprinkler and surface irrigation; Pump selection.

CE342T	Soil Mechanics Theoretical	3 Credits
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Pre-requisite: CE242

Soil Compaction, Principle of Effective Stress, Vertical Stresses in Soil Masses (due to own weight and external loads), Shear Strength of Soils, Compressibility of Soils (immediate and delayed consolidation), Lateral Earth Pressure Theories (Rankine's, and Coulomb's), Stability of Rigid Retaining Walls.

CE342L	Soil Mechanics Lab.	3 Credits
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Pre-requisite: CE342T

Experiments in Soil Mechanic laboratory including the followings: Sieve Analysis, Liquid Limit, Plastic Limit, Specific Gravity. Permeability, Compaction, Direct Shear, Unconfined Compression (Saturated Clays), One Dimensional Consolidation. Uni-axial Compression (Rocks), Point Load (Rocks).



CE372	ENVIROMENTAL ENG. 1	3 Credits
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Pre-requisite: CE322

Introduction, sources of water, estimation of water demand, water quality analysis, Modification of water quality (treatment) coagulation, flocculation, sedimentation, sand

CE403	Structue Analysis 3	3 Credits
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Pre-requisite: CE303

Moment Distribution Method (Beams & Frames) Energy Method .
Matrix Flexibility.

CE405	Reinforced Cocrete Design 2	3 Credits
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Pre-requisite: CE305

Design of one way ribbed slabs .Design of staires .Design of cantilever retaining walls .shear and moment transfer for slabs supported columns (footing) .Design of isolated and combined footings .(Two - way slab on stiff .beams) using method of coeff .Two – way slab using Direct. Design method (slabs on beams and flat – plates).

CE407	Steel Design 2	3 Credits
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Pre-requisite: CE307

Beams and plate girders . Beams columns . Columnbases and grillages. Connection composite construction . Application : Design of plate girders and industrial buildings.

CE414	Pavement Design	3 Credits
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Pre-requisite: CE314

Introduction, paving performance, paving types, cities and hardness, material properties, analysis of stresses in city paving and solid paving, identification of theories of finding stresses and emotions paving analysis, paving design methods, design methods such as AASHTO, asphalt institute, group laboratory road, CBP method, PCI method and others, paving design,



paving rehabilitation and paving maintenance methods, identification of landing measurement devices such as Benkelman Beam and FWP.

CE416	Highway Geometric Design	3 Credits
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Pre-requisite: CE232, CE311

Introduction; functions and classification of highways, factors and elements in the geometric design of arterials; freeways, intersections; interchanges and parking facilities: Special design studies and reports.

CE424	Hydrolic Structures	3 Credits
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Pre-requisite: CE322, CE325

Characteristics of a reservoir, dam site, investigation, reservoir sedimentation and life of a dam, flood routing and spillway and types, energy dissipators in dams, outlet, works, sewage tanks, fates, types of dams and their selection, piping even, and seepage under and through dams, treatment of dam foundation, uplift forces on dam foundation, stability analysis of gravity and earth fill dams, culverts, siphons, bench flumes, drops and falls, corvettes, siphons, bench flumes, drops and falls, corrosion protection in hydraulic structures.

CE427	Harbor Engineering	3 Credits
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Pre-requisite: CE322

Introduction, Wind wave and wave prediction. Mechanics of wave motion. Planning and layout of ports. Breakwater and sea walls. Design and construction. Port structures. Navigation aids Lift over drift and sedimentation problems.

CE442	Soil Mechanics 2	3 Credits
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Pre-requisite: CE342

Lateral earth pressure. Retaining walls. Site investigation, Techniques and evaluation of subsurface conditions. Bearing capacity and shallow foundation Deep foundation slope stability.



CE462	Building Construction	3 Credits
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Pre-requisite: CE405

Functions and classification of buildings, building models, building design specifications, building rules (types, uses, structural design of common types) brick wall construction, design of bearing brick walls, construction of tiles and roofs, design of hollow brick tiles, stairs (types and design) Simple stairs) heat insulator, humidity blocker, building connections, moldings, field visits.

CE463	Contr., Spec., Quant.	2 Credits
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Pre-requisite:

Introduction to engineering economy. Engineering projects and project, management. General and technical conditions of contracts. Construction specifications and construction equipment. Estimation, measurement and payment. Site visits.

CE472	Environmental Engineering 2	3 Credits
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Pre-requisite: CE372

Introduction, Waste water flows, quantities and variations, Waste water collection system, Sewer design, Storm water drainage, Sewer appurtenance sewage pumping and Pumping stations, waste water characteristics, Waste water treatment, primary and biological treatment. Disposal of wastewater sludge- treatment and disposal.

المحتوى العلمي للمقررات الدراسية الاختيارية بقسم الهندسة المدنية

CE501	Adv. Solid Mechanics	3 Credits
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Pre-requisite: CE301

Analysis of stress and stream. Stress-Strain Relations and General Equations of Elasticity. Plane-stress and Plane-strain Problems systems. Torsion of Various shaped Bars, Unsymmetrical bending of straight beams. Energy Principles and Variational Methods, Bending and Compression of Bars (Elastic Stability).



CE502	Dynamics of Structures	3 Credits
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Pre-requisite: CE222, CE403

Linear undamped and damped systems under free and forced vibrations. Response of SDOF system to harmonic, periodic (Fourier analysis and response spectra), impulsive and general dynamic loading (Duhamel integral). Dynamic response of MDOF system (using normal mode theory). Two Degrees of Freedom Systems, Continuous System, Lagrange's Equation.

CE503	Matrix Structural Analysis	3 Credits
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Pre-requisite: CE403

Flexibility method. Basic stiffness method. Automatic stiffness method. Introduction to F.E.

CE504	Introduction to Plates and Shells	3 Credits
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Pre-requisite: CE301

Bending of plates and long strip plates, rectangular plates, circular plates. Membrane Theory of shells Domes and cylindrical shells. Folded plates.

CE505	Adv. Reinforced Concrete Design	3 Credits
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Pre-requisite: CE405

Design of two-way slabs using direct design method and equivalent force method. Short and large term deflection calculations. Analysis and design of shear walls, brackets and deep beams. Analysis and design of water tanks.

CE506	Pre-stressed Concrete Design	3 Credits
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Pre-requisite: CE403, CE405

Materials and specifications. Pre-stressing systems. Loss of prestress. Analysis and design of sections for flexure, shear, bend and bearing. Cable Layout, camber and deflections. Application to beams and slabs.

CE507	Adv. Steel Design	3 Credits
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Pre-requisite: CE403, CE407



Elastic and plastic design of steel frames: braced and non-braced connections. Design of steel bridges: types and systems. Truss and plate girder bridges. Hinges and bearings. Applications Design of multistory building and bridges.

CE508	Structural Model analysis	3 Credits
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Pre-requisite: CE303

Concept of stress and strain. Measurements of strain using electrical and mechanical strain gauges. Measurement of dynamic strain using electrical strain gauges and pick up transducers. Introduction to photo elasticity. Model studies.

CE509	Bridges Design	3 Credits
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Pre-requisite: CE403, CE405

Types and classification of bridges. Specification of loads and stresses in bridges. Analysis and design of single and continuous slab, T-beam and arch or box bridges. Abutments, piers and foundations. Bearings.

CE512	Planning and Design Airports	3 Credits
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Pre-requisite: CE416

Introductory notes on airports, classes of airports, aircraft characteristics related to airport planning and design; taxiway and runway configurations; environmental factors Affecting runway design; runway capacity and delays; air traffic control. and Navigation aids.

CE513	Traffic Engineering	3 Credits
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Pre-requisite: CE416

Traffic engineering versus transport engineering driver and vehicle characteristics, Traffic Volume speed, travel time and parking studies, Traffic operations and control; traffic flow theory, capacity-performance relationship; single design pedestrian flow.

CE514	Economics of Transportation	3 Credits
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Pre-requisite: CE416



Economic aspects of transportation, techno economic and characteristics of the different Systems, costs and benefits in transportation projects Methods of evaluating alternative Transportation projects.

CE515	Terminals	3 Credits
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Pre-requisite: CE416

Terminal functions, problems, characteristics, construction and integration; factors in Design for economic operations, terminals for specific commodities.

CE516	Highway Materials	3 Credits
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Pre-requisite: CE314

Introduction; climate and environmental considerations in pavement design; highway Material characterization; soil and base stabilization; sub grade classification; bases sub bases and bituminous surfaces; pavement distresses and maintenance.

CE517	Pavement Design	3 Credits
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Pre-requisite: CE314

Introduction; performance and failure criteria for pavement design; stresses in flexible Pavements. Stresses in rigid pavements; Vehicle and traffic considerations; design of Flexible highway and airport pavements. Design of rigid highway and airport pavements; Overlay design.

CE518	Transportation Planning	3 Credits
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Pre-requisite: CE416

Introduction, transportation planning process, examination of transportation and land use Models, trip generation analysis, model of travel distributions, applications of traffic Assignment technology to transportation network, selection and evaluation of alternate Transportation proposals.

CE521	Special Study	3 Credits
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Pre-requisite: CE424



Seminars and discussion classes related to hydraulics, field trips to water structures and System.

CE522	Wind Mechanics	3 Credits
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Pre-requisite: CE322

Introduction, Ideal fluid flow. Bluff body flow, Dynamic response of structures, Aerodynamic instability, modeling techniques, Random vibration, spectral density, Wind Structure, structural design, pollutant dispersion.

CE523	Ground Water Hydrology	3 Credits
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Pre-requisite: CE325

Occurrence of ground water, aquifers, ground water exploration methods, movement of Ground water, flow net, overrunning equations of ground water, hydraulic of wells: inference of wells and multiple well systems, recovery test, image well method, filter design and screen, construction of wells.

CE524	Offshore Structures	3 Credits
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Pre-requisite: CE427

Types of offshore structures, Wave theories, Wave forces on small bodies wave forces on large bodies; Random waves and forces; Dynamics response of framed structures and vortex induced oscillations, Models and prototypes; Scour around offshore Structures due to waves and currents, protection against scour.

CE526	Unsteady Flow in Pipe Lines	3 Credits
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Pre-requisite: CE322

Rigid and elastic water column theory, water hammer in pump discharge lines, water hammer analysis to include hydraulics losses and for compound pipes, graphical water hammer analysis, computer methods of water hammer analysis, sewage tanks, air chambers at pumping plants.

CE527	Costal Engineering	3 Credits
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Pre-requisite: CE427



Introduction; Two-dimensional wave equations and wave characteristics; Wave refraction, diffraction and reflection, Coastal water level fluctuations, Wind generated Waves; Wave structure interaction Coastal zone processes, Diffusion on coastal; water.

CE528	Pipe Networks	3 Credits
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Pre-requisite: GE108, CE322

Introduction, city planning and system layout; Hydraulics, hydraulic analysis of pipe networks; Design of long pipelines; Sea water intakes; Economical design of pipe networks; pumps and pumping stations; Distribution pumping and storage system appearances System evaluation Management and operation of distribution systems; Computer solution of pipe networks; computer uses; Other pipe network uses; Special cases.

CE529	Irrigation and drainage	3 Credits
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Pre-requisite: CE325

Importance of irrigation; Feasibility studies of irrigation; Irrigation practices; Surface, sub-surface and overhead irrigation; Moisture in soils; Crop water, Design of field irrigation systems; Selection of pumps-drainage for irrigated lands, surface drainage, subsurface drainage, Design of subsurface field drainage system. The canal systems, Canal layout, Canal design, Canal structures. Flow measurements. Mechanization and land preparation for irrigation.

CE531	Photogrammetry	3 Credits
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Pre-requisite: CE232

Introduction, Optics of photogrammetry; Principles of photogrammetry, Cameras, film processing and printing; photographic measurements and refinements scales coordinates systems, compactors, Geometry of vertical photographs stereoscopic viewing, Stereoscopic parallax; Planimetric mapping Photogrammetric control; tilted photographs; Stereoscopic plotting in3trurrients, Stereo plotters orientations; project and flight planning.

CE532	Geodetic Surveying	3 Credits
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Pre-requisite: CE232



Introduction; Procedures of obtaining horizontal control, triangulation, trilateration traversing inertia, satellites, procedures of obtaining vertical control, geometric leveling, trigonometric leveling, Procedures of obtaining directions, solar and stellar observations; Data reduction, atmospheric corrections, observations equations matrix manipulations, least squares adjustments; statistical test, Applications examples.

CE533	Remote Sensing	3 Credits
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Pre-requisite: CE232

Introduction; Electromagnetic radiation, Energy sources, energy interaction with earth surface features and atmosphere; Elements of photographic systems, Films, photographic processing, Cameras Resolution, radiometric characteristics of Aerial photographs, densitometry; thermography; multispectral scanning, h1SS, Spectral pattern recognition, Classification, Microwave sensing radar, passive microwave sensors; Remote sensing from space, Landsat system, SPOT system.

CE534	Data Analysis and Adjustment	3 Credits
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Pre-requisite: CE232

Introduction; Measurements and errors, Types of errors, probability, Significant figures, error propagations, linearization's; Adjustment of observations, Simple methods, the Introduction; Route location; Simple curves; Compound and reverse curves; Highway survey; Railroad survey; Survey for other routes; Earthwork; Distribution analysis; Obstacle problems; Aerial photography in route design; Automation in route, location and design; Alignment design and stakeout, Design; project.

CE537	GIS	3 Credits
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Pre-requisite: CE232

Introduction, what is GIS, what does GIS do, the importance of GIS, the components of GIS, types of data, spatial data and its format, raster and vector data structures, topology rules, attribute data, meta data, data base



management system, rational data base management system, spatial analysis, GIS applications.

CE541	Foundation Engineering	3 Credits
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Pre-requisite: CE442

Soil exploration, General principles of foundation design. Settlement analysis. Shallow Foundations. Dec, foundations and special types of foundation.

CE545	Rock Mechanics	3 Credits
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Pre-requisite: CE442

Identification and classification. Mechanical Properties. Stress- strain characteristics. Foundation on rock. Rock. Rock mechanics in practice.

CE546	Engineering Soil Properties	3 Credits
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Pre-requisite: CE342

Determination, analysis and application of the index and engineering properties of soils Laboratory testing procedures. Reliability of results. Evaluation and control methods.

CE547	Soil Improvement	3 Credits
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Pre-requisite: CE442

Geotechnical process, Methods of ground water control, Settlement of ground adjacent to excavation caused by ground water towering, shallow compaction, deep compaction dynamic consolidation stabilization of soil. Protection of foundation structures against attack by soils and ground water.