Ministry of Higher Education and Scientific Research
University of Technology
Building and Construction Engineering Department
Undergraduate Study Syllabus 2016/2017
Third Year

4- Roads and Bridges Engineering Division

First Semester

Subject		Hrs./week			Units
		Theo.	Tut.	Lab.	
B.E 3228	Soil Mechanics (1)	2	2	1	3
B.E 3238	Building Services (1)	2			2
B.E 3231	Engineering Analysis	2	2		2
B.E 3233	Theory of Structures (1)	2	2		2
B.E 3234	Reinforced Concrete Design (1)	2	1		2
B.E 3235	Principles of Remote Sensing (1)	1	1	1	2
B.E 3239	Sanitary and Environmental Eng. (1)	1	1	1	2
B.E 3347	Traffic Engineering	2			2
B.E 3109	English A say Writing Language	1		1	2
B.E 3111	Leadership and Management Skills	1	1		1
Total		**16**	**10**	**4**	**20**
		30			

Second Semester

Subject		Hrs./week			Units
		Theo.	Tut.	Lab.	
B.E 3229	Soil Mechanics (2)	2	2	1	3
B.E 3232	Numerical Analysis	1	1	1	2
B.E 3346	Railway Engineering	2	1		2
B.E 3236	Principles of Remote Sensing (2)	1	1	1	2
B.E 3237	Reinforced Concrete Design (2)	2	1		2
B.E 3230	Highway Engineering (1)	2	1	2	3
B.E 3240	Sanitary and Environmental Eng. (2)	1	1	1	2
B.E 3345	Pavement Design (1)	2	1		2
B.E 3344	Airport Engineering	2	1		2
Total		**15**	**10**	**6**	**20**
		31			

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B.E. : 3228 Soil Mechanics (1)	Theory: 2hrs/week Tutorial: 2hrs. / week Practical: 1 hr./week
1- Geotechnical Properties Formation of soil, Grain size distribution , Clay minerals	4
2- Soil classification	4
3- Weight-Volume relationship	8
4- Soil Compaction	4
5- Hydraulic Properties Field and Lab. Permeability	4
6- Steady state Flow: One and Two-dimensional flow, flow net, piping and boiling.	16
7- Principle of effective stress Total stress, effective stress, pore water pressure.	12
8- Stresses within a Soil Mass, geostatic stresses, Stresses due to external loads.	8
total	60
Lab. 1 hr./week	
1.Water content	1
2. Atterberg limits	2
3. Specific gravity	2
4. Sieve analysis	1
5. Hydrometer analysis	3
6. Compaction test	2
7. Field density test	2
8.Permeability test	2
total	15

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B.E 3238	Building Services (2 Hrs. / week)	Hrs.
Introduction		2
Type of pipes and Fitting used in water system 1. Type of pipes. 2. Type of Valves. 3. Pipe supports.		2
Design and Analysis of Cold Water System.		6
Design and Analysis of Hot Water System.		4
Calculation of Hot water storage Capacity and Heater Power.		4
Design of Sanitary System.		6
Design of Storm Water Drainage System.		2
Design of Fire Protection System.		4
Total		30

B.E 3302 Civil Eng. System Analysis (1)	(2 Hrs/week)
Introduction civil engineering system	4
Mathematical model in linear programming	8
Graphical method in LP	4
Simplex method	4
Two phase method in LP	4
Dual problems	2
Assignment strategy - Hungarian method	4
total	30

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B.E. 3231: Engineering Analysis	Theory: 2hrs./ Week Tutorial: 1hr./ Week
1- Ordinary differential equations-: 1-1 Applications of first order differential equations. 1-1-1 Salt concentration in tanks. 1-1-2 Discharge through orifices. 1-2 Applications of second and higher order differential equations. 1-2-1 Mechanical vibration. 1-2-2 Elastic stability. 1-2-3 Newton's 2nd law of motion.	12
2- Simultaneous linear differential equations. 2-1 Cramer's rule. 2-2 Applications. 2-2-1 Salt concentration in tanks. 2-2-2 Mechanical vibration- stiffness formulation. 2-2-3 Frequency of structures by the energy conservation law.	12
3- Second & higher order linear differential equations with no constant coefficients. 3-1 Euler method. 3-2 Power series (Frobenius method).	12
4- Fourier series: 4-1 Periodic functions & Fourier coefficients. 4-2 Even & odd functions. 4-3 Half range expansion.	12
5- Partial differential equations: 5-1 Separation of variables method. 5-2 Applications.	12

B.E. 3109: English Essay Writing Language	Theory: 2 hrs./ Week
Unit One: Introduction to Scientific Statements 1.1 Be and have in scientific statements	6

1.2 Statements requiring the present simple	
Unit Two: Dimensions and Properties 2.1 Dimensions 2.2 Properties 2.3 Negative form of the simple present statement 2.4 'Fronted' statements (structure 3)	6
Unit Three: Comparatives Data 3.1 Simple statements of comparison 3.2 The superlative degree	6
Unit Four: Impersonal Scientific Statements-The Passive 4.1 Use of the passive 4.2 Form of the passive 4.3 Spelling rules 4.4 Suffixes	4
Unit Five: Experimental Descriptions	4
Unit six: Describe Charts and Graphs 6.1 The criteria of the academic writing 6.2 Describing Figures (Bar Charts) 6.3 Describing the graphs	4

B.E. 3111 : Leadership & Management Skills	2 Hrs./Week
Management framework	4
Management the Life Cycle	3
Basic Planning Principles	4

Risk Management	3
Ethics and Transparency in Public Organization	3
Motivating of Team	3
Assuring Project Quality	4
Data Collection and Analysis	3
Project Control Frame Work	3
TOTAL	30

B.E.3235 : Principle of Remote sensing (1)	Theory: 1hr/ Week Tutorial: 1hr./ Week Lab :1hr/ Week
1. Basic concepts, Definitions, importance and advantages, Comparison to maps, GIS, aerial photography and sonar.	2
2. Components, Data representation, Applications (Agriculture and forestry, geology, hydrology, land-use and land-cover, mapping, meteorology, environment)	2
3. Electromagnetic (EM) radiation, EM energy, Interaction mechanisms (Reflectance, Emissivity), Laws regarding amount of energy radiated from an object, Parts of EM spectrum.	2
4. EM Spectrum, Wavelength bands, atmosphere effects and interaction between E.M rays and atmosphere, scattering, absorption, reflectance spectra	2
5. Sensors, History, Satellite characteristics, Orbits and swath width, Scanner sensor systems.	2
6. Spatial, spectral, radiometric and temporal resolutions, overview of different sensors, satellite and airborne comparison	2
7. Properties of aerial photography, components of aerial cameras, Image motion, classification of aerial photos, orientation of camera axis, angular coverage, emulsion type.	2
8. Geometric properties of aerial photo, definitions, image and object space, photo scale, and relief displacement.	2
9. Relationship between coordinates of image and objects points, ground coordinates from vertical photo, photo overlap	2
10. Applications and examples of aerial photo, distance between flight lines, No. of images, area of image and one model. applications & examples for flight lines design	2
11. Digital Image processing: Image enhancement: Image reduction and magnification, contrast enhancement.	2
12. Band ratio, spatial filtering, digital image classification	2
13. Images corrections: Radiometric and geometric corrections, images rectification.	3
14. Ground control points, No. of GCCs, root mean square error RMSE, resampling methods.	3
Total	30

Lab. 1hrs/week	
1. Photogrammetry Exercise: scale, length and area. Air photo interpretation exercise (groups); Aerial photography for land cover mapping.	1
2. Photogrammetry Exercise: radial/relief displacement.	1
3. Photogrammetry Exercise: stereo pairs.	1
4. Measurement and Analysis of Reflectance. Reflectance Spectra	1
5. Identifying Digital image, Methods of image processing	1
6. Identifying ERDAS software	1
7. Viewer& Band combination. Image Export and Import	1
8. Subsets	1
9. Georeferencing using a georeferenced image Georeferencing using coordinates from a GPS unit.	1
10. Image Enhancement and filters	1
11. Image Merging (Pansharpening)	1
12. Mosaic Images	1
13. Unsupervised Classification and Supervised Classification	1
14. Classification Accuracy	2
Total	15

B.E. 3234 : Reinforced Concrete Design (1)	Theory: 2hrs./ Week Tutorial: 1hr./ Week
1. Introduction to reinforced concrete (concrete and steel)	6
2. Introduction methods of design and analysis for concrete structures and load stages for beam with equivalent cracks section for singly, doubly and T-sections	6
3. Analysis and design of singly reinforced concrete beams by ultimate strength design method	6
4. Analysis and design of doubly reinforced concrete beams by ultimate strength design method	6

5. Analysis and design of T and L reinforced concrete beams by ultimate strength desig method	6
6. Design of continuous beams and one way slabs using coefficient methods	15
Total	45

B.E. 3239: Sanitary and Environmental engineering (1)	Theory: 1hr./ Week Tutorial: 1hr./ Week
1. Introduction to sanitary engineering 1.1 sources of water	2
1.2 Population estimation methods	
1.3 fire demand calculation	
2. Water Quality Characteristics	4
3. Water Treatment Plant Unites 3.1 Intake	2
3.2 Screen	2
3.3 Sedimentation: coagulation and flocculation processes	4
3.4 Overflow rate and design	4
3.5 Filtration	4
3.6 Disinfection	2
3.7 Pumps types and applications	2
4. Network and water distribution	4
Lab.	1hr./ Week
1.Physical Properties	1
2.Determination of pH value	1
3.Conductivity	1
4.Turbidity	1
5.Jar $Test_1$	2
6.Jar $Test_2$	2
7.Setting Column	2
8.Free Chlorine & Combined Chlorine	2
9.Filtration Capacity	2
10.Oil & Grease	1

B.E. 3233: Theory of Structures (1)	Theory: 2hrs./ Week Tutorial: 2hr./ Week
1. Determinate Structures 1.1 Introduction + Stability and determinacy	6
1.2 Influence Lines - Beams	4
1.3. Influence Lines - Girder	6
1.4. Influence Lines – Frame, Truss and Composite	4

2. Deformation of Structures 2.1. Deflection and Rotation	16
3. Indeterminate Structures 3.1. Introduction to indeterminate structures. Consistent deformation for the analysis of indeterminate frames and Trusses.	4
3.2. Symmetry and Anti-Symmetry	2
3.3. Slope deflection Method	18
Total	60

B.E. 3340 Airport Engineering	**Theory: 2hrs./ Week** **Tutorial: 1hr./ Week**
Structure and organization	1
Forecasting of demands	2
Characteristics of aircrafts as they effect airports	1
Characteristics of aircrafts as they effect airports	2
Airport Master Planning	1
Airport Master Planning	2
Site Selection	1
Calculation of runway length	2
Airport Layout Plan	1

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Master Planning According to ICAO Recommendation	2
Air Traffic Control, Lighting and Signing	1
Runway configuration	2
Runway length and corrections	1
Airport Drainage	2
Airport Drainage	1
Design of drainage networks	2
Design of inlets, man halls, etc.	1
Structural pavement design	2
Structural pavement design	1
Load and traffic consideration	2
Load and traffic consideration	1
Reinforced concrete pavement	2
Reinforced concrete pavement	1
Load classification number	2
Runway configurations and relationship with the terminal area	1
Airport capacity determination for the long range and short range purposes	2
Basic Runway Length	1
Estimating the Runway length using FAA charts in landing and takeoff	2
Design of longitudinal runway grades	1
Design of longitudinal runway grades	2

B.E. 3230 : Highway Engineering	Theory: 2hrs./ Week Tutorial: 1hr./ Week Lab. : 2 hr./Week
1- Transportation planning	3
2- Selection of route location of highways	3
3- Surveys and costs	6
4- Cross section characteristics highways	3
5- Design of horizontal alignment	6
6- Design of vertical alignment	6
7- Asphalt concrete mix design	6
8- Flexible pavement design	3
9- Rigid pavement design	3
10- Traffic engineering	3
11- Pavement drainage	3

Lab. : 2hr./Week	
1- Penetration test	2
2- Ductility test	4
3- Softening point test	4
4- Flash point test	4
5- Viscosity test	4
6- Loss on heating test	4
7- C.B.R. test	4
8- Marshall test	4

B.E. 3232: Numerical Analysis	Theory: 1hr./ Week Tutorial: 1hr./ Week Lab. : 1hr./Week
6- Matrices: 6-1 Review. 6-2 Solution of linear ordinary differential equations. 6-2-1 Row of transformation (matrix inversion). 6-2-2 Gauss elimination. 6-2-3 Gauss-Jordan method. 6-2-4 Gauss-Seidel method. 6-2-5 L-U method. 6-2-6 Eigen values & Eigen vectors.	4
1- Introduction to numerical methods: 7-1 Difference table. 7-2 Differences & divided differences.	4
2- Linear interpolation: 8-1 Newton-Gregory interpolation polynomial. 8-2 Newton-Divided difference formula. 8-3 Lagrange interpolating polynomial.	4
3- Numerical integration: 9-1 Trapezoidal and Simpson's rules. 9-2 Gaussian quadrature.	4
4- Solution of non-linear equations: 10-1 Newton-Raphson method. 10-2 Indeterminate coefficients. 10-3 Indeterminate weights.	4
5- Numerical solution of ordinary differential equations (initial value problems): 11-1 Taylor series. 11-2 Euler method. 11-3 Modified Euler method. 11-4 Runge-Kutta 4^{th} order method.	4
6- Finite difference methods for boundary-value problems.	6
Lab. : 1hr./Week	
1- Interpolation	2
2- Integration	2

3- Solution of non-linear equations	2
4-Systems of simultaneous Equations	2
5- Numerical solution of ordinary differential equations (initial value problems)	2
6- Finite difference method.	3
7- Examination.	2

B.E.3236 : Principle of Remote sensing (2)	Theory: 1hr/ Week Tutorial: 1hr./ Week Lab :1hr/ Week
1. Elements of Geographical Information Systems (GIS): Introduction, format of the Geographical data.	2
2. GIS components and structure, spatial data models vector format, raster or grid model	2
3. Thermal Infrared Images, principles, kinetic heat, radiant flux and temperature, thermal radiation law, diurnal temperature cycle, emissivity, thermal sensing system	2
4. Factors effecting separation of target from background, advantages and disadvantages of thermal Imaging system, factors affecting thermal imagery, thermal sensing systems [detection/recognition and range of a FLIR Sensor]	2
5. Active remote sensing (Radar images), microwave, terrestrial surface object parameters (roughness, electrical properties).	2
6. Radar system parameters (signal wavelength and polarization, inclination angle, spatial resolution), advantages of radar data, radar sensor types.	2
7. Mathematical applications and examples on thermal and radar imaging.	2
8. Active remote sensing (Radar images), Laser scanning, basic principles, Laser-Radar performance (Laser- Radar equation, receivers).	2
9. Basic principles of laser ranging, profiling and scanning, flight planning	2
10. Examples and Applications	2
11. Principle of digital terrain modeling	2
12. Digital terrain surface modeling Interpolation Techniques for terrain surface modeling	2
13. GPS: principles and basics. Types of systems, measurements steps, GPS observables.	3
14. GPS positioning modes, GPS methods GPS applications and accuracy.	3
Total	30
Lab. 1hrs/week	
1. Map (Categories, types, scale, symbol, Map projection (UTM), shape of the earth and coordinates systems.	1
2. GIS: definition, Components, uses of GIS, GIS data model and Functions.	1
3. Fundamentals of Arc Map, General view on Arc Map, Arc Toolbox, Catalog, Arc GIS, and Management of contents table (TOC).	1
4. Built the personal Geodatabase, Create shape file, Open existing shape file.	1
5. Drawing, snap and editing feature.	1
6. Symbolizing, Topology and Editing	1

7. Geometric correction	1
8. Create point's layer from coordinates (X, Y, Z).	1
9. Arc toolbox (buffer , clip , intersect)	1
10. Labels, Graphs and reports	1
11. Start project with Arc Map, Map production (Layout)	1
12. Introduction to GPS Geo-Xt Trimble.	1
13. GPS Applications (1)	1
14. GPS Applications (2)	2
Total	15

B.E. 3237 : Reinforced Concrete Design (2)	Theory: 2hrs./ Week Tutorial: 1hr./ Week
1. Serviceability of beams (singly, doubly , T beams and continuous beams) and one way slabs	12
2. Shear and diagonal tension design for beams	6
3. Torsion design of beams	9
4. Design of two way slabs by using coefficient method 2 or 3	12
5. Introduction to concentrically loaded columns.	6
Total	45

B.E. 3240: Sanitary and Environmental engineering (2)	Theory: 1hr./ Week Tutorial: 1hr./ Week
1. Sewer materials	2
2. Characteristics of wastewater 2.1 Physical, chemical and microbiological Characteristics	4
2.2 Sewage disposal	4
3. Wastewater Treatment Plant Unites	2
3.1 Preliminary treatment systems	2
3.2 Primary treatment	4
3.3 Biological treatment	4
3.4 Secondary Treatment Systems	4
4. Sludge Treatment and Disposal	2
5. Miscellaneous Wastewater Treatment Techniques	2
Lab.	1hr./ Week
1.Salinity	1
2.Solid Measurement: a-Total solids	1
b-Total Dissolved solids	1
c-Total suspended solids	1

3.Alkalinity	1
4.Total Hardness	1
5.Calcium Hardness	1
6.Chlorides	1
7.Dissolved Oxygen	2
8.Biochemical Oxygen Demand (BOD)	1
9.Chemical Oxygen Demand (COD)	1
10.Iron	1
11.Lead	1
12.Cadmium	1

B.E. 3229 : Soil Mechanics (2)	Theory: 2hrs/week Tutorial: 2hrs. / week Practical: 1 hr./week
1. Consolidation theory and settlement: Terzagi theory and assumptions, Consolidation test	8
2. Consolidation analysis. Consolidation Settlement and Degree of Consolidation.	16
3. Shear Strength of Soils : Mohr-Coulomb theory	8
4. Laboratory test, direct shear, triaxial test and coefficient of pore water pressure.	12
5. Slop Stability , stability calculation for granular and cohesive soils	8
6. Total stress analysis for determination of Factor of safety , Taylor's Stability number	4
7. Effective stress analysis for determination of factor of safety a- The conventional method. b- The Simplified method. c- The Rigorous method.	4
total	60
Lab. 1 hr./week	
1. Consolidation test	3
2. Unconfined compression test	3
3. Direct shear test	3
4. Triaxial compression test	3
5. California Bearing Ratio test	3
total	15

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B.E 3345 **Pavement Design I**	**Theory: 2hrs./ Week** **Tutorial: 1hr./ Week**
1- Introduction to pavement materials	3
2- Soil & soil stabilization	6
3- Aggregate & its properties	6
4- Bituminous materials	6
5-Asphalt mixes: types, load carrying mechanism, and properties	6
6- Production of asphalt mixes	6
7- Design of bituminous mixes	6
8- Superpave systems	6

B.E 4346 Railway Engineering	**Theory: 2hrs./ Week** **Tutorial: 1hr./ Week**
Introduction to Railway Engineering	3
Railway Track Element	3
Beams on Elastic Foundation	6
Stresses in Rails and Track	6
Bending of Rail	6
Train - Track Dynamics	6
Track Alignment and Geometric Design	3
Turnouts, and Sidetracks	3
Stations and Yards	3
Points, Crossings and Simple Layouts	3
Signaling and Inter-locking	3
Total	45

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No.	B.E. 3347 Traffic Engineering	Theo. 2hrs./ week
1	Traffic Stream characteristics a) Speed b) Volume c) Density	4
2	Traffic Volume Forecast Traffic growth.	2
3	Principles of traffic, traffic volume-speed-density Relationship	2
4	The Road User	2
5	The Vehicle	2
6	The Road: Stopping sight distance (SSD) Minimum Passing sight distance (PSD) Sight Distance at intersections Turning Radius	4
7	Headway distribution in highway traffic flow	2
8	Intersections : At grade intersection Signalized intersection Un signalized intersection Grade Separated (Interchange)	4
9	Intersection capacity	2
10	Design of signalized intersections	2
11	Parking	2
12	Traffic Signs and marking	2
13	Course Examination	