**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This course is designed for prospective water resources engineers. The major focus of the course is on developing mathematical reasoning and thinking. This course encourages students to formulate conjectures and to explore mathematical concepts through investigations, use of technology, analytical and logical thinking. This course is designed to develop students' problem solving, mathematical reasoning and communication skills that are essential to become water resources engineers. The mathematical content of this course will include topics from Functions, Limits and continuity, Trigonometric functions, differentiation, Matrices, applications of derivatives, Integration, Application of definite integrals, Transcendental functions and techniques of integrations. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resources Engineering | ***2. University Department/Centre*** |
| **Calculus I , 102 WRMA**  This course introduces the description of mathematical theorems, fundamentals of differentiation, integration and their application such as extreme values graph of the functions, calculation of areas and volumes.  The course is designed to present a background about trigonometric and fundamental of transcendental function. | ***3. Course title/code& Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Program(s) to which it Contributes*** |
| Annual System; There is only one mode of delivery, which is a “Day program”. The students are full time students, and on campus. They attend full day program in face to face mode. The academic year is composed of 30 weeks regular subjects. | ***5. Modes of Attendance offered*** |
| 1st and 2nd / 2015-2016 | ***6. Semester/Year*** |
| 120 hours / 4 hours per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course***  The aims are to enable candidates to:  1. develop their mathematical knowledge and oral, written and practical skills in a way which encourages confidence and provides satisfaction and enjoyment;  2. read mathematics, and write and talk about the subject in a variety of ways;  3. develop a feel for number, carry out calculations and understand the significance of the results obtained;  4. apply mathematics in everyday situations and develop an understanding of the part which mathematics plays in the world around them;  5. solve problems, present the solutions clearly, check and interpret the results;  6. develop an understanding of mathematical principles;  7. recognise when and how a situation may be represented mathematically, identify and interpret relevant factors and, where necessary, select an appropriate mathematical method to solve the problem;  8. use mathematics as a means of communication with emphasis on the use of clear expression;  9. develop an ability to apply mathematics in other subjects, particularly science and technology;  10. develop the abilities to reason logically, to classify, to generalise and to prove;  11. appreciate patterns and relationships in mathematics;  12.produce and appreciate imaginative and creative work arising from mathematical ideas;  13. develop their mathematical abilities by considering problems and conducting individual and co-operative enquiry and experiment, including extended pieces of work of a practical and investigative kind;  14. appreciate the interdependence of different branches of mathematics;  15. acquire a foundation appropriate to their further study of mathematics and of other disciplines. | |

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| ***10·Learning Outcomes*** |
| 1. To define and understand functions and how to graph these functions. 2. To define and understand the trigonometric functions and how to graph these functions. 3. To have the ability for dealing with limits and how to check the continuity of the functions. 4. To determine the slope of a curve at a point and the rate of at which the function is changed. 5. To know how to find the derivative of the functions and then using this derivative to find the extreme values of the functions. 6. To be able to use the fundamental theorem of calculus to evaluate definite integral and calculate the areas, volumes, lengths of plane curves. 7. To learn how to define, understand, graph and derive the transcendental functions. 8. To be able to specify and apply the integral methods. |
| ***11.Teaching and Learning Methods*** |
| 1. Lectures 2. Tutorials 3. Home works 4. Test and exams 5. In class questions and discussions 6. Connection between theory and applications |
| ***12. Assessment Methods***   1. Examinations, Tests and Quizzes 2. Extracurricular activities 3. Student engagement during lectures 4. Home works |
| ***13. Grading Policy***  1- Quizzes will be a (5-10) closed books and notes quizzes during the academic year. The quizzes will count 10% of the total course grade.  2- Tests, 2 to 6 times, and will count 20% of the total course grade.  3- Extracurricular activities, this is optional and will count extra marks 1 to 5% for the students, depending on the type of activity.  4- Final Exam: The final exam will be comprehensive close books and notes, take place in June from 9:00 AM to 12:00 PM. The final will count 70% of the total course grade. |

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| ***14. Course Structure*** | | | | | |
| Assessment method | Teaching Method | Unit model or Topic title | Los  Article 10 | Hours | Week |
| (1-4) of article 12 | (1-6) of article 11 | Equation of Line and Circle | 1 | 3 theo  1 tutorial | 1 |
| (1-4) of article 12 | (1-6) of article 11 | Functions | 1 | 3 theo  1 tutorial | 2 |
| (1-4) of article 12 | (1-6) of article 11 | Absolute Value | 1 | 3 theo  1 tutorial | 3 |
| (1-4) of article 12 | (1-6) of article 11 | Trigonometric Functions | 2 | 3 theo  1 tutorial | 4 |
| (1-4) of article 12 | (1-6) of article 11 | Limits and continuity | 3 | 3 theo  1 tutorial | 5 |
| (1-4) of article 12 | (1-6) of article 11 | Slope of curve | 4 | 3 theo  1 tutorial | 6 |
| (1-4) of article 12 | (1-6) of article 11 | Differentiation Rules | 5 | 3 theo  1 tutorial | 7 |
| (1-4) of article 12 | (1-6) of article 11 | Derivative of Trigonometric Functions | 5 | 3 theo  1 tutorial | 8 |
| (1-4) of article 12 | (1-6) of article 11 | Chain Rule | 5 | 3 theo  1 tutorial | 9 |
| (1-4) of article 12 | (1-6) of article 11 | Applications of derivative | 5 | 3 theo  1 tutorial | 10 |
| (1-4) of article 12 | (1-6) of article 11 | Applications of derivative | 5 | 3 theo  1 tutorial | 11 |
| (1-4) of article 12 | (1-6) of article 11 | Applications of derivative | 5 | 3 theo  1 tutorial | 12 |
| (1-4) of article 12 | (1-6) of article 11 | Lopital,s Rule | 5 | 3 theo  1 tutorial | 13 |
| (1-4) of article 12 | (1-6) of article 11 | Fundamentals of Integration | 6 | 3 theo  1 tutorial | 14 |
| (1-4) of article 12 | (1-6) of article 11 | Fundamentals of Integration | 6 | 3 theo  1 tutorial | 15 |
| (1-4) of article 12 | (1-6) of article 11 | The definite integrals | 6 | 3 theo  1 tutorial | 16 |
| (1-4) of article 12 | (1-6) of article 11 | Area | 6 | 3 theo  1 tutorial | 17 |
| (1-4) of article 12 | (1-6) of article 11 | Volumes | 6 | 3 theo  1 tutorial | 18 |
| (1-4) of article 12 | (1-6) of article 11 | Length of Curve | 6 | 3 theo  1 tutorial | 19 |
| (1-4) of article 12 | (1-6) of article 11 | Surface Area | 6 | 3 theo  1 tutorial | 20 |
| (1-4) of article 12 | (1-6) of article 11 | Transcendental Functions | 7 | 3 theo  1 tutorial | 21 |
| (1-4) of article 12 | (1-6) of article 11 | Transcendental Functions | 7 | 3 theo  1 tutorial | 22 |
| (1-4) of article 12 | (1-6) of article 11 | Methods of Integration | 7 | 3 theo  1 tutorial | 23 |
| (1-4) of article 12 | (1-6) of article 11 | Methods of Integration | 7 | 3 theo  1 tutorial | 24 |
| (1-4) of article 12 | (1-6) of article 11 | Methods of Integration | 7 | 3 theo  1 tutorial | 25 |
| (1-4) of article 12 | (1-6) of article 11 | Conic sections | 7 | 3 theo  1 tutorial | 26 |
| (1-4) of article 12 | (1-6) of article 11 | Conic sections | 7 | 3 theo  1 tutorial | 27 |
| (1-4) of article 12 | (1-6) of article 11 | Conic sections | 7 | 3 theo  1 tutorial | 28 |
| (1-4) of article 12 | (1-6) of article 11 | Determinates | 7 | 3 theo  1 tutorial | 29 |
| (1-4) of article 12 | (1-6) of article 11 | Determinates | 7 | 3 theo  1 tutorial | 30 |

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| ***15. Infrastructure*** | | |
| Textbook  George B. Thomas , Maurice D, Weir and Joil R. Hass (2010). “Thomas, Calculus” Twelfth Edition, | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| Extracurricular Activities | Special requirements (include forexample workshops, periodicals,IT software, websites) | |
|  | Community-based facilities  (include for example, guest  Lectures , internship ,field studies) | |
| ***16. Admissions*** | | |
|  | | Pre-requisites |
|  | | Minimum number of students |
| 67 | | Maximum number of students |
|  | | ***17. Course Instructors*** |

**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resources | ***2. University Department/Centre*** |
| **Computer Programs,211 WRCO**  This course introduces and teaches the student many topics/issues related to computer programs. Topics covered:  1. Introduction to computer application  2. Computer component  3. Microsoft Windows  4. Microsoft Word  5. Microsoft Excel  6. AutoCAD  In this course, the student will: understand, know, be familiar and be able to deals with types and parts, devices, storage, input/output units of computer, and also content of drop-menus of programs mentioned above.  The course is designed to provide a background to higher level courses. The course is taught through 4 hrs per week, 2 theoretically and 2 practically at the Lab. | ***3. Course title/code& Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Program(s) to which itContributes*** |
| Annual System ; There is only one mode of delivery, which is a “Day Program”. The students are full time students, and on campus. They attend full day program in face-to-face mode. The academic year is composed of 30-week regular subjects. | ***5. Modes of Attendance offered*** |
| 1st and 2nd Semester, Academic Year 2015 – 2016 | ***6. Semester/Year*** |
| 120 hrs. / 4 hrs. per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| 1. Computing Fundamentals (Introduction to Computer Application):   1) Introduce the following:  a. Historical introduction,  b. Computer types: super computer, main frame,...  c. Computer Parts (soft and hard): monitor, keyboard, mouse, operating  system, applications, files,...  d. Devices inside the system unit of computer: mother board, power supply,  hard disk,...  e. Computer storage units: hard disk, floppy disk, flash disk,...  f. Input and output units: keyboard, scanner, monitor, speaker,...  g. Icons, files and folders (create new, rename, copy or moving, saving, ...)  h. Items of control panel  2). Provide a background to higher level courses   1. MS Word Program:   1) Introduce and learn the student how to deals with Word documents from all respects especially through drop-down menus along with their content/facilities; for example:  a. File Menu (create new document, open document, typing, saving and  printing document,....)  b. Edit Menu (find and replace any word(s) in document, ....)  c. View Menu (add header and footer, ....)  d. Insert Menu (insert page No., Diagram,....)  e. Format Menu (font, bullets, boarders,....)  f. Tools Menu (check spelling and grammar, search, ...)  g. Table Menu (create and using tables, sort data, ...)  2) Provide a background to higher level courses   1. MS Excel Program:   1) Introduce and learn the student how to deals with Excel sheet from all respects especially through drop-down menus along with their content/facilities; for example:  a. File Menu (create new sheet, open sheet, save, printing,...)  b. Edit Menu (copy and paste, find, replace,...)  c. Insert Menu (cells, rows, columns, charts, function, ...)  d. Format Menu (cells, rows, columns, sheet,...)  e. Tools Menu (spelling, search,...)  f. Data Menu (sort, filter, table,...)  g. Windows (hide, split, freeze,...)  2) Provide a background to higher level courses   1. AutoCAD Program:   1) Introduce and learn the student how to deals with AutoCAD drawing from all respects especially through drop-down menus along with their content/facilities; for example:  a. File Menu (new drawing, save and save as, plot,...)  b. Edit Menu (copy and cut, paste, ...)  c. Draw Menu (line, polyline, arc, circle, hatch, text,...)  d. Dimension Menu (linear, arc length, angular, baseline,...)  e. Modify Menu (mirror, offset, move, rotate, trim, filet,...)  2) Provide a background to higher level courses | |

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| ***10·Learning Outcomes***  At the end of the class:  1. Regarding Computing Fundamentals (Introduction to Computer Application): the  student will:  a) Understand introduction history of computer  b) Know types and parts of computer,  c) know and deals with devices inside the system unit of computer  d) Be familiar with storage and input / output units in computer  e) Be able to deals with files, folders; also items in control panel  2. Regarding Word, Excel and AutoCAD, the student will be able to deals with  topics related to that program, and be familiar with the drop-down menus and  their content (mentioned above in Article 9 points 2, 3, and 4). |
| ***11.Teaching and Learning Methods*** |
| 1. Lectures. 2. Homework and Assignments. 3. Lab. (practical). 4. Tests and Exams. 5. In-Class Questions and Discussions. 6. Connection between Theory and Application. 7. In- and Out-Class oral conversation. 8. Reports and Posters |
| ***12. Assessment Methods***  1. Examinations, Tests, and Quizzes.  2. Student Engagement during Lectures.  3. Responses Obtained from Students, Questionnaire about  Curriculum and Faculty Member ( Instructor ). |
| ***13. Grading Policy***  **1. Tests**, 10 Nos. and will count 50 % of the total course grade (30 % theoretical and 20 % Laboratory Work).  **2. Final Exam:**  The final exam will be comprehensive, closed books and notes and take place on June 2014. The final exam will count 50% of the total course grade |

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| ***14. Course Structure*** | | | | | |
| Assessment  Method | Teaching  Method | Unit/Module or  Topic Title | LOs  ( Article  10 ) | Hours | Week |
| 1 – 3 of article (12) | 1-8 of  article (11) | Intr. to computer application | 1 | 4  2 the.  2 prac. | 1 |
| 1 – 3 of article (12) | 1-8 of  article (11) | Computer component | 1 | 4  2 the.  2 prac. | 2 |
| 1 – 3 of article (12) | 1-8 of  article (11) | Computer component | 1 | 4  2 the.  2 prac. | 3 |
| 1 – 3 of article (12) | 1-8 of  article (11) | Microsoft Windows | 1 | 4  2 the.  2 prac. | 4 |
| 1 – 3 of article (12) | 1-8 of  article (11) | Microsoft Windows | 1 | 4  2 the.  2 prac. | 5 |
| 1 – 3 of article (12) | 1-8 of  article (11) | Microsoft Word | 2 | 4  2 the.  2 prac. | 6 |
| 1 – 3 of article (12) | 1-8 of  article (11) | Microsoft Word | 2 | 4  2 the.  2 prac. | 7 |
| 1 – 3 of article (12) | 1-8 of  article (11) | Microsoft Word | 2 | 4  2 the.  2 prac. | 8 |
| 1 – 3 of article (12) | 1-8 of  article (11) | Microsoft Word | 2 | 4  2 the.  2 prac. | 9 |
| 1 – 3 of article (12) | 1-8 of  article (11) | Microsoft Word | 2 | 4  2 the.  2 prac. | 10 |
| 1 – 3 of article (12) | 1-8 of  article (11) | Microsoft Excel | 2 | 4  2 the.  2 prac. | 11 |
| 1 – 3 of article (12) | 1-8 of  article (11) | Microsoft Excel | 2 | 4  2 the.  2 prac. | 12 |
| 1 – 3 of article (12) | 1-8 of  article (11) | Microsoft Excel | 2 | 4  2 the.  2 prac. | 13 |
| 1 – 3 of article (12) | 1-8 of  article (11) | Microsoft Excel | 2 | 4  2 the.  2 prac. | 14 |
| 1 – 3 of article (12) | 1-8 of  article (11) | Microsoft Excel | 2 | 4  2 the.  2 prac. | 15 |
| 1 – 3 of article (12) | 1-8 of  article (11) | Microsoft Excel | 2 | 4  2 the.  2 prac. | 16 |
| 1 – 3 of article (12) | 1-8 of  article (11) | AutoCAD | 2 | 4  2 the.  2 prac. | 17 |
| 1 – 3 of article (12) | 1-8 of  article (11) | AutoCAD | 2 | 4  2 the.  2 prac. | 18 |
| 1 – 3 of article (12) | 1-8 of  article (11) | AutoCAD | 2 | 4  2 the.  2 prac. | 19 |
| 1 – 3 of article (12) | 1-8 of  article (11) | AutoCAD | 2 | 4  2 the.  2 prac. | 20 |
| 1 – 3 of article (12) | 1-8 of  article (11) | AutoCAD | 2 | 4  2 the.  2 prac. | 21 |
| 1 – 3 of article (12) | 1-8 of  article (11) | AutoCAD | 2 | 4  2 the.  2 prac. | 22 |
| 1 – 3 of article (12) | 1-8 of  article (11) | AutoCAD | 2 | 4  2 the.  2 prac. | 23 |
| 1 – 3 of article (12) | 1-8 of  article (11) | AutoCAD | 2 | 4  2 the.  2 prac. | 24 |
| 1 – 3 of article (12) | 1-8 of  article (11) | AutoCAD | 2 | 4  2 the.  2 prac. | 25 |
| 1 – 3 of article (12) | 1-8 of  article (11) | AutoCAD | 2 | 4  2 the.  2 prac. | 26 |
| 1 – 3 of article (12) | 1-8 of  article (11) | AutoCAD | 2 | 4  2 the.  2 prac. | 27 |
| 1 – 3 of article (12) | 1-8 of  article (11) | AutoCAD | 2 | 4  2 the.  2 prac. | 28 |
| 1 – 3 of article (12) | 1-8 of  article (11) | AutoCAD | 2 | 4  2 the.  2 prac. | 29 |
| 1 – 3 of article (12) | 1-8 of  article (11) | AutoCAD | 2 | 4  2 the.  2 prac. | 30 |

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| ***15. Infrastructure*** | | |
| * Excel Scientist and Engineering Cookbook * AutoCAD, Kyless * Notebook prepared by the instructor of the course * Collection of sheets of solved and unsolved problems and Exams questions | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| * Laboratory work in the ( Computer Lab ) of the department | Special requirements (include forexample workshops, periodicals,IT software, websites) | |
| ---- | Community-based facilities  (include for example, guest  Lectures , internship field studies) | |
| ***16. Admissions*** | | |
|  | | Prerequisite |
|  | | Minimum number of students |
| 60 | | Maximum number of students |
|  | | ***17. Course Instructors*** |

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**TEMPLATE FOR COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

**COURSE SPECIFICATION**

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** | |
| Department of Water Resources Engineering | ***2. University Department/Centre*** | |
| **Engineering Mechanics / 104WREM**  This course introduces the fundamental principals of engineering mechanics covering the following topics:  1-Statics  -Basic concepts of mechanics; vectors Newton's Laws, free body diagram  - Force systems, (action and reaction, principal of transmissibility, concurrent forces, rectangular components, moment, couple, resultant.  -Equilibrium; system isolation and free body diagram.  -Structure; plane trusses, method of joint, method of sections.  -Center of mass; centroids of lines, area, volume, centroids of composite bodies and figures.  -Friction; static friction, kinetic friction, friction angle.  -Moment of inertia; rectangular and polar moment of inertia, radius of gyration, transfer of axes.  2-Dynamics  -Kinematics of particles (velocity and acceleration); rectilinear motion plane curvilinear motion, rectangular coordinates, normal and tangential coordinates, polar coordinates, relative motion.  -Kinetics o particles (force, mass and acceleration); Newton's second law, rectilinear motion, curvilinear motion.  Work and kinetic energy; work of linear spring, work on curvilinear motion, principle of work and kinetic energy, potential energy.  The course is designed to provide a background to higher level courses (strength of materials, structural analysis, reinforced concrete design etc..).  -The course is  taught through 4 hrs per week, 3 hrs theories,  1 hrs tutorial. | ***3. Course title/code & Description*** | |
| B Sc degree in Water Resource Engineering ( WRE ) | ***4. Program(s) to which it Contributes*** | |
| Annual System ; There is only one  mode of delivery, which is a “Day  Program”. The students are full time  students, and on campus. They attend  full day program in face-to-face  mode. The academic year is  composed of 30-week regular  subjects. | ***5. Modes of Attendance offered*** | |
| 1st and 2nd , 2015 – 2016 | ***6. Semester/Year*** | |
| 120 hrs / 4 hrs per week | ***7. Number of hours tuition (total)*** | |
| 2017 | ***of Date of production/revision 8- this specification*** | |
| ***. 9.Aims of the Course*** | | |
| The primary purposes of engineering mechanics is to:  1-Develop the capacity to predict the effects of force and motion while carrying out  the creative design functions of engineering. This capacity requires more than a  mere knowledge of the physical and mathematical principles of mechanics.  2-Increase the ability to visualize configurations in terms of real materials, actual  constraints and the practical limitations which govern the behavior of mechanics  and structures.  3- Help the student to develop his ability to visualize which is so vital to problem  formulation.  4- Achieve maximum progress when the principles and their limitations are learned  together within the context of engineering applications.  5-To build up a strong background knowledge for the next engineering courses such  as fluid mechanics, strength of materials, structural analysis etc… | | |
| ***10.Learning Outcomes*** | | |
| At the end of the class, the student will be able to:  a. Determine the resultant of the system of forces exerted on the rigid body in the  form of vector or scalar and transform them into equivalent force couple system.  b. Use equilibrium equations to determine the external reactions of statically  determinate structures.  c. Find the internal forces and their types in the members of statically determinate  truss by both joint method and section method.  d. Determine the centroids of line, area, and volume.  e. Calculate the moment of inertia of area of any shape and can transfer it to any  axis.  f. Describe the motion of particle at any moment (displacement, velocity and  acceleration) That is moving on linear or curvilinear path. The motion of  projectiles can also be solved.  g. Resolve the motion of particle by rectangular ,tangential-transverse and polar  coordinates, respectively.  h. Analyze the relative motion of bodies (displacement, velocity, and acceleration).  i. Calculate centroid, area moment of inertia of various figures.  j. Calculate various types of forces (external, internal, and friction force) which are  exerted on the moving bodies by using second Newton's law.  k.Use work and equations to determine velocity, displacement, and applied force. | | |
| ***11.Teaching and Learning Methods*** | | |
| 13. Lectures  14. Tutorials  15. Homework and Assignments  17. Tests and Exams  18. In-Class Questions and Discussions  19. Connection between Theory and Application  21. Extracurricular Activities  22. Seminars  23. In- and Out-Class oral conservations | | |
| ***Assessment 12.Methods***  1. Examinations, Tests, and Quizzes  2. Extracurricular Activities  3. Student Engagement during Lectures  4. Responses Obtained from Students, Questionnaire about  Curriculum and Faculty Member (Instructor ) | | |
| ***13 Grading Policy***  1. Quizzes:  - There will be a (20 – 25) closed books and notes quizzes  during the academic year.  - The quizzes will count 20% of the total course grade.  2. Tests, 2-3 Nos. and will count 10% of the total course grade.  3. Extracurricular Activities, this is optional and will count extra  marks (1 – 5 %) for the student, depending on the type of activity.  4. Final Exam:  - The final exam will be comprehensive, closed books and  notes, and will take place on January 2014 from 9:00 AM - 12:00 PM  in rooms (W1+W2)  - The final exam will count 70% of the total course grade | | |

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| ***14.Course Structure*** | | | | | |
| Assessment  Method | Teaching  Method | Unit/Module or  Topic Title | LOs  ( Article  10 ) | Hours | Weeks |
| 1 – 4 of article (12) | 1-12 of  article (11) | Basic concepts, scalar and vectors | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut. | 1 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Force, action, and reaction | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 2 |
| 1 – 4 of article (12) | 1-12 of  article (11) | vector components | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 3 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Rectangular components | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 4 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Momenta and couples | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 5 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Resultant | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 6 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Equilibrium, free body diagram | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 7 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Plane trusses, method of joint | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 8 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Method of section | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 9 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Center of mass, determining the center of gravity | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 10 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Centroid of line, area, volume | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 11 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Centroid of compound figures | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 12 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Friction, friction force | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 13 |
| 1 – 4 of article (12) | 1-12 of  article (11) | static friction and kinetic friction | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 14 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Type of friction problems | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 15 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Area moment of inertia | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 16 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Radius of gyration, transfer of axes | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 17 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Moment of inertia of compound figure | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 18 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Rectilinear motion, velocity and acceleration | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 19 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Curvilinear motion, velocity, acceleration | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 20 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Rectangular coordinates, x,y | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 21 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Normal and tangential coordinates, velocity and acceleration | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 22 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Polar coordinates, velocity and acceleration | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 23 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Relative motion, displacement, velocity and acceleration | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 24 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Newton's 2nd law, force, mass and acceleration | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 25 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Rectilinear motion, force, mass and acceleration | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 26 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Curvilinear motion, force, mass and acceleration | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 27 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Work and kinetic energy | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 28 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Potential energy, work and linear spring | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 29 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Principle of work and kinetic energy | a,l,m,n,  o,p,q,r | 4  3 the.  1 tut | 30 |

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| ***15.Infrastructure*** | | |
| ***Textbook***  “Engineering Mechanics/ Statics”; by James L  Merriam and L.G.Kraige,volume 1, fifth  Edition, 2006.  “Engineering Mechanics/ Dynamics”; by James  L.Merriam and L.G.Kraige, volume 1,fifth  Edition, SI Version 2006.  ***References***  1-"Vector Mechanics for Engineers" Statics and  Dynamics, Beer, F.P.,Int. Student Ed.,1962.  2-"Engineering Mechanics Statics and Dynamics,  " By Archie Higdon and William B.Stiles  third eddition., 1968.  3. “Mechanics of Materials"; by  Russel C. Hibbeler , Seven Edition, 2008  ***Others***   1. Notebook prepared by the instructor of the   course   1. Collection of sheets of solved and unsolved   problems and Exams questions | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| Available websites related to the subject.  Extracurricular activities. | Special requirements (include for  example workshops,  periodicals, IT software, websites) | |
| Field and scientific visits.  Extra lectures by foreign guest lecturers | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***. 16Admissions*** | | |
|  | | Pre-requisites |
| / | | Minimum number of students |
| 80 | | Maximum number of students |
|  | | ***17. Course Instructors*** |

**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resources Engineering | ***2. University Department/Centre*** |
| **Engineering Drawing , 105 WRED**  This course provides a broad understanding of the basic principles of engineering drawing. The emphasis is on using tools to draw parallel and perpendicular lines, and to construct circles, arcs, tangents and irregular curves. As well as making sketches in isometric and orthographic views with dimensioning. Moreover creating sectional views in 2-D drawings. | ***3. Course title/code & Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Program(s) to which it Contributes*** |
| Annual System ; There is only one  mode of delivery, which is a “Day  Program”. The students are full time  students, and on campus. They attend  full day program in face-to-face  mode. The academic year is composed of 30-week regular subjects. | ***5. Modes of Attendance offered*** |
| 1st and 2nd / Academic Year 2015 – 2016 | ***6. Semester/Year*** |
| 150 hrs / 5 hrs per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| 1. Introduce basic definitions and introductory concepts of Engineering Drawing and lines. 2. Introduce the lettering in pencil. 3. Introduce the graphic instruments and their use 4. Introduce the alphabet of lines. 5. Provide exercises for the T- square, triangles and scale. 6. Learning how to make combinations between arcs and circles by using compass. 7. Learning how to put the dimensions, notes, limits and precision. 8. Learning how to draw the ellipse in different methods. 9. Ability to create orthographic views for engineering objects. 10. Ability to create isometric or pictorial drawings. 11. Ability to create sectional views in 2-D drawings. | |

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| ***10·*** ***Learning Outcomes*** |
| 1. Graphics has always been the language of engineering and the preferred media for conveyance of design ideas. 2. Having good technique in lettering as in drawing. 3. Ability to use tools to draw parallel and perpendicular lines, and to construct circles, arcs, tangents and irregular curves. 4. The alphabet of lines. 5. Making combinations between arcs and circles by using compass. 6. Putting the dimensions, notes, limits and precision. 7. Drawing the ellipse in different methods. 8. Creating orthographic views for engineering objects. 9. Creating isometric or pictorial drawings. 10. Creating sectional views in 2-D drawings. |
| ***11.*** ***Teaching and Learning Methods*** |
| 1. Lectures. 2. Sketching engineering objects in the freehand mode. 3. Homework and Assignments. 4. Tests and Exams. 5. In-Class Questions and Discussions. |
| ***12. Assessment Methods*** |
| 1. Examination, tests, and quizzes 2. Student engagement during lectures   ***13. Grading Policy***  1. Quizzes:  - There will be (4) closed books and notes quizzes during the academic year.  - The quizzes will count 5% of the total course grade.  2. Tests, 4-5 Nos. and will count 10% of the total course grade.  3. 15% of the total course grade for the 1st semester classwork and homework.  4. 15% of the total course grade for the 2nd semester classwork and homework  5. Final Exam:  - The final exam will be closed books and notes, and will take place on June  2014 from 9:00 AM - 12:00 PM  - The final exam will count 25% of the total course grade  N.B. 30% of the total course grade will be for (perspective geometry). |

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| ***14. Course Structure*** | | | | | |
| Assessment Method | Teaching Method | Unit/Module or Topic Title | LOs (Article 10) | Hours | Week |
| **/** | **/** | For 1st Year ; The 1st semester starts in November | / | / | 1 |
| 2 |
| 3 |
| 4 |
| 5 |
| 1 – 2 of  Article (12) | 1 – 5 of  Article (11) | General Introduction about Engineering Drawing and Lines. | 1 | 5 | 6 |
| 1 – 2 of  Article (12) | 1 – 5 of  Article (11) | Lettering | 2 | 5 | 7 |
| 1 – 2 of  Article (12) | 1 – 5 of  Article (11) | Graphic instruments and their use. | 3 | 5 | 8 |
| 1 – 2 of  Article (12) | 1 – 5 of  Article (11) | The alphabet of lines | 4 | 5 | 9 |
| 1 – 2 of  Article (12) | 1 – 5 of  Article (11) | Exercises for the T-square, triangles and scale.  Circles and Tangents | 3 & 4 | 5 | 10 |
| 1 – 2 of  Article (12) | 1 – 5 of  Article (11) | Combinations (arcs and circles) | 5 | 5 | 11 |
| 5 | 12 |
| 1 – 2 of  Article (12) | 1 – 5 of  Article (11) | Dimensions, notes, limits and precision. | 6 | 5 | 13 |
| 1 – 2 of  Article (12) | 1 – 5 of  Article (11) | The Ellipse | 7 | 5 | 14 |
| 1 – 2 of  Article (12) | 1 – 5 of  Article (11) | Orthographic Drawing and Sketching (Projection) | 8 | 5 | 15 |
| 5 | 16 |
| 5 | 17 |
| 5 | 18 |
| 5 | 19 |
| 5 | 20 |
| 1 – 2 of  Article (12) | 1 – 5 of  Article (11) | Pictorial Drawing and sketching (isometric) | 9 | 5 | 21 |
| 5 | 22 |
| 5 | 23 |
| 5 | 24 |
| 5 | 25 |
| 5 | 26 |
| 1 – 2 of  Article (12) | 1 – 5 of  Article (11) | Sectional views and Conventions | 10 | 5 | 27 |
| 5 | 28 |
| 5 | 29 |
| 5 | 30 |

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| ***15. Infrastructure*** | | |
| ***Textbook***  Engineering Drawing and Graphic Technology “By Thomas E. French & Charles J. Vierck”  ***References***  / | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| / | Special requirements (include for example workshops, periodicals, IT software, websites) | |
| / | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***16. Admissions*** | | |
| / | | Pre-requisites |
| / | | Minimum number of students |
| 75 | | Maximum number of students |
|  | | ***17. Course Instructors*** |

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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resources Engineering | ***2. University Department/Centre*** |
| **Statistical Engineering, 106 WRES** | ***3. Course title/code& Description*** |
| B.Sc. in Water Resources Engineering | ***4. Program(s) to which it Contributes*** |
| Annual system; There is only 0ne mode of delivery, which is a "Day Program ".The students are full time students, and on campus. They attend full day program in face-to-face. The academic year is composed of 30-week regular subjects. Each week there are three lectures, and each lecture 50-mintus. | ***5. Modes of Attendance offered*** |
| 1st and 2nd Semesters, Academic Year 2017-2018 | ***6. Semester/Year*** |
| 90 | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course***  1- Graduate water resources engineers to serve in water resources management.  2- Improving the teaching and the administrative activities to meet international  accreditation standards and the mission of department.  3- Improving the academic abilities of the faculty and attracting highly skilled  personnel.  4- Improve the abilities of management and technical support staff and attract the  highly skilled for employment.  5-Optimum use of resources and potential of the department.  6-Coopration academic exchange programs partnerships with other universities and  academic centers in developed countries.  7- Establishing viable applied research that generates knowledge for local and  foreign market. | |
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| ***10·Learning Outcomes***  a- An ability to apply knowledge of statistics.  b- Knowing the methods of presentation the data.  c-Calculating the measures of central tendency, measures of dispersion, and to know  what means these measurements.  d-An ability to identify and formulate water resources problems.  e- Applying the statistical analysis and to serve the statistical decision.  f- The broad education necessary to understand the impact of engineering solution in  global and social context.  g-An ability to create statistical models (mathematical models). |
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| ***11.Teaching and Learning Methods***  1-Lectures  2- Tutorials  3-Homework and Assignment  4-Test and Exams  5-In class Questions and Discussion  6-Extracturricular Activities |
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| ***12. Assessment Methods***  1- Examination  2- Extracurricular Activities |
| ***13. Grading Policy***  1-There will be 5-6 closed book testes during the academic year, and will count  30% of the total grade.  2- Final Exam:  The final exam will be comprehensive, closed book and notes, and will take  place in June -2014 from 9:00 AM -12:00PM .  - The final exam will count 70% of total course grade. |

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| ***14. Course Structure*** | | | | | |
| Assessment Method | Teaching Method | Topic Title | LOs  (Artical10) | Hours | Week |
| 1-2 article(12) | 1-6 of article(11) | Introduction | a,b | 3 | 1 |
| 1-2 article(12) | 1-6 of article(11) | Introduction | a,b | 3 | 2 |
| 1-2 article(12) | 1-6 of article(11) | Measures of Central Tendency | B,c | 3 | 3 |
| 1-2 article(12) | 1-6 of article(11) | Measures of Central Tendency | B,c,d | 3 | 4 |
| 1-2 article(12) | 1-6 of article(11) | Measures of central tendency | B,c,d | 3 | 5 |
| 1-2 article(12) | 1-6 of article(11) | Measures of Central Tendency | B,cd | 3 | 6 |
| 1-2 article(12) | 1-6 of article(11) | Measures of Dispersion | C,d | 3 | 7 |
| 1-2 article(12) | 1-6 of article(11) | Measures of Dispersion | c.d | 3 | 8 |
| 1-2 article(12) | 1-6 of article(11) | Measures of Dispersion | C,d | 3 | 9 |
| 1-2 article(12) | 1-6 of article(11) | Basis of Probability | E,f | 3 | 10 |
| 1-2 article(12) | 1-6 of article(11) | Basis of Probability | E,f | 3 | 11 |
| 1-2 article(12) | 1-6 of article(11) | Basis of Probability | E,f | 3 | 12 |
| 1-2 article(12) | 1-6 of article(11) | Discrete Probability Dis. | F,g | 3 | 13 |
| 1-2 article(12) | 1-6 of article(11) | Discrete Probability Dis. | F,g | 3 | 14 |
| 1-2 article(12) | 1-6 of article(11) | Binomial Dis. | F,g | 3 | 15 |
| 1-2 article(12) | 1-6 of article(11) | Poisson’s Dist. | F,g | 3 | 16 |
| 1-2 article(12) | 1-6 of article(11) | Continuous Probability Dis. | F,g | 3 | 17 |
| 1-2 article(12) | 1-6 of article(11) | Continuous Probability Dis. | F,g | 3 | 18 |
| 1-2 article(12) | 1-6 of article(11) | Normal Dist. | F,g | 3 | 19 |
| 1-2 article(12) | 1-6 of article(11) | Normal Dist. | F,g | 3 | 20 |
| 1-2 article(12) | 1-6 of article(11) | Normal Dist. | F,g | 3 | 21 |
| 1-2 article(12) | 1-6 of article(11) | T-Dist. | G,f | 3 | 22 |
| 1-2 article(12) | 1-6 of article(11) | Hypothesis-Test | G,f | 3 | 23 |
| 1-2 article(12) | 1-6 of article(11) | Test of Mean | G,f | 3 | 24 |
| 1-2 article(12) | 1-6 of article(11) | Z-Test | G,f | 3 | 25 |
| 1-2 article(12) | 1-6 of article(11) | Z-Test | G,f | 3 | 26 |
| 1-2 article(12) | 1-6 of article(11) | T-Test | G,f | 3 | 27 |
| 1-2 article(12) | 1-6 of article(11) | Correlation and Regression | G | 3 | 28 |
| 1-2 article(12) | 1-6 of article(11) | Simple Regression | G | 3 | 29 |
| 1-2 article(12) | 1-6 of article(11) | Simple Regression | G | 3 | 30 |

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| ***15. Infrastructure*** | | |
| Text Book:  "Introduction to Statistics" by M. Abu-salih and Awad , John Wily and Sons,1983.  References :  "Applied Statistics and Probability for Engineers" by Douglas C. Montgomery and George C. Runger, 2011, John Willy and Sons. | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
|  | Special requirements (include for example workshops, periodicals ,IT software, websites) | |
|  | Community-based facilities  (include for example, guest  Lectures , internship, field studies) | |
| ***16. Admissions*** | | |
|  | | Pre-requisites |
|  | | Minimum number of students |
| 65 | | Maximum number of students |
|  | | ***17. Course Instructors*** |

**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| Building Construction Materials is a study of materials and supplies used in construction. Identification, uses, manufacture and structure of wood, cement, masonry and metal materials are discussed. The course focuses on the advantages and disadvantages of materials as they relate to durability, permeability, aesthetic qualities, internal stresses, heat and sound energy transfer, combustibility, fire ratings, and other physical characteristics. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resources | ***2. University Department/Centre*** |
| **Materials technology, 107 WRME**  This course appraises the characteristics, properties, applications and behaviour (including strengthening mechanisms) during processing, fabrication, and service of a wide range of engineering materials, evaluate the effects of stress, fatigue, creep, corrosion, and wear on material, examine forms and effects of corrosion in metals and review the main methods of corrosion prevention, systematically apply and justify procedures used in the failure analysis of a Component, systematically specify and justify suitable material(s) for a given application, and including the use of relevant material selection methodologies. | ***3. Course title/code& Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Program (s) to which it Contributes*** |
| One Semester System; There is only one mode of delivery, which is a “Day program”. The students are full time students, and on campus. They attend full day program in face to face mode. The academic semester is composed of 15 weeks regular subjects. | ***5. Modes of Attendance offered*** |
| 2nd semester, 2017-2018 | ***6. Semester/Year*** |
| 60 hours / 4 hours per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| **9. Aims of the Course**  The aim of this course is to get the students acquainted with the correlation between material behaviour and material properties. In engineering, designs are put into practice by making use of materials. As the student gets to know the mechanisms and concepts that determine the material behaviour, (s)he will have the required knowledge to make an optimal material choice. Finally, the student will understand how properties of the material can be optimized by adapting the material processing and consequently change the structural characteristics of the material. | |
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| ***10·Learning Outcomes*** |
| On completion of this course, students should be able to:   1. Understand the language of building materials. 2. Recognize major types of construction materials. 3. Understanding the brick properties and types. 4. Understand the brick works; bond types and bond materials. 5. Understanding concrete material; cement and aggregate. 6. Deals with admixtures. 7. Concrete properties. |
| ***11.Teaching and Learning Methods*** |
| 1. Lectures 2. Tutorials 3. Home works assignments 4. Lab. Experiments 5. Test and exams 6. In class questions and discussions 7. Connection between theory and applications 8. Reports, Presentations and Posters |
| ***12. Assessment Methods***   1. Examinations, Tests and Quizzes 2. Extracurricular activities 3. Student engagement during lectures 4. Home works 5. Reports Presentation and discussions |
| ***13. Grading Policy***  1- Quizzes will be (2 - 5) closed books and notes quizzes during the academic semester. The quizzes will count 5% of the total course grade.  2- Reports (5-7 Experiments) during the academic semester. The reports will count 5% of the total course grade.  3- Tests, 2 to 3 times, and will count 30% of the total course grade.  4- Final Exam: The final exam will be comprehensive close books and notes, take place in June from 9:00 AM to 11:30 AM. The final will count 60% of the total course grade. |

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| ***14. Course Structure*** | | | | | |
| Assessment Method | Teaching Method | Unit model or Topic title | LO’s  Article 10 | Hours | Week |
| 1 to 5 of article 12 | 1 to 8 of article 11 | Introduction in Material Technology | 1and 2 | 2 theo  2 Lab. | 16 |
| Introduction in Material Technology | 1and 2 | 2 theo  2 Lab. | 17 |
| Bricks | 3 | 2 theo  2 Lab. | 18 |
| Types of Brick | 3 | 2 theo  2 Lab. | 19 |
| Brick works | 4 | 2 theo  2 Lab. | 20 |
| Types of bond | 4 | 2 theo  2 Lab. | 21 |
| Mortar and its types | 4 | 2 theo  2 Lab. | 22 |
| Concrete | 5 | 2 theo  2 Lab. | 23 |
| Concrete works | 5 | 2 theo  2 Lab. | 24 |
| Cement | 5 | 2 theo  2 Lab. | 25 |
| Aggregates | 5 | 2 theo  2 Lab. | 26 |
| Admixtures | 6 | 2 theo  2 Lab. | 27 |
| Properties of concrete | 7 | 2 theo  2 Lab. | 28 |
| Properties of concrete | 7 | 2 theo  2 Lab. | 29 |
| Properties of concrete | 7 | 2 theo  2 Lab. | 30 |

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| ***15. Infrastructure*** | | |
| Text book  Artin Livon and Zuhiyr Saako, 1977. “Building Construction” University of Mousul-Iraq. (Arabic Reference) | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| Laboratory experiments in the materials Laboratory of the Department of Civil Engineering | Special requirements (include for example workshops, periodicals ,IT software, websites) | |
| None. | Community-based facilities  (include for example, guest  Lectures , internship,field studies) | |
| ***16. Admissions*** | | |
|  | | Pre-requisites |
|  | | Minimum number of students |
|  | | Maximum number of students |
|  | | ***17. Course Instructors*** |

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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| University of Baghdad  College of Engineering | ***1. Teaching Institution*** |
| Department of Water Resources | ***2. University Department/Centre*** |
| **Engineering Geology, 108 WREG**  The course introduces basic definitions of minerals, rocks,, materials, rock mechanics, and surface erosion control | ***3. Course title/code& Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Program(s) to which it Contributes*** |
| Semester System ; There is only one  mode of delivery, which is a “Day  Program”. The students are full time  students, and on campus. They attend  full day program in face-to-face  mode. The semester is composed of 15-week regular subjects. One hour theoretical and 2 hours of laboratory work per week | ***5. Modes of Attendance offered*** |
| 1st semester, Academic year 2017-2018 | ***6. Semester/Year*** |
| 45 hours, 1 hr theoretical and 2 hrs laboratory work per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| Teaching Principles of Engineering Geology | |

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| ***10·Learning Outcomes*** |
| Students will learn:  1-The engineering properties of rocks including computer  applications.  2- Types of aquifers and the motion of groundwater through  different aquifers including internet sources.  3-Tthe engineering properties of soils including computer  applications.  4- The mechanics of Mass Movement including internet sources.  5- The geo-engineering aspects of the reservoirs and dam  construction including internet sources. |
| ***11.Teaching and Learning Methods*** |
| 1. Lecture notes 2. Computer software’s (Rock lab and Mohr’s view)-Lab work. 3. Wooden samples of Faults and failure planes. |
| ***12. Assessment Methods***  1- Two Monthly written exams. |
| ***13. Grading Policy***  1- 30% monthly exams  2- 70% final exam. |

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| ***14. Course Structure*** | | | | | |
| Assessment Method  Article 12 | Teaching Method  Article 11 | Topic Title | LO’s  Article 10 | Hours | Week |
| 1 | 1,2,3 | Engineering Properties of Rocks |  | 3  1 theo  2 lab | 1 |
| 1 | 1,2,3 | Engineering Properties of Rocks |  | 3  1 theo  2 lab | 2 |
| 1 | 1,2,3 | Engineering Properties of Rocks |  | 3  1 theo  2 lab | 3 |
| 1 | 1,2,3 | Engineering Properties of Rocks |  | 3  1 theo  2 lab | 4 |
| 1 | 1,2,3 | Engineering Properties of Rocks |  | 3  1 theo  2 lab | 5 |
| 1 | 1,2,3 | Engineering Properties of Rocks | 1 | 3  1 theo  2 lab | 6 |
| 1 | 1,2,3 | Software ROCKLAB | 1 | 3  1 theo  2 lab | 7 |
| 1 | 1,2,3 | Classification of Rocks | 1 | 3  1 theo  2 lab | 8 |
| 1 | 1,2,3 | Classification of Rocks | 1 | 3  1 theo  2 lab | 9 |
| 1 | 1,2,3 | Groundwater and Geology | 2 | 3  1 theo  2 lab | 10 |
| 1 | 1,2,3 | Groundwater and Geology | 2 | 3  1 theo  2 lab | 11 |
| 1 | 1,2,3 | Engineering and Physical Properties of Soils | 3 | 3  1 theo  2 lab | 12 |
| 1 | 1,2,3 | Engineering and Physical Properties of Soils | 3 | 3  1 theo  2 lab | 13 |
| 1 | 1,2,3 | Mechanics of Mass Movement | 4 | 3  1 theo  2 lab | 14 |
| 1 | 1,2,3 | Dams and Reservoirs | 5 | 3  1 theo  2 lab | 15 |

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| ***15. Infrastructure*** | | |
| Engineering and General Geology. | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| Principles of Engineering Geology.  Physical Geology. | Special requirements (include forexample workshops, periodicals,IT software, websites) | |
|  | Community-based facilities  (include for example, guest  Lectures , internship,field studies) | |
| ***16. Admissions*** | | |
|  | | Pre-requisites |
|  | | Minimum number of students |
| 70 – 80. | | Maximum number of students |
|  | | ***17. Course Instructors*** |

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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resources  ( WRD ) | ***2. University Department/Centre*** |
| Introduction  to Water Resources Engineering / 109 WRIR  Topics covered: Water Resources, Irrigation Water, Flood Control, Water Resources Project in Iraq, Water Consumer Sector, Hydropower, Laws and International regional conventions on the use of shared water resource. The course is taught through 2 hrs peer week. | ***3. Course title/code & Description*** |
| B Sc degree in Water Resources Engineering | ***4. Program(s) to which it Contributes*** |
| Annual System ; There is only one  mode of delivery, which is a “Day  Program”. The students are full time  students and on campus. They attend full day program in face-to-face mode. The academic year is composed of 30-week regular subject | ***5. Modes of Attendance offered*** |
| 1st and 2nd / Academic Year 2017 – 2018 | ***6. Semester/Year*** |
| 60 hrs. / 2 hrs. per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course***  The main goal of this course to learn the student that water is one of the most precious and a finite resources that is essential for agriculture, industry and human existence and the life in Iraq since eternity depends on the waters of its two great rivers: The Tigris and the Euphrates but its geographical location being the lower riparian state, is placing it in an embarrassing situation because it is negatively affected by the multi-purpose Turkish project constructed or planned to be constructed without a prior consultation with Iraq. Therefore this course is designed to alert  Students to the problem of water shortage in Iraq and how to save them and to conserve while providing necessary quantities as well as conserve the environment | |
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| ***10·*** ***Learning Outcomes*** |
| At the end of the class, the student will be able to :   1. Know the sources of water resources. 2. know the water resources in Iraq. 3. Know that Iraq is primarily dependent for its water resources on the Tigris and Euphrates rivers, both these rivers are formed in turkey. 4. study the path of the Euphrates and Tigris with its tributaries. 5. know the project being constructed at present and are planned to be constructed in the future by Turkey on the Tigris and Euphrates rivers will lead to a grave deficiency in the quantity of waters in flowing into Iraq and to their low quality so there a problem of water shortage and the state has developed a policy to keep the water viewed by students. 6. Capable al understand how to transfer irrigation water through irrigation water network at all levels and distribution in the field in different ways such as Subsurface irrigation, Surface irrigation, Sprinkler and Drip irrigation and learn the advantages and disadvantages each methods and learn the criteria that determine the quality of potable water for irrigation 7. Learn how to get rid of excess water from the plant through drainage network at all levels and moving away from the field 8. know types and benefits for structures of irrigation and drainage network 9. know the method of flood control 10. know the types of reservoirs, dams and spillways 11. know the planned and executing projects to controlling Iraqi water resources for irrigation purposes and flood control such as dams and reservoirs, barrages and cross regulators, irrigation and land reclamation projects and main outfall drain 12. know the Water Consumer Sectors such as Agriculture sector, Industry sector, hydropower and water supply and municipal .It was concluded that the agriculture sector the biggest consumer of water. 13. Learn how electricity is generated from hydroelectric stations. 14. know the international laws and conventions and to regulate the use of regional shared water resources. 15. know how to negotiate on the apportionment of the waters of the Tigris and the Euphrates. 16. Understand the main challenge that faces the Arab countries is that more than 70% of the Arab surface water with its sources in non Arab countries. 17. Understand the lack of agreement with the non-Arab countries has many adverse effects mainly in the fact that those the non-Arab countries in the upstream part of the river have constructed some water control structures that affect the interest of the downstream Arab countries. 18. Understand the problem of water shortage and techniques to save, conserve and manage our water resources while providing necessary quantities to satisfy economic and social requirements as well as conserve the environment. 19. Learn how to write and to contribute to class discussion based on the reading |
| ***11.*** ***Teaching and Learning Methods*** |
| 1-Lectures.  2-Tests and Exams.  3-Field Trip.  4-Extracurricular Activities.  5-Seminars.  6-In-and out-Class oral conservations.  7-Reports,Presentation and Posters |
| ***12. Assessment Methods***  1-Examinations ,Tests, and Quizzes 2-Extracurricular Activities  3-student Engagement during lectures |
| ***13. Grading Policy***  1. Homework:  - The search paper will count 6% of the total course grade.  2. Exams:  - There will be six closed books and notes exam during the academic year,  - The mid-term exam will count 24% of the total course grade.  3. Final Exam:  - The final exam will be comprehensive, closed books and notes, and will take  place on, June, 2014 from 9:00 AM -12:00 PM in room XXXXX.  - The final exam will count70% of the total course grade |

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| ***14. Course Structure*** | | | | | |
| Assessment  Method | Teaching  Method | Unit/Module or  Topic Title | LOs  ( Article  10 ) | Hours | Week |
| 1-3 of article(12) | 1-7 of article(11) | Water resources: hydrologic cycle ,Sources | a | 2 theo. | 1 |
| 1-3 of article(12) | 1-7 of article(11) | Field of Water Resource | a | 2 theo. | 2 |
| 1-3 of article(12) | 1-7 of article(11) | Water Resources in Iraq: Sources | b,c,d,p,r | 2 theo. | 3 |
| 1-3 of article(12) | 1-7 of article(11) | Water Resources in Iraq: Sources | b,c,d,p,r | 2 theo. | 4 |
| 1-3 of article(12) | 1-7 of article(11) | Iraqi water policy to conserve the water resources | e,p,q,r | 2 theo. | 5 |
| 1-3 of article(12) | 1-7 of article(11) | Irrigation: sources, soil -water relationship | f | 2 theo. | 6 |
| 1-3 of article(12) | 1-7 of article(11) | Water quality | f | 2 theo. | 7 |
| 1-3 of article(12) | 1-7 of article(11) | Irrigation methods | f | 2 theo. | 8 |
| 1-3 of article(12) | 1-7 of article(11) | Drainage: sources of excess water | g | 2 theo. | 9 |
| 1-3 of article(12) | 1-7 of article(11) | Drainage and Irrigation net work | f,g | 2 theo. | 10 |
| 1-3 of article(12) | 1-7 of article(11) | Drainage and Irrigation net work structure | h | 2 theo. | 11 |
| 1-3 of article(12) | 1-7 of article(11) | Ground water: occurrence, ground water hydraulic | g | 2 theo. | 12 |
| 1-3 of article(12) | 1-7 of article(11) | Flood control: method of flood control | i | 2 theo. | 13 |
| 1-3 of article(12) | 1-7 of article(11) | Types of reservoirs | j | 2 theo. | 14 |
| 1-3 of article(12) | 1-7 of article(11) | Types of dams | j | 2 theo. | 15 |
| 1-3 of article(12) | 1-7 of article(11) | Types of spillways | j | 2 theo. | 16 |
| 1-3 of article(12) | 1-7 of article(11) | Water Resources project in Iraq: Dams | k | 2 theo. | 17 |
| 1-3 of article(12) | 1-7 of article(11) | Reservoirs | k | 2 theo. | 18 |
| 1-3 of article(12) | 1-7 of article(11) | Barrage | k | 2 theo. | 19 |
| 1-3 of article(12) | 1-7 of article(11) | Irrigation and Reclamation Projects | k | 2 theo. | 20 |
| 1-3 of article(12) | 1-7 of article(11) | Outfall Drain | k | 2 theo. | 21 |
| 1-3 of article(12) | 1-7 of article(11) | Water Consumer Sector: Agriculture sector, Industry sector | l | 2 theo. | 22 |
| 1-3 of article(12) | 1-7 of article(11) | Hydropower, water supply and municipal | l | 2 theo. | 23 |
| 1-3 of article(12) | 1-7 of article(11) | Hydropower: introduction | m | 2 theo. | 24 |
| 1-3 of article(12) | 1-7 of article(11) | Method of electrical generation, hydropower station in Iraq | m | 2 theo. | 25 |
| 1-3 of article(12) | 1-7 of article(11) | Laws on the use of Shared Water Resources | n,p,q,r | 2 theo. | 26 |
| 1-3 of article(12) | 1-7 of article(11) | , the apportionment of the Tigris and Euphrates | n,o,p,q,r | 2 theo. | 27 |
| 1-3 of article(12) | 1-7 of article(11) | Each student will write a major research paper on some water resources issue and each student will also present his/her research to the class during the last few weeks of the semester | p,q,r,s | 2 theo. | 28 |
| 1-3 of article(12) | 1-7 of article(11) | Each student will write a major research paper on some water resources issue and each student will also present his/her research to the class during the last few weeks of the semester | p,q,r,s | 2 theo. | 29 |
| 1-3 of article(12) | 1-7 of article(11) | Each student will write a major research paper on some water resources issue and each student will also present his/her research to the class during the last few weeks of the semester | P,q,r,s | 2 theo. | 30 |

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| ***15. Infrastructure*** | | |
| References   1. Encyclopedia of Iraq’s Irrigation services by Ministry of Water Resources 2. .Irrigation & Drainage by Charle Shukri 3. Study of Laws , international and regional conventions to regulate the use of water resources by AOAD -   4- Irrigation &Drainage in Iraq by Najib Karofa  Others  1-Notebook prepared by the instructor of the course  2-Magazin Tender Rafidain by ministry of Water Resources | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| Available websites related to the subject.  Extracurricular activities. | Special requirements (include for example workshops, periodicals, IT software, websites) | |
| * Extra lectures by foreign guest lecturers * Scientific Visits. | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***16. Admissions*** | | |
|  | | Pre-requisites |
| / | | Minimum number of students |
| 57 | | Maximum number of students |
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**COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resources Engineering | ***2. University Department/Centre*** |
| Mathematics II, 210 WRMA | ***3. Course title/code & Description*** |
| B.Sc. in Water Resources Engineering (WRE) | ***4. Program(s) to which it Contributes*** |
| Annual System, where the academic year is composed of 30-week regular subjects.  Each graduating student has to successfully complete 163 credits. Each subject credit is one 50-minute lecture a week or 3 hours of lab a week. There is *no* on-line subject which may be used as supplementary material for the class room instruction | ***5. Modes of Attendance offered*** |
| 1st and 2nd Year 2017 – 2018 | ***6. Semester/Year*** |
| 120 hrs/ 4 hrs per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| Improve the ability of student in the three dimensional mathematics and graph of three dimensional functions and their projection. Additionally, the course titles that descripted below. Study the hyperbolic functions, polar equations and functions, vectors, sequences and series, double and triple integrals, complex numbers, partial derivatives and the application in each listed item. | |

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| ***10·*** ***Learning Outcomes*** |
| At the end of the class, the student will be able to:   1. Find sketches, derivation and integration of hyperbolic and Inverse hyperbolic functions and their applications (Catenary Cables) 2. Achieve the transformation between the Polar and Cartesian Coordinates and graph of polar functions, conic sections in polar coordinates and their sketches and derivative and integration of polar equations. 3. Analyze of vectors in space with the dot and cross product techniques and find the equations of line and plane in space and the product of three or more vectors. Derivatives of vectors and find the tangential and normal components velocity and acceleration in polar form. 4. Find the derivative of functions of more than one variable and use of chain Rule and non-independence. Evaluation of the directional derivatives and the related applications. How to apply the partial derivatives in the engineering problems and the higher order derivatives and the extreme points . Use Largrange multiplier with constraint. 5. Understand the double integrals with definition, theory and how to find the region of integral with applications. Evaluate the double integrals in polar form, surface area and volume. 6. Use the sequences and series in the field of engineering and the tests of them for convergence. Specify the alternative series and their tests. Use of power series and their convergence. 7. Use of complex numbers in different forms and operations. |
| ***11.*** ***Teaching and Learning Methods*** |
| 1. Lectures  2. Tutorials  3. Homework and Assignments  4. Tests and Exams  6. In-Class Questions and Discussions  7. Connection between Theory and Application |
| ***12. Assessment Methods***  1. Examinations, Tests, and Quizzes.  2. Extracurricular Activities.  3. Student Engagement during Lectures.  4. Responses Obtained from Students, Questionnaire about  Curriculum and Faculty Member (Instructor). |
| ***13. Grading Policy***  1. Quizzes:  - There will be a ( 4 – 6 ) closed books and notes quizzes  during the academic year.  - The quizzes will count 10% of the total course grade.  2. Tests, 5-6 Nos. and will count 15 -20% of the total course grade.  3. Extracurricular Activities, this is optional and will count extra  marks (5 % ) for the student, depending on the type of activity.  4. Final Exam:  - The final exam will be comprehensive, closed books and  notes, and will take place on May 2014 from 9:00 AM - 12:00 PM  in rooms ( WR5 + WR6 )  - The final exam will count 70% of the total course grade |

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| ***14. Course Structure*** | | | | | |
| Assessment  Method | Teaching  Method | Unit/Module or  Topic Title | LO’s (Article 10) | Hours | Week |
| 1 – 4 of article (12) | 1-7 of article (11) | Definition of hyperbolic functions | a | 3 theo.  1 tutorial | 1 |
| 1 – 4 of article (12) | 1-7 of article (11) | Inverse hyperbolic | a | 3 theo.  1 tutorial | 2 |
| 1 – 4 of article (12) | 1-7 of article (11) | Applications | a | 3 theo.  1 tutorial | 3 |
| 1 – 4 of article (12) | 1-7 of article (11) | Polar Coordinates and graph of polar functions | b | 3 theo.  1 tutorial | 4 |
| 1 – 4 of article (12) | 1-7 of article (11) | Conic sections in polar coordinates and their sketches | b | 3 theo.  1 tutorial | 5 |
| 1 – 4 of article (12) | 1-7 of article (11) | Derivative and integration of polar equations | b | 3 theo.  1 tutorial | 6 |
| 1 – 4 of article (12) | 1-7 of article (11) | Vectors: components , unit vectors | c | 3 theo.  1 tutorial | 7 |
| 1 – 4 of article (12) | 1-7 of article (11) | Dot and cross product | c | 3 theo.  1 tutorial | 8 |
| 1 – 4 of article (12) | 1-7 of article (11) | Equation of line and plane in space | c | 3 theo.  1 tutorial | 9 |
| 1 – 4 of article (12) | 1-7 of article (11) | Product of three or more vectors | c | 3 theo.  1 tutorial | 10 |
| 1 – 4 of article (12) | 1-7 of article (11) | Derivatives of vectors and tangential and normal components | c | 3 theo.  1 tutorial | 11 |
| 1 – 4 of article (12) | 1-7 of article (11) | Velocity and acceleration in polar form | c | 3 theo.  1 tutorial | 12 |
| 1 – 4 of article (12) | 1-7 of article (11) | Introduction to Partial derivative | d | 3 theo.  1 tutorial | 13 |
| 1 – 4 of article (12) | 1-7 of article (11) | Chain Rule and non-independence | d | 3 theo.  1 tutorial | 14 |
| 1 – 4 of article (12) | 1-7 of article (11) | Directional derivatives and the applications | d | 3 theo.  1 tutorial | 15 |
| 1 – 4 of article (12) | 1-7 of article (11) | Applications of partial derivatives | d | 3 theo.  1 tutorial | 16 |
| 1 – 4 of article (12) | 1-7 of article (11) | Higher order derivatives and the extreme points | d | 3 theo.  1 tutorial | 17 |
| 1 – 4 of article (12) | 1-7 of article (11) | Higher order derivatives and the extreme points | d | 3 theo.  1 tutorial | 18 |
| 1 – 4 of article (12) | 1-7 of article (11) | Largrange multiplier with constraint | d | 3 theo.  1 tutorial | 19 |
| 1 – 4 of article (12) | 1-7 of article (11) | Double integrals , definition and theory | e | 3 theo.  1 tutorial | 20 |
| 1 – 4 of article (12) | 1-7 of article (11) | Applications | e | 3 theo.  1 tutorial | 21 |
| 1 – 4 of article (12) | 1-7 of article (11) | Double integrals in polar form | e | 3 theo.  1 tutorial | 22 |
| 1 – 4 of article (12) | 1-7 of article (11) | Surface area and volume | e | 3 theo.  1 tutorial | 23 |
| 1 – 4 of article (12) | 1-7 of article (11) | Sequences and series | f | 3 theo.  1 tutorial | 24 |
| 1 – 4 of article (12) | 1-7 of article (11) | Tests for convergence | f | 3 theo.  1 tutorial | 25 |
| 1 – 4 of article (12) | 1-7 of article (11) | Tests for convergence | f | 3 theo.  1 tutorial | 26 |
| 1 – 4 of article (12) | 1-7 of article (11) | Alternative series and their tests | f | 3 theo.  1 tutorial | 27 |
| 1 – 4 of article (12) | 1-7 of article (11) | Power series and their convergence | F | 3 theo.  1 tutorial | 28 |
| 1 – 4 of article (12) | 1-7 of article (11) | Complex numbers and operations | g | 3 theo.  1 tutorial | 29 |
| 1 – 4 of article (12) | 1-7 of article (11) | Complex numbers and operations | g | 3 theo.  1 tutorial | 30 |

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| ***15. Infrastructure*** | | |
| Thomas' Calculus- 11th edition  Any mathematics text book contains one or more of the listed description in the course description item. | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| Available websites related to the subject. | Special requirements (include for example workshops, periodicals, IT software, websites) | |
|  | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***16. Admissions*** | | |
| GE 101 | | Pre-requisites |
| - | | Minimum number of students |
| 75 | | Maximum number of students |
|  | | ***17. Course Instructors*** |

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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resources | ***2. University Department/Centre*** |
| **Computer Programming, 211 WRM** | ***3. Course title/code& Description*** |
| B Sc in Water Resources Engineering (WRE) | ***4. Program(s) to which itContributes*** |
|  | ***5. Modes of Attendance offered*** |
| 1st and 2nd Semesters, academic 2017-2018 | ***6. Semester/Year*** |
| 60 hrs, 2 theoretical and 2 tutorial | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| The course aim to introduce the basics of Microsoft Windows, windows properties, file menu, tool menu, Microsoft word, Excel language, Mat Lab | |

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| |  | | --- | | ***10 · Learning Outcomes***  The student will be able to deal with:  ­   1. Excel Language 2. Mat Lab | | ***11.Teaching and Learning Methods*** | | 1. Lectures 2. Tutorials 3. Reports 4. Technical practice | | ***12. Assessment Methods***  1. Examinations  2. Reports | | ***13. Grading Policy***   1. Four monthly examinations that account 30% 2. Reports that account 10% 3. Final examination that accounts 60% | |

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| Assessment Method | Teaching Method | Topic | LO’s | Week |
| 1, 2 | 1, 2, 3, 4 | Introduction to the Mat Lab | 1, 2 | 1 |
| 1, 2 | 1, 2, 3, 4 | M-files | 2 | 2 |
| 1, 2 | 1, 2, 3, 4 | Command windows | 2 | 3 |
| 1, 2 | 1, 2, 3, 4 | Expressions (Expressions): constants (constant), variables (variables), transactions (operators) | 2 | 4 |
| 1, 2 | 1, 2, 3, 4 | Orders of input and output (Input and Output commands) | 2 | 5 |
| 1, 2 | 1, 2, 3, 4 | Matrices and polynomial functions (Arrays and polynomials) | 2 | 6 |
| 1, 2 | 1, 2, 3, 4 | How to enter matrices (entering matrices) | 2 | 7 |
| 1, 2 | 1, 2, 3, 4 | Generating arrays (generating matrices) | 2 | 8 |
| 1, 2 | 1, 2, 3, 4 | Diagonal | 2 | 9 |
| 1, 2 | 1, 2, 3, 4 | Find determinants | 2 | 10 |
| 1, 2 | 1, 2, 3, 4 | Transpose | 2 | 11 |
| 1, 2 | 1, 2, 3, 4 | Inverse | 2 | 12 |
| 1, 2 | 1, 2, 3, 4 | Sum | 2 | 13 |
| 1, 2 | 1, 2, 3, 4 | Output matrices (product) | 2 | 14 |
| 1, 2 | 1, 2, 3, 4 | Output matrices (product) | 2 | 15 |
| 1, 2 | 1, 2, 3, 4 | Output matrices (product) | 2 | 16 |
| 1, 2 | 1, 2, 3, 4 | Output matrices (product) | 2 | 17 |
| 1, 2 | 1, 2, 3, 4 | Iterative loops (if, switch and case, for, while) | 2 | 18 |
| 1, 2 | 1, 2, 3, 4 | Function (function) | 2 | 19 |
| 1, 2 | 1, 2, 3, 4 | Graphics | 2 | 20 |
| 1, 2 | 1, 2, 3, 4 | Graphics | 2 | 21 |
| 1, 2 | 1, 2, 3, 4 | Graphics | 2 | 22 |
| 1, 2 | 1, 2, 3, 4 | Graphics | 2 | 23 |
| 1, 2 | 1, 2, 3, 4 | Drawing commands (plotting) | 2 | 24 |
| 1, 2 | 1, 2, 3, 4 | Drawing commands (plotting) | 2 | 25 |
| 1, 2 | 1, 2, 3, 4 | Drawing commands (plotting) | 2 | 26 |
| 1, 2 | 1, 2, 3, 4 | Drawing commands (plotting) | 2 | 27 |
| 1, 2 | 1, 2, 3, 4 | Drawing functions (plotting function) and ( drawing tools figure tools) and (mesh and surface) | 2 | 28 |
| 1, 2 | 1, 2, 3, 4 | Drawing functions (plotting function) and ( drawing tools figure tools) and (mesh and surface) | 2 | 29 |
| 1, 2 | 1, 2, 3, 4 | Drawing functions (plotting function) and ( drawing tools figure tools) and (mesh and surface) | 2 | 30 |

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| ***15. Infrastructure*** | | |
| Programming in matlab | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| Programming in matlab | Special requirements (include forexample workshops, periodicals,IT software, websites) | |
|  | Community-based facilities  (include for example, guest  Lectures , internship,field studies) | |
| ***16. Admissions*** | | |
|  | | Pre-requisites |
| 10 | | Minimum number of students |
| 38 | | Maximum number of students |
|  | | ***17. Course Instructors*** |

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**TEMPLATE FOR COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

**COURSE SPECIFICATION**

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** | |
| Department of Water Resources | ***2. University Department/Centre*** | |
| **Strength of Materials / 212WESM**  This course introduces the fundamental principals of mechanics of materials covering the following topics:  -Simple stresses in loaded member (average normal, bearing and shear stress. Stress in thin walled pressure vessels is also considered  - Simple strain, Hooke's Low, Poisson's ratio, biaxial deformations.  -Torsion in solid and hollow shafts.  -Shear and bending moment diagrams in beams.  -Stresses in beams, derivation of formula for bending stress and shear stresses  -Beam deflections: double integration method, theorem of area moment method, Moment diagram by parts, superposition method.  -Combined stresses, combined axial and flexural loads, variation of stress at a point. Mohr's circle.  -The course is designed to provide a background to higher level courses ( structural analysis, reinforced concrete design).  -The course is taught through 3 hrs per week, 2 hrs theories, 1 hrs tutorial. | ***3. Course title/code & Description*** | |
| B Sc degree in Water Resource Engineering ( WRE ) | ***4. Programme(s) to which it Contributes*** | |
| Annual System ; There is only one  mode of delivery, which is a “Day  Program”. The students are full time  students, and on campus. They attend  full day program in face-to-face  mode. The academic year is  composed of 30-week regular  subjects. | ***5. Modes of Attendance offered*** | |
| 1st and 2nd /2017 – 2018 | ***6. Semester/Year*** | |
| 90 hrs / 3 hrs per week | ***7. Number of hours tuition (total)*** | |
| 2017 | ***of Date of production/revision 8- this specification*** | |
| ***. 9.Aims of the Course*** | | |
| 1. Introduce the fundamental principal of stress , strain and the relationship between  them.  2. Determine the internal forces in the elastic bodies using equilibrium equations .  3. Draw the shear force diagram and bending moment diagram for statically  determinate beams under various types of loadings by both section method and  area method.  4. Explain and derive equations for calculating bending stress and horizontal  shearing stress across the beam for different cross sections.  5.Derive equation for determination the stress and twist angle in circular solid and  hollow shafts due to torsion.  6. Use theory of flexural bending to derive differential equation for calculating the  deflection of beams.  7. Apply the first theorem and second theorem of the area-moment method to  determine the slope and deflection of beams.  8. Draw the bending moment diagram by part to simplify the calculation of  deflection by moment-area method.  9. Use superposition theorem to determine the deflection.  10.Determine state of stresses at a point using Mhore's circle.  11. Provide a strong background to higher level courses such as structural analysis  and design of reinforced concrete. | | |
| ***10.Learning Outcomes*** | | |
| At the end of the class, the student will be able to:  a. Determine the internal forces (normal forces, shear forces and bending moment)  in beams(simply-supported, cantilever ,over-hanged) resulting from applied  external loads.  b. Calculate; all types of the internal stresses (shearing stress, flexural stress and  stress due to torsion) through the cross section of the structural member.  c. Find the elastic deformations of structural member subjected to axial stress using  Hook's low.  d. Draw the shear force diagram and bending moment diagram for statically  determinate beams applying both section method and area method.  e. Use double integration method to calculate the deflection of beams under  different types of loadings by applying the boundary conditions. The slope of  elastic curve is also can be found.  f. Calculate the deflection and slop of the elastic curve of the flexural beams using  moment area method.  g. Determine the deflection and slope of the elastic curve of the flexural beams  using superposition method.  h. Draw the bending moment diagram of beams by part to simplify the calculating  the deflection by moment area method.  i. Analyze the stresses at a point (shear an normal stress) through different planes.  j. Draw Mohr's circle to determine the normal and shear stress at any plane. The  principal stresses are also can be found. | | |
| ***11.Teaching and Learning Methods*** | | |
| 13. Lectures  14. Tutorials  15. Homework and Assignments  17. Tests and Exams  18. In-Class Questions and Discussions  19. Connection between Theory and Application  21. Extracurricular Activities  22. Seminars  23. In- and Out-Class oral conservations | | |
| ***Assessment 12.Methods***  1. Examinations, Tests, and Quizzes  2. Extracurricular Activities  3. Student Engagement during Lectures  4. Responses Obtained from Students, Questionnaire about  Curriculum and Faculty Member (Instructor) | | |
| ***13 Grading Policy***  1. Quizzes:  - There will be a (20 – 25) closed books and notes quizzes  during the academic year.  - The quizzes will count 20% of the total course grade.  2. Tests, 2-3 Nos. and will count 10% of the total course grade.  3. Extracurricular Activities, this is optional and will count extra  marks (1 – 5 %) for the student, depending on the type of activity.  4. Final Exam:  - The final exam will be comprehensive, closed books and  notes, and will take place on January 2014 from 9:00 AM - 12:00 PM  in rooms (M12 + M13)  - The final exam will count 70% of the total course grade | | |

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| ***. 14.Course Structure*** | | | | | |
| Assessment  Method | Teaching  Method | Unit/Module or  Topic Title | LOs  ( Article  10 ) | Hours | Weeks |
| 1 – 4 of article (12) | 1-12 of  article (11) | Definition of simple stresses | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 1 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Normal stress and axial force diagram | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 2 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Equilibrium equation and free body diagram | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 3 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Determination of internal forces | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 4 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Simple normal stress | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 5 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Simple Shear stress | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 6 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Simple bearing stress | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 7 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Stress in thin-walled cylinder | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 8 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Stress-strain diagram, Hook' law | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 9 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Axial deformation, Poisson' ratio | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 10 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Biaxial deformation | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 11 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Shear-force diagram  by section method | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 12 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Bending moment diagram  by section | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 13 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Shear-force diagram  by area method | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 14 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Bending moment diagram  by area method | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 15 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Derivation of flexural stress formula | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 16 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Flexural stress in un-symmetrical section | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 17 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Derivation of horizontal shearing stress formula | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 18 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Derivation of torsions formulas | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 19 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Torsion stress and twist angle | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 20 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Derivation of differential equation for elastic curve | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 21 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Deflection by double integration method | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 22 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Theorem of area moment method | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 23 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Moment diagram by part | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 24 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Deflection by moment area of cantilever and simple beams | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 25 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Deflection by method of superposition | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 26 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Combined stresses | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 27 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Variation of stress at a point, Analytical derivation | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 28 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Determination of stresses at a point by Mhor's circle | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 29 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Relation between modulus of rigidity and modulus of elasticity | a,l,m,n,  o,p,q,r | 3  2 the.  1 tut. | 30 |

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| ***15.Infrastructure*** | | |
| ***Textbook***  “Strength of Materials”; by Ferdinand L.  Singer/ Andrew Pytel, Third edition 1980.  ***References***  1. “Mechanics of materials"; by  Russel C. Hibbeler , Seven Edition, 2008  2-"Introduction to mechanics of solid"; By  Popov,E. P., 1968.  3-"Elements of strength of materials"; By  Timoshinko and Young, 4th edition, 1962  ***Others***   1. Notebook prepared by the instructor of the   course   1. Collection of sheets of solved and   unsolved problems and Exams  questions | | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER |
| Available websites related to the subject.  Extracurricular activities. | | Special requirements (include for  example workshops,  periodicals, IT software, websites) |
| Field and scientific visits.  Extra lectures by foreign guest lecturers | | Community-based facilities  (include for example, guest  Lectures , internship , field studies) |
| ***. 16Admissions*** | | |
|  | Pre-requisites | |
| / | Minimum number of students | |
| 75 | Maximum number of students | |

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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| University of Baghdad  College of Engineering | ***1. Teaching Institution*** |
| Department of Water Resources | ***2. University Department/Centre*** |
| **Components of Hydraulic Structures/ 213 WRCS**  This course introduces the description of Component of Hydraulic Structure consist Engineering projects, Foundations, Retaining walls, Irrigation Networks, Irrigation Structure, Control and Regulator Structure, Crossing Structure, Protection structure and Stilling Basin, Dams and spillways  The course includes 3 hrs per week, 1  Theoretical and 2 laboratory | ***3. Course title/code & Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Programme(s) to which it Contributes*** |
| Semester System ; There is only one  mode of delivery, which is a “Day  Program”. The students are full time  Students and, on campus. They attend  full day program in face-to-face mode. The academic semester is composed of 15-week regular subjects. | ***5. Modes of Attendance offered*** |
| 1st Semester, Academic year 2017 – 2018 | ***6. Semester/Year*** |
| 45 hrs / 3 hrs per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| 1. Definitions of Engineering projects and component. 2. Definitions Foundations type and draw it by using AutoCAD program 3. Definitions Retaining walls type and draw it by using AutoCAD program 4. Explain the Irrigation and drainage component 5. Definitions Control and Regulator Structure and draw it by using AutoCAD program 6. Definitions Crossing Structure and draw it by using AutoCAD program 7. Definitions Protection structure and draw it by using AutoCAD program 8. Definitions Dams and spillways and draw it sections by using AutoCAD program | |

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| ***10·*** ***Learning Outcomes*** |
| At the end of the class, the student will be able to:   1. Understand general introduction about engineering project specially irrigation project 2. Understand foundation and retaining wall types, description and sketching 3. Understand irrigation network type, longitudinal and cross section of canals 4. Understand drainage network type, longitudinal and cross section of drain 5. Understand control and regulatory structure component, description and sketching 6. Understand crossing structure component, description and sketching 7. Understand protection structure component, description and sketching 8. Understand dams and spillways component, description and sketching |
| ***11.*** ***Teaching and Learning Methods*** |
| 1. Lectures  2. lab work  3. Homework and Assignments  4. Tests and Exams  5. In-Class Questions and Discussions  6. Connection between Theory and Application  7. Extracurricular Activities |
| ***12. Assessment Methods***  1. Examinations, Tests, and Quizzes  2. Lab work  3. Project  4. Responses Obtained from Students, Questionnaire about  Curriculum and Faculty Member (Instructor). |
| ***13. Grading Policy***  1. Lab work:  - There will be a minimum of eleven sets of lab work during the academic course.  - The lab work will count 10% of the total course grade.  - The lab work exam during the course will count 5% of the total course grade.  2. Project:  - There will be a seminar during the course end about hydraulic structures in Iraq  each student chose one hydraulic structure.  - The Project will count 5% of the total course grade.  3. Exams:  - There will be three exams during the academic course,  - The exams will count 20% of the total course grade.  4. Final Exam:  - The final exam will be comprehensive, closed books and will take place on  Monday, January, 2014 from 9:00 AM - 12:00 PM. in class rooms (w1+w2)  - The final exam will count60% of the total course grade |

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| ***14. Course Structure*** | | | | | |
| **Assessment**  **Method** | **Teaching**  **Method** | **Unit/Module or**  **Topic Title** | **LO’s**  **( Article**  **10 )** | **Hours** | **Week** |
| 1 – 4 of article (12) | 1-7 of article (11) | Introduction and Engineering projects | a | 3  1 (theo.) +2 (lab.) | 1 |
| 1 – 4 of article (12) | 1-7 of article (11) | Foundations | a,b | 3  1 (theo.) +2 (lab.) | 2 |
| 1 – 4 of article (12) | 1-7 of article (11) | Retaining walls | a,b,c | 3  1 (theo.) +2 (lab.) | 3 |
| 1 – 4 of article (12) | 1-7 of article (11) | Irrigation Networks | a,b,c,d | 3  1 (theo.) +2 (lab.) | 4 |
| 1 – 4 of article (12) | 1-7 of article (11) | Irrigation Networks | a,b,c,d | 3  1 (theo.) +2 (lab.) | 5 |
| 1 – 4 of article (12) | 1-7 of article (11) | Irrigation Structure | a,b,c,d | 3  1 (theo.) +2 (lab.) | 6 |
| 1 – 4 of article (12) | 1-7 of article (11) | Control and Regulatory Structure | a,b,c,d | 3  1 (theo.) +2 (lab.) | 7 |
| 1 – 4 of article (12) | 1-7 of article (11) | Control and Regulatory Structure | a,b,c,d | 3  1 (theo.) +2 (lab.) | 8 |
| 1 – 4 of article (12) | 1-7 of article (11) | Crossing Structure | a,b,c,d,e | 3  1 (theo.) +2 (lab.) | 9 |
| 1 – 4 of article (12) | 1-7 of article (11) | Crossing Structure | a,b,c,d,e | 3  1 (theo.) +2 (lab.) | 10 |
| 1 – 4 of article (12) | 1-7 of article (11) | Protection Structure | a,b,c,d,e | 3  1 (theo.) +2 (lab.) | 11 |
| 1 – 4 of article (12) | 1-7 of article (11) | Protection Structure | a,b,c,d,e,f | 3  1 (theo.) +2 (lab.) | 12 |
| 1 – 4 of article (12) | 1-7 of article (11) | Dams and Spillways | a,b,c,d,e,f | 3  1 (theo.) +2 (lab.) | 13 |
| 1 – 4 of article (12) | 1-7 of article (11) | Dams and Spillways | a,b,c,d,e,f,g | 3  1 (theo.) +2 (lab.) | 14 |
| 1 – 4 of article (12) | 1-7 of article (11) | Irrigation Structure Seminar | a,b,c,d,e,f,g | 3  1 (theo.) +2 (lab.) | 15 |

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| ***15. Infrastructure*** | | |
| **Textbook**  “Irrigation Drawing”, Arabic book by Abd Al-Riza, Abd Al-Rasool, Baghdad, 1992  **References**  "Hydraulic Canals",by J. Montanes  "Principles of irrigation Engineering", by Newell & Murphy  ***Others***  1. Notebook prepared by the instructor of the course  2. Collection of sheets of solved and  unsolved problems and Exams questions | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| Available websites related to the subject.  Extracurricular activities. | Special requirements (include for example workshops, periodicals, IT software, websites) | |
| * Extra lectures by foreign guest lecturers. | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***16. Admissions*** | | |
| GE 101and GE 201 | | Pre-requisites |
| 40 | | Minimum number of students |
| 60 | | Maximum number of students |
|  | | ***17. Course Instructors*** |

**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Water Resources Department  ( WRD ) | ***2. University Department/Centre*** |
| **Surveying, 214 WRSU**  This course introduces the introduction , definitions , classifications and principles on Plane Surveying ; Distance Measurements ; Taping Survey ; Leveling ; Topographic Survey ; Areas and Volumes ; Directions and Angles ;Theodolite ; Traversing . The course is taught through 5 hrs per week , 2 theoretical, 1 tutorial , and 2 practical | ***3. Course title/code & Description*** |
| B Sc degree in Water Resources Engineering (WRE ) | ***4. Program(s) to which it Contributes*** |
| Annual System ; There is only one  mode of delivery, which is a “Day  Program”. The students are full time  students, and on campus. They attend full day program in face-to-face mode. The academic year is composed of 30-week regular subject | ***5. Modes of Attendance offered*** |
| 1st and 2nd / Academic Year 2017 – 2018 | ***6. Semester/Year*** |
| 150 hrs / 5 hrs per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| The fundamental of surveying class provides basic knowledge about the principles of surveying for measurement, location, design and construction of engineering projects .Student s develop skill using surveying instruments including measuring tapes, automatic levels, digital theodolite, planimeter and total station.  Cooperative efforts to acquire surveying data during Laboratory periods and apply fundamental concepts to adjust data and prepare maps and planning projects | |

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| ***10·*** ***Learning Outcomes*** |
| At the end of the class, the student will be able to:   1. Understand the basic principle of plane surveying and its application. 2. Gain the ability to measure Horizontal Distance using Tape. 3. Calculate the correction for incorrect tape length. 4. Discuss the difference between random error, systematic error and mistakes. 5. Measure distance with obstacle using Tape. 6. Set out a point and building by Tape. 7. Draw the longitudinal & grid scales. 8. Booking and reducing the level. 9. Demonstrate ability to set-up automatic level and read level rod and collect field data using differential leveling (laboratory). 10. Calculate the combined effect of curvature and refraction. 11. Demonstrate understanding of profile and cross sectioning to attain earthwork data. 12. Indentify the characteristic and uses of contour lines and method of contouring. 13. Draw contour map and to draw a profile of a center line of a proposed route from contour. Map 14. calculate area of uniform figures and area of cross section using coordinate system. 15. Measure area of land from map by planimeter. 16. Determine cut and fill volumes in earthwork. 17. Calculate the capacity of reservoir from contours map. 18. Designation of bearings and deflection. 19. Know the types of angles. 20. Demonstrate the ability to set-up theodolite and measure the horizontal and vertical angles. 21. Adjust the traverse and calculate coordinates. 22. Gain the ability to apply knowledge of mathematics, science, and engineering to understand the measurement techniques and equipment used in land surveying. 23. Improve ability to function as a member of a survey party in completing the assigned field work. |
| ***11.*** ***Teaching and Learning Methods*** |
| 1-Lectures.  2-Tutorials.  3-HomeWork and Assignments.  4-Field Works.  5-Tests and Exams.  6-In-class Questions and Discussions.  7-Connnection Theory and Application.  8-Reports. |
| ***12. Assessment Methods*** |
| 1-Examinations, Tests, and Quizzes 2-Extracurricular Activities .  3-student Engagement during lectures.  ***13. Grading Policy***  1. Homework:  - There will be a minimum of seven sets of homework during the academic yea:  2. Exams:  - There will be seven closed books and notes exam during the academic year,  - The mid-term exam will count 35% of the total course grade.  3-There will be Seventeen Report on fieldwork.  - The reports will count 15% of the total course grade  4. Final Exam:  - The final exam will be comprehensive, closed books and notes, and will take  place on Sunday, June, 2014 from9:00 AM -12:00 PM in room XXXXX.  - The final exam will count50% of the total course grad |

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| ***14. Course Structure*** | | | | | |
| Assessment  Method | Teaching  Method | Unit/Module or  Topic Title | LOs  ( Article  10 ) | Hours | Week |
| 1-3 of article (12) | 1-8 of article ( 11 ) | Plane Surveying: Introduction, Classification | a,v,w | 5  2 the.  1 tut.  2 lab. | 1 |
| 1-3 of article (12) | 1-8 of article ( 11 ) | Definition, Principles | a,v,w, | 5  2 the.  1 tut.  2 lab | 2 |
| 1-3 of article (12) | 1-8 of article ( 11 ) | Surveying measurement, Units | a,v,w | 5  2 the.  1 tut.  2 lab | 3 |
| 1-3 of article (12) | 1-8 of article ( 11 ) | Errors and Mistakes | d,v,w | 5  2 the.  1 tut.  2 lab | 4 |
| 1-3 of article (12) | 1-8 of article ( 11 ) | Horizontal Distance: Method of measuring, Instrument | b,v,w | 5  2 the.  1 tut.  2 lab | 5 |
| 1-3 of article (12) | 1-8 of article ( 11 ) | Taping | b,v,w | 5  2 the.  1 tut.  2 lab | 6 |
| 1-3 of article (12) | 1-8 of article ( 11 ) | Errors in taping | c,v,w | 5  2 the.  1 tut.  2 lab | 7 |
| 1-3 of article (12) | 1-8 of article ( 11 ) | Taping survey: Field work | f,v,w | 5  2 the.  1 tut.  2 lab | 8 |
| 1-3 of article (12) | 1-8 of article ( 11 ) | Obstacles in measuring, closing error | e,v,w | 5  2 the.  1 tut.  2 lab | 9 |
| 1-3 o)f article (12 | 1-8 of article ( 11 ) | Scales | g,v,w | 5  2 the.  1 tut.  2 lab | 10 |
| 1-3 of article (12) | 1-8 of article ( 11 ) | Leveling: Definition | h,i,v,w | 5  2 the.  1 tut.  2 lab | 11 |
| 1-3 of article (12) | 1-8 of article ( 11 ) | Booking and reducing the levels | h,i,v,w | 5  2 the.  1 tut.  2 lab | 12 |
| 1-3 of article (12) | 1-8 of article ( 11 ) | Booking and reducing the levels | h,i,v,w | 5  2 the.  1 tut.  2 lab | 13 |
| 1-3 of article (12) | 1-8 of article ( 11 ) | Correction of curvature, refraction and and closing Error | j ,v,w | 5  2 the.  1 tut.  2 lab | 14 |
| 1-3 of article (12) | 1-8 of article ( 11 ) | Profile and Cross Section | k,v,w | 5  2 the.  1 tut.  2 lab | 15 |
| 1-3 of article (12) | 1-8 of article (11) | Topographic Surveying: Characteristic | l,v,w | 5  2 the.  1 tut.  2 lab | 16 |
| 1-3 of article (12) | 1-8 of article (11) | Uses of contour line | m,v,w | 5  2 the.  1 tut.  2 lab | 17 |
| 1-3 of article (12) | 1-8 of article (11) | Areas: Area of Uniform figures, Area of Lands | n,v,w | 5  2 the.  1 tut.  2 lab | 18 |
| 1-3 of article (12) | 1-8 of article (11) | Area of cross section | n,v,w | 5  2 the.  1 tut.  2 lab | 19 |
| 1-3 of article (12) | 1-8 of article (11) | Area by coordinates, Area by D.M.D and Area from maps | n,o,v,w | 5  2 the.  1 tut.  2 lab | 20 |
| 1-3 of article (12) | 1-8 of article (11) | Volumes: from cross section | p,v,w | 5  2 the.  1 tut.  2 lab | 21 |
| 1-3 of article (12) | 1-8 of article (11) | Volumes from cross section | p,v,w | 5  2 the.  1 tut.  2 lab | 22 |
| 1-3 of article (12) | 1-8 of article (11) | Volumes from contours maps, volumes from spot level | p,q,v,w | 5  2 the.  1 tut.  2 lab | 23 |
| 1-3 of article (12) | 1-8 of article (11) | Directions and angles: Meridian, Deflection | r,v,w | 5  2 the.  1 tut.  2 lab | 24 |
| 1-3 of article (12) | 1-8 of article (11) | Types of angles | s,v,w | 5  2 the.  1 tut.  2 lab | 25 |
| 1-3 of article (12) | 1-8 of article (11) | Theodolite, Measurement of horizontal and vertical angles | t,v,w | 5  2 the.  1 tut.  2 lab | 26 |
| 1-3 of article (12) | 1-8 of article (11) | computation of bearing from angles | s,v,w | 5  2 the.  1 tut.  2 lab | 27 |
| 1-3 of article (12) | 1-8 of article (11) | Travers : Types, Traversing adjustment | u,v,w | 5  2 the.  1 tut.  2 lab | 28 |
| 1-3 of article (12) | 1-8 of article (11) | Traversing adjustment | u,v,w | 5  2 the.  1 tut.  2 lab | 29 |
| 1-3 of article (12) | 1-8 of article (11) | Computation of coordinate | u,v,w | 5  2 the.  1 tut.  2 lab | 30 |

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| ***15. Infrastructure*** | | |
| Textbook  Engineering Surveying by Dr. Nagi Tawifek  References   1. Engineering Surveying by Yassin Taha Obaid 2. Engineering &Cadastral Surveying by Zaid Abdul Jabbar 3. A Text Book of Surveying by Jawahar Sharma 4. Engineering surveying by W.Schofield and M.Breach 5. Surveying by A.M.Chandara   Others  1-Notebook prepared by the instructor  of the course  2. Collection of sheets of solved and unsolved  problems and Exams questions | | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER |
|  Laboratory experiments in the field  Available websites related to the subject.  Extracurricular activities. | | Special requirements (include for example workshops, periodicals, IT software, websites) |
| Extra lectures by foreign guest lecturers. | | Community-based facilities  (include for example, guest  Lectures , internship , field studies) |
| ***16. Admissions*** | | |
| GE 201 and GE 101 Courses | Pre-requisites | |
| / | Minimum number of students | |
| 67 | Maximum number of students | |
|  | ***17. Course Instructors*** | |

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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department Of Water Resource Engineering | ***2. University Department/Centre*** |
| **Soil Physics/ 215 WRSP**  Soil physics and physical characteristics, the solid state, particle size distribution characterization, textural fraction, specific surface area of soil particles, soil structure and aggregation, water content and potential, soil water, energy state of water in soil, soil moisture characteristic curve, water flow in saturated soil, water flow in unsaturated soil, infiltration, redistribution of water in soil profile. | ***3. Course title/code & Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Program(s) to which it Contributes*** |
| Semester System ; There is only one  mode of delivery, which is a “Day  Program”. The students are full time  students, and on campus. They attend  full day program in face-to-face  mode. The academic semester is  composed of 30-week regular  subjects. | ***5. Modes of Attendance offered*** |
| 1st Semester, Academic year 2017-2018 | ***6. Semester/Year*** |
| 75 hrs / 5 hrs per week, 2 hrs theoretical, 1 hr tutorial, and 2 hrs laboratory | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9- Aims of the Course***  1- Introduce definition of soil physics and physical proprieties of soil.  2- Specific surface area of soil particles.  Definition of soil structure and aggregation. 3- | |
| 1. Introduce Soil water, energy state of water in soil. 2. Soil moisture characteristic curve. 3. Water flow in saturated soil. 4. Water flow in unsaturated soil. 5. Introduce definition of soil Infiltration. 6. Redistribution of water in soil profile | |

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| ***10·*** ***Learning Outcomes***  At the end of the class , the student will be able to define:   1. Soil, soil physics and physical characteristics of soil. 2. Soil texture, textural fractions, particle size distribution. 3. Descriptive for soil profile horizons. 4. Particle density, bulk density, porosity, void ratio, water content and degree of saturation. 5. Specific surface area of soil particles. 6. Soil structure, aggregate size distribution, and aggregate stability. 7. Water content and potential. 8. Measurement of soil wetness. 9. Total soil water potential, gravity, pressure, and osmotic potential. 10. Soil moisture characteristic curve, hysteresis of soil. 11. Water flow in saturated soil, Darcy low. 12. Flow in a horizontal column. 13. Flow in a vertical column. 14. Flow in a composite column. 15. Hydraulic conductivity of saturated soil. 16. Equation of saturated flow. 17. Water flow in unsaturated soil. 18. Infiltration, equation and measurement. |
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| ***11.*** ***Teaching and Learning Methods*** |
| 1. Lecture  2. Tutorials  3. Homework and Assignments  4. Lab. Experiments  5. Tests and Exams  6. In-Class Questions and Discussions  7. Connection between Theory and Application  8. In- and Out-Class oral conservations  9. Reports |
| ***12. Assessment Methods***  1. Examinations, Tests, and Quizzes  2. Extracurricular Activities.  3. Student Engagement during Lectures.  4. Responses Obtained from Students, Questionnaire about  Curriculum and Faculty Member ( Instructor) |
| ***13. Grading Policy***  1. Four monthly examinations that account 35%  2. Laboratory reports account 7%  3. Laboratory examination account 8%  4. Final examination accounts 50% |

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| ***14. Course Structure*** | | | | | |
| Assessment  Method | Teaching  Method | Unit/Module or  Topic Title | LO’s  ( Article  10 ) | Hour | Week |
| 1-4 of article (12) | 1-9 of article(11) | Soil physical and physical characteristics | a | 5  2theo  1 tut  2 lab | 1 |
| 1-4 of article (12) | 1-9 of article(11) | 1-9 of article(11) | a ,b ,c ,d | 5  2theo  1 tut  2 lab | 2 |
| 1-4 of article (12) | 1-9 of article(11) | 1-9 of article(11) | a, b, c, d | 5  2theo  1 tut  2 lab | 3 |
| 1-4 of article (12) | 1-9 of article(11) | Specific surface area of soil particles | e | 5  2theo  1 tut  2 lab | 4 |
| 1-4 of article (12) | 1-9 of article(11) | Soil structure and aggregation | f | 5  2theo  1 tut  2 lab | 5 |
| 1-4 of article (12) | 1-9 of article(11) | Water content and potential | g | 5  2theo  1 tut  2 lab | 6 |
| 1-4 of article (12) | 1-9 of article(11) | Soil water, energy state of water in soil | h ,i | 5  2theo  1 tut  2 lab | 7 |
| 1-4 of article (12) | 1-9 of article(11) | Soil water, energy state of water in soil | h, i | 5  2theo  1 tut  2 lab | 8 |
| 1-4 of article (12) | 1-9 of article(11) | Soil moisture characteristic curve | j | 5  2theo  1 tut  2 lab | 9 |
| 1-4 of article (12) | 1-9 of article(11) | Water flow in saturated soil | k, | 5  2theo  1 tut  2 lab | 10 |
| 1-4 of article (12) | 1-9 of article(11) | Water flow in saturated soil | k, l, m,n,o,p | 5  2theo  1 tut  2 lab | 11 |
| 1-4 of article (12) | 1-9 of article(11) | Water flow in unsaturated soil | q | 5  2theo  1 tut  2 lab | 12 |
| 1-4 of article (12) | 1-9 of article(11) | Water flow in unsaturated soil | q | 5  2theo  1 tut  2 lab | 13 |
| 1-4 of article (12) | 1-9 of article(11) | Infiltration | r | 5  2theo  1 tut  2 lab | 14 |
| 1-4 of article (12) | 1-9 of article(11) | Redistribution of water in soil profile | r | 5  2theo  1 tut  2 lab | 15 |

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| ***15. Infrastructure*** | | |
| Introduction to Environmental Soil Physics, Danial Hillel, 2004 | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| Soil Physic , Jury & Horton ,2004 | Special requirements (include for example workshops, periodicals, IT software, websites) | |
|  | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***16. Admissions*** | | |
|  | | Pre-requisites |
| 0 | | Minimum number of students |
| 70 | | Maximum number of students |
|  | | ***17. Course Instructors*** |

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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department Of Water Resource Engineering | ***2. University Department/Centre*** |
| **Land Reclamation, 216 WRLR**  Reclamation concept, salt affected soils, characteristics, distribution and classification, properties of some important salt, program performance for reclamation of saline soils, field and laboratory surveying and investigation, leaching requirements, leaching curves, equations, mathematical form and modeling, leaching efficiency coefficient, leaching methods and time of leaching, salt balance in reclaimed soils, salt storage variations, leaching fraction calculations, irrigation water quality, reclamation of gypsiferous, desert, and calcareous soils. | ***3. Course title/code & Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Program(s) to which it Contributes*** |
| Semester System ; There is only one  mode of delivery, which is a “Day  Program”. The students are full time  students, and on campus. They attend  full day program in face-to-face  mode. The academic semester is  composed of 15-week regular  subjects. | ***5. Modes of Attendance offered*** |
| 2nd Semester Academic Year 2017-2018 | ***6. Semester/Year*** |
| 75 hrs. / 5 hrs. per week, 2theoretical, 1 tutorial, and 2 laboratory | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| 1-Introduce definition of land reclamation, saline soils, sodic soils, saline-sodic soils.  2- Classification salt affected soils.  3-Properties of some important salt.  4- Program performance for reclamation of saline soils  5- Determination the leaching efficiency coefficient, leaching requirement.  6- Leaching methods, time of leaching, and leaching curve.  7- Leaching fraction calculation.  8- Salt balance in reclaimed soil.  9- Assessment of water quality irrigation.  10- Reclamation of gypsiferous soil.  11- Reclamation of desert and sandy soil.  12- Reclamation of calcareous soil. | |

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| ***10·*** ***Learning Outcomes***  At the end of the class, the student will be able to:  a-Define land reclamation, saline soils, sodic soils.  b- Define types of salt- affected soils.  c- Define reclamation of salt- affected soils, leaching efficiency coefficient.  d- Solve leaching equation.  e- Calculate leaching requirements.  f- Prepare leaching curves.  g- Know leaching methods for reclamation soils.  h- Know mathematical forms and modeling.  i- Know single reservoir with bypass.  j- Define series of reservoirs with bypass.  -Prepare salt balance in reclaimed soil. k  I- Define irrigation water quality.  m- Reclaim gypsiferous, desert and sandy soils. |
| ***11.*** ***Teaching and Learning Methods*** |
| 1. Lectures  2. Tutorials  3. Homework and Assignments  4. Lab. Experiments  5. Tests and Exams  6. In-Class Questions and Discussions  7. Connection between Theory and Application  8. In- and Out-Class oral conservations  9. Reports |
| ***12. Assessment Methods***  1. Examinations, Tests, and Quizzes  2. Extracurricular Activities.  3. Student Engagement during Lectures.  4. Responses Obtained from Students, Questionnaire about  Curriculum and Faculty Member ( Instructor) |
| |  | | --- | |  | | ***13. Grading Policy*** 1.    1. Quizzes:  - There will be a (20 – 25) closed books and notes quizzes  during the academic year.  - The quizzes will count 20% of the total course grade.  2. Tests, 2-3 Nos. and will count 10% of the total course grade.  3. Extracurricular Activities, this is optional and will count extra  marks (1 – 5%) for the student, depending on the type of activity.  4. Final Exam:  - The final exam will be comprehensive, closed books and  notes, and will take place on January 2014 from 9:00 AM - 12:00  PM in rooms ( M12 + M13 )  - The final exam will count 70% of the total course grade | |

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| ***14. Course Structure*** | | | | | |
| Assessment  Method | Teaching  Method | Unit/Module or  Topic Title | LOs  ( Article | Hour | Week |
| 1-4 of article (12) | 1-9 of article(11) | Land reclamation concept | a | 5  2 theo  1 tut  2 lab | 16 |
| 1-4 of article (12) | 1-9 of article(11) | 1-9 of article(11) | b | 5  2 theo  1 tut  2 lab | 17 |
| 1-4 of article (12) | 1-9 of article(11) | Properties of some important salt | b, c | 5  2 theo  1 tut  2 lab | 18 |
| 1-4 of article (12) | 1-9 of article(11) | Program performance for reclamation of saline soils, field and laboratory surveying and investigation, leaching requirements | d | 5  2 theo  1 tut  2 lab | 19 |
| 1-4 of article (12) | 1-9 of article(11) | Leaching curve, equations, mathematical form and modeling, leaching efficiency coefficient | e | 5  2 theo  1 tut  2 lab | 20 |
| 1-4 of article (12) | 1-9 of article(11) | Leaching curve, equations, mathematical form and modeling, leaching efficiency coefficient | f, g | 5  2 theo  1 tut  2 lab | 21 |
| 1-4 of article (12) | 1-9 of article(11) | Leaching methods and time of leaching | f, g | 5  2 theo  1 tut  2 lab | 22 |
| 1-4 of article (12) | 1-9 of article(11) | Salt balance in reclaimed soils | k | 5  2 theo  1 tut  2 lab | 23 |
| 1-4 of article (12) | 1-9 of article(11) | Salt storage variation | k | 5  2 theo  1 tut  2 lab | 24 |
| 1-4 of article (12) | 1-9 of article(11) | Leaching fraction calculations | g d, e, f,g | 5  2 theo  1 tut  2 lab | 25 |
| 1-4 of article (12) | 1-9 of article(11) | Irrigation water, quality, classification and assessment for reclamation | i | 5  2 theo  1 tut  2 lab | 26 |
| 1-4 of article (12) | 1-9 of article(11) | Irrigation water quality, classification and assessment for reclamation | i | 5  2 theo  1 tut  2 lab | 27 |
| 1-4 of article (12) | 1-9 of article(11) | Reclamation of gypsiferous soil | m | 5  2 theo  1 tut  2 lab | 28 |
| 1-4 of article (12) | 1-9 of article(11) | Reclamation of desert and sandy soils | m | 5  2 theo  1 tut  2 lab | 29 |
| 1-4 of article (12) | 1-9 of article(11) | Reclamation of calcareous soils | m | 5  2 theo  1 tut  2 lab | 30 |

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| ***15. Infrastructure*** | | |
| Land Reclamation, Theoretical and Practical Principles,1992 | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| Irrigation Drainage and Salinity , Kovda,1974 | Special requirements (include for example workshops, periodicals, IT software, websites) | |
|  | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***16. Admissions*** | | |
|  | | Pre-requisites |
| 0 | | Minimum number of students |
| 70 | | Maximum number of students |
|  | | ***17. Course Instructors*** |

**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resources | ***2. University Department/Centre*** |
| **Water Quality and Treatment 217 WRWM**  Introduction to water pollution, sources of water pollution, quality and characteristics of sewage, decomposition of sewage, the aerobic decomposition the anaerobic decomposition Nitrogen, Sulphur and Carbon cycle for both types of decomposition. Treatment of sewage, definition of preliminary, primary, secondary and final treatment, sludge treatment and disposal. Surface water, water quality standards, pollution effect on aquatic life, conventional water pollutants, toxic water pollutants, Water treatment, selection of water treatment processes, methods used for treatment include screening, settling, coagulation, flocculation, filtration through beds of sand, and disinfection. | ***3. Course title/code & Description*** |
| B Sc degree in Water Resources Engineering | ***4. Program(s) to which it Contributes*** |
| Annual System ; There is only one mode  of delivery, which is a “Day Program”.  The students are full time students, and on campus. They attend full day program in face-to-face mode. The academic year is composed of 30-week regular subjects.  Each subject credit is one 50-minute lecture a week or 3 hours of lab a week. There is *no* on-line subject  which may be used as supplementary  material for the class room instruction. | ***5. Modes of Attendance offered*** |
| 1st and 2nd Semesters, Academic year 2017-2018 | ***6. Semester/Year*** |
| 120 hrs / 4 hrs, per week 2 hrs theoretical and 2 hrs laboratory | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| 1. Introduce definition of water pollution, sources of pollution. 2. Physical and Chemical characteristics of sewage and their testing. 3. Determine of Biochemical Oxygen Demand and Chemical Oxygen Demand. 4. Treatment of sewage, purpose of wastewater treatment. 5. Definition of preliminary treatment, screening, grit chamber, skimming tank. 6. Definition of primary sedimentation, theory of sedimentation, design of sedimentation tank. 7. Secondary or biological treatment, trickling filter, definition, recirculation of treated sewage. 8. Activated sludge process, definition, design, considerations involved in an activated sludge. 9. Sludge treatment and disposal. 10. Surface water, quality criteria for surface water, water quality standard. 11. Selection of water treatment process. 12. The methods used for water treatment include screening, settling, treatment   with chemicals, filtration through beds of sand and disinfection. | |

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| ***10·*** ***Learning Outcomes*** |
| At the end of the class, the student will be able to define:  a-Water pollution, sources of water pollution.  b-Quality and characteristics of sewage.  c- Pollution effects on aquatic life.  d- organic matter in wastewater.  e- Population Equivalent.  f-Classification of wastewater treatment plant.  g-Design the units of wastewater plant.  h- Water quality standard.  j- Water treatment system.  i- Selection of water treatment process.  j- unit of water treatment plant. |
| ***11.*** ***Teaching and Learning Methods*** |
| 1. Lecture  2. Tutorials  3. Homework and Assignments  4. Lab. Experiments  5. Tests and Exams  6. In-Class Questions and Discussions  7. Connection between Theory and Application  8. In- and Out-Class oral conservations  9. Reports and Posters |
| ***12. Assessment Methods***  ***1.*** Examinations, Tests, and Quizzes  2. Extracurricular Activities  3. Student Engagement during Lectures  4. Responses Obtained from Students, Questionnaire about  Curriculum and Faculty Member (Instructor) |
| ***13. Grading Policy***  1. Quizzes:  - There will be a ( 20 – 25 ) closed books and notes quizzes  during the academic year.  - The quizzes will count 20% of the total course grade.  2. Tests, 2-3 Nos. and will count 10% of the total course grade.  3. Extracurricular Activities, this is optional and will count extra  marks ( 1 – 5 % ) for the student, depending on the type of activity.  4. Final Exam:  - The final exam will be comprehensive, closed books and  notes, and will take place on January 2014 from 9:00 AM - 12:00  PM in rooms ( M12 + M13 )  - The final exam will count 70% of the total course grade |

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| ***14. Course Structure*** | | | | | |
| Assessment Method | Teaching Method | Unit/ Module or Topic Title | LO’s  (Article 10) | Hours | Week |
| 1-4 of article(12) | 1-6 0f article (11) | Introductory to water pollution | a | 4  2 theo  2 lab | 1 |
| 1-4 of article(12) | 1-6 0f article (11) | Quality and characteristics of Municipal wastewater | b, c | 4  2 theo  2 lab | 2 |
| 1-4 of article(12) | 1-6 0f article (11) | Biological oxidation of organic matter | d | 4  2 theo  2 lab | 3 |
| 1-4 of article(12) | 1-6 0f article (11) | Biochemical Oxygen Demand (BOD) | d | 4  2 theo  2 lab | 4 |
| 1-4 of article(12) | 1-6 0f article (11) | Biochemical Oxygen Demand (BOD) | d, e | 4  2 theo  2 lab | 5 |
| 1-4 of article(12) | 1-6 0f article (11) | Chemical Oxygen Demand (COD) | d | 4  2 theo  2 lab | 6 |
| 1-4 of article(12) | 1-6 0f article (11) | Decomposition of organic matter | d | 4  2 theo  2 lab | 7 |
| 1-4 of article(12) | 1-6 0f article (11) | Treatment of sewage Preliminary treatment | f | 4  2 theo  2 lab | 8 |
| 1-4 of article(12) | 1-6 0f article (11) | Primary Treatment | f | 4  2 theo  2 lab | 9 |
| 1-4 of article(12) | 1-6 0f article (11) | Secondary Treatment | f | 4  2 theo  2 lab | 10 |
| 1-4 of article(12) | 1-6 0f article (11) | Trickling Filter | f | 4  2 theo  2 lab | 11 |
| 1-4 of article(12) | 1-6 0f article (11) | Activated Sludge Process | f | 4  2 theo  2 lab | 12 |
| 1-4 of article(12) | 1-6 0f article (11) | Activated Sludge Process | f | 4  2 theo  2 lab | 13 |
| 1-4 of article(12) | 1-6 0f article (11) | Sludge digestion Process | f | 4  2 theo  2 lab | 14 |
| 1-4 of article(12) | 1-6 0f article (11) | Disposal of digested sludge | f | 4  2 theo  2 lab | 15 |
| 1-4 of article(12) | 1-6 0f article (11) | Introduction to surface water quality | g | 4  2 theo  2 lab | 16 |
| 1-4 of article(12) | 1-6 0f article (11) | Water quality standard | g | 4  2 theo  2 lab | 17 |
| 1-4 of article(12) | 1-6 0f article (11) | Pollution effects on aquatic life | g | 4  2 theo  2 lab | 18 |
| 1-4 of article(12) | 1-6 0f article (11) | Conventional water pollutants | g | 4  2 theo  2 lab | 19 |
| 1-4 of article(12) | 1-6 0f article (11) | Toxic water pollutants | g | 4  2 theo  2 lab | 20 |
| 1-4 of article(12) | 1-6 0f article (11) | Selection of water treatment process | h, e | 4  2 theo  2 lab | 21 |
| 1-4 of article(12) | 1-6 0f article (11) | Types of treatment | h, e | 4  2 theo  2 lab | 22 |
| 1-4 of article(12) | 1-6 0f article (11) | Screening | h, e | 4  2 theo  2 lab | 23 |
| 1-4 of article(12) | 1-6 0f article (11) | Settling | h, e | 4  2 theo  2 lab | 24 |
| 1-4 of article(12) | 1-6 0f article (11) | Settling | h, e | 4  2 theo  2 lab | 25 |
| 1-4 of article(12) | 1-6 0f article (11) | Coagulation | h, e | 4  2 theo  2 lab | 26 |
| 1-4 of article(12) | 1-6 0f article (11) | Flocculation | h, e | 4  2 theo  2 lab | 27 |
| 1-4 of article(12) | 1-6 0f article (11) | Filtration | h, e | 4  2 theo  2 lab | 28 |
| 1-4 of article(12) | 1-6 0f article (11) | Filtration | h, e | 4  2 theo  2 lab | 29 |
| 1-4 of article(12) | 1-6 0f article (11) | Disinfection | h, e | 4  2 theo  2 lab | 30 |

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| ***15. Infrastructure*** | | |
| Sewage and Waste Disposal Engineering: by Santosh Kumar Garg, 1994 | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| Water Supply and Pollution Control: by Warren Viessman, Jr. Mark J. Hammer, Eighth Edition, 2009 | Special requirements (include for example workshops, periodicals, IT software, websites) | |
|  | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***16. Admissions*** | | |
|  | | Pre-requisites |
|  | | Minimum number of students |
| 70 | | Maximum number of students |
|  | | ***17. Course Instructors*** |

**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering , University of Baghdad(WRED) | ***1. Teaching Institution*** |
| Department of Water Resources Department (WRD) | ***2. University Department/Centre*** |
| **Hydrology /319WRHY**  .This course introduces the description of hydrologic cycle topic covers;  Weather and hydrology, precipitation, double mass analysis principles, stream flow and water stage computation, measurements of discharge, evaporation, characteristics of hydrograph, runoff calculations, unit hydrograph, S-curve, infiltration indices, stream flow routing, wave movement, abrupt wave , design storm and flood, and probability.  . The course is  taught through 3 hrs per week, 2  theoretical, 1 hr tutorial. | ***3. Course title/code & Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Program(s) to which it Contributes*** |
| Annual System ; There is only one  mode of delivery, which is a “Day  Program”. The students are full time  students, and on campus. They attend  full day program in face-to-face  mode. The academic year is  composed of 30-week regular  subjects. | ***5. Modes of Attendance offered*** |
| 1st and 2nd ***.*** / Academic Year 2017 – 2018 | ***6. Semester/Year*** |
| 90 hrs. / 3 hrs. per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| 1. Definitions of hydrological cycle including precipitation measurements. 2. Description the relation between stage-discharge principles and units. 3. Evaporation, type of method analysis. 4. Explain the hydrologic meanings of hydrograph, separation of hydrograph component. 5. Derivation of unit hydrograph and S-curve. 6. Rainfall runoff relation and infiltration capacity. 7. Flood routing using different methods (storage equation, Muskingum method and graphical method). 8. Probability using plotting positions, gumbel distribution, and log-pearson type –III distribution. | |

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| ***10·*** ***Learning Outcomes*** |
| At the end of the class, the student will be able to:   1. Define the hydrological cycle. 2. Calculate the discharge of the river cross sectional area using current meter method. 3. Deal with the stage-discharge relation through rating curves. 4. Calculate the discharge using Chezy’s and Manning’s formulas. 5. Be familiar with evaporation principles. 6. Separate the hydrograph components. 7. Derive unit hydrograph. 8. Know how to draw the S-curve from unit hydrograph. 9. Calculate the infiltration indices (ɸ and W). 10. Know how to compute the outflow from the inflow using (storage equation, Muskingum, and graphical methods). 11. Estimate the flow through the return period principles (probability). |
| ***11.*** ***Teaching and Learning Methods*** |
| 1. Lectures.  2. Tutorials.  3. Homework and Assignments.  4. Tests and Exams.  5. In-Class Questions and Discussions.  6. Connection between Theory and Application.  7. Extracurricular Activities. |
| ***12. Assessment Methods***  1. Examinations, Tests, and Quizzes.  2. Extracurricular Activities.  3. Student Engagement during Lectures.  4. Responses Obtained from Students, Questionnaire about  Curriculum and Faculty Member ( Instructor ). |
| ­­­­­­­  ***13. Grading Policy***  1. Quizzes:  - There will be a ( 6 – 8 ) closed books and notes quizzes  during the academic year.  - The quizzes will count 25% of the total course grade.  2. Tests, 6-8 Nos. and will count 5% of the total course grade.  3. Extracurricular Activities, this is optional and will count extra  marks ( 1 – 5 % ) for the student, depending on the type of activity.  4. Final Exam:  - The final exam will be comprehensive, closed books and  notes, and will take place on January 2014 from 9:00 AM - 12:00 PM  in class rooms (w1+w2)  - The final exam will count 70% of the total course grade |

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| ***14. Course Structure*** | | | | | |
| **Assessment**  **Method** | **Teaching**  **Method** | **Unit/Module or**  **Topic Title** | **LOs**  **( Article**  **10 )** | **Hours** | **Week** |
| 1 – 4 of article (12) | 1-7 of article (11) | Hydrologic cycle and measurement of precipitation | a | 3  2 the.  1 tut. | 1 |
| 1 – 4 of article (12) | 1-7 of article (11) | Estimating of missing precipitation and double-mass analysis | a, b | 3  2 the.  1 tut. | 2 |
| 1 – 4 of article (12) | 1-7 of article (11) | Average precipitation over area and measurements of snow | a, b | 3  2 the.  1 tut. | 3 |
| 1 – 4 of article (12) | 1-7 of article (11) | Stream flow and stage | a, b, c | 3  2 the.  1 tut. | 4 |
| 1 – 4 of article (12) | 1-7 of article (11) | Discharge measurement | a, b, c, d | 3  2 the.  1 tut. | 5 |
| 1 – 4 of article (12) | 1-7 of article (11) | Stage-discharge relations and units | a, b, c, d | 3  2 the.  1 tut. | 6 |
| 1 – 4 of article (12) | 1-7 of article (11) | Stage-discharge relations and units | a, b, c, d | 3  2 the.  1 tut. | 7 |
| 1 – 4 of article (12) | 1-7 of article (11) | Stage –discharge relations and units | a, b, c, d | 3  2 the.  1 tut. | 8 |
| 1 – 4 of article (12) | 1-7 of article (11) | evaporation | a, b, c, d, e | 3  2 the.  1 tut. | 9 |
| 1 – 4 of article (12) | 1-7 of article (11) | Characteristic of hydrograph | a, b, c, d, e | 3  2 the.  1 tut. | 10 |
| 1 – 4 of article (12) | 1-7 of article (11) | Stream flow recessions | a, b, c, d, e | 3  2 the.  1 tut. | 11 |
| 1 – 4 of article (12) | 1-7 of article (11) | Hydrograph separation | a, b, c, d, e, f | 3  2 the.  1 tut. | 12 |
| 1 – 4 of article (12) | 1-7 of article (11) | Hydrograph separation | a, b, c, d, e, f | 3  2 the.  1 tut. | 13 |
| 1 – 4 of article (12) | 1-7 of article (11) | Unit hydrograph | a, b, c, d, e, f, g | 3  2 the.  1 tut. | 14 |
| 1 – 4 of article (12) | 1-7 of article (11) | Derivation of unit hydrograph | a, b, c, d, e, f, g | 3  2 the.  1 tut. | 15 |
| 1 – 4 of article (12) | 1-7 of article (11) | S-curve | a, b, c, d, e, f, g, h | 3  2 the.  1 tut. | 16 |
| 1 – 4 of article (12) | 1-7 of article (11) | Synthetic unit hydrograph | a, b , c, d, e, f, g, h | 3  2 the.  1 tut. | 17 |
| 1 – 4 of article (12) | 1-7 of article (11) | Rational method | a, b, c, d, e, f, g, h | 3  2 the.  1 tut. | 18 |
| 1 – 4 of article (12) | 1-7 of article (11) | Rational method | a, b, c, d, e, f, g, h | 3  2 the.  1 tut. | 19 |
| 1 – 4 of article (12) | 1-7 of article (11) | Rainfall runoff relation and infiltration capacity | a, b, c, d, e, f, g, h, i | 3  2 the.  1 tut. | 20 |
| 1 – 4 of article (12) | 1-7 of article (11) | Infiltration index | a, b, c, d, e, f, g, h, i | 3  2 the.  1 tut. | 21 |
| 1 – 4 of article (12) | 1-7 of article (11) | Stream flow routing and wave movement | a, b, c, d, e, f, g, h, j | 3  2 the.  1 tut. | 22 |
| 1 – 4 of article (12) | 1-7 of article (11) | Abrupt wave | a, b, c, d, e, f, g, h, i, j | 3  2 the.  1 tut. | 23 |
| 1 – 4 of article (12) | 1-7 of article (11) | Storage equation and routing in a river channels | a, b, c, d, e, f, g, h, i, j | 3  2 the.  1 tut. | 24 |
| 1 – 4 of article (12) | 1-7 of article (11) | Muskingum method | a, b, c, d, e, f, g, h, i, j | 3  2 the.  1 tut. | 25 |
| 1 – 4 of article (12) | 1-7 of article (11) | Reservoir routing | a, b, c, d, e, f, g, h, j, | 3  2 the.  1 tut. | 26 |
| 1 – 4 of article (12) | 1-7 of article (11) | Reservoir routing | a, b, c, d, e, f, g, h, i | 3  2 the.  1 tut. | 27 |
| 1 – 4 of article (12) | 1-7 of article (11) | Graphical method | a, b, c, d, e, f, g, h, j, | 3  2 the.  1 tut. | 28 |
| 1 – 4 of article (12) | 1-7 of article (11) | Probability and plotting positions | a, b, c, d, e, f, g, h, i, j, k | 3  2 the.  1 tut. | 29 |
| 1 – 4 of article (12) | 1-7 of article (11) | Gumbel distribution and log- pearson type III disribution | a, b, c, d, e, f, g, h, i, j, k | 3  2 the.  1 tut. | 30 |

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| ***15. Infrastructure*** | | |
| **Textbook**  Hydrology for engineers Ray K. Linsley, Max Adam Kohler.  **References**   1. Applied hydrology by Chow Maidment Mays. 2. Hydrology and flood plain analysis. 3. Hydrology in practice Elizabeth M. Show.   ***Others***  1. Notebook prepared by the instructor of the course  2. Collection of sheets of solved and  unsolved problems and Exams  questions | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| Available websites related to the subject.  Extracurricular activities. | Special requirements (include for example workshops, periodicals, IT software, websites) | |
| * Extra lectures by foreign guest lecturers. | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***16. Admissions*** | | |
| GE101, GE201 | | Pre-requisites |
| 40 | | Minimum number of students |
| 60 | | Maximum number of students |
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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Water Resources Department | ***2. University Department/Centre*** |
| **Soil Mechanics and Foundation Design/ 320 WRSM**  All that concerns soil properties and classification, types and analysis of stress distribution on soil, shearing strength of soil and methods of calculation, Soil permeability and filter requirement, soil hydraulic seepage analysis, one dimensional consolidation, earth pressure and retaining structure, stability of slopes, settlement of foundation, bearing capacity and design of shallow foundation. | ***3. Course title/code & Description*** |
| B.Sc. in Water Resources Engineering | ***4. Program(s) to which it Contributes*** |
| Annual System; There is only one mode of delivery, which is a “Day program”. The students are full time students, and on campus. They attend full day program in face-to-face mode. The academic year is  composed of 30-week regular subjects.. This subject given 2 hours theory, 2 hour tutorial, and 2 hour lab work per week for one semester. There is *no* on-line subject which may be used as supplementary material for the class room instruction. | ***5. Modes of Attendance offered*** |
| 1st and 2nd Academic year 2017-2018 | ***6. Semester/Year*** |
| 180 hrs/4 hrs per week(first semester) then 120 hrs/4 hrs per week (second semester) | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| 1. Introduce basic definitions and introductory concepts of soil mechanics  2. Introduce basic definitions and introductory concepts of foundation design.  3. Explain the flow of water through soil and the stresses that happened  4. Design of shallow footings.  5. Explain the bearing capacity and type of settlement.  6.Explain the flow of water through soil especially due to earth dams  7. Provide a background to higher level courses involving soil mechanic and  foundation design.  8. Explain the stresses due to retaining wall (rigid or flexible wall).  9. Explain the stresses that happened due to external loads and the geostatic stresses.  10. Explain how to describe the soil of any site and field tests. | |

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| ***10·*** ***Learning Outcomes*** |
| 1. The graduate student will be able to design and analyze shallow  foundation.  2. He will be able to describe the soil of the site with all the other  laboratory available test information.  3. Also he/she can analyze and design retaining walls, Dams and check all  the information of and available design. |
| ***11.*** ***Teaching and Learning Methods*** |
| 1. Lectures.  2. Tutorials.  3. Homework and Assignments.  4. Lab. Experiments.  5. Tests and Exams.  6. In-Class Questions and Discussions.  7. Seminars.  8. Reports and presentations. |
| ***12. Assessment Methods***  1. Examinations, Tests, and Quizzes.  2. Student Engagement during Lectures.  3. Responses Obtained from Students, Questionnaire about Curriculum and Faculty  Member (Instructor). |
| ***13. Grading Policy***  1. Quizzes:  - There will be about (5-8) closed books and notes quizzes during the academic  year. The quizzes will count 20% of the total course grade.  2. Tests  - There will be about (1-2) closed books and notes quizzes during the academic and  will count 10% of the total course grade.  3.Lab work  -There will about (7-8) experimental soil tests. This work will account 10% of the  total course grade.  4. Final Exam:  - The final exam will be comprehensive, closed books and Notes. The final exam  will count 60% of the total course grade. |

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| ***14. Course Structure*** | | | | | |
| Assessment Methods | Teaching method | Topic Title | LOs | Hours | Week |
| 1-3 of article (12) | 1-8 of article (11) | Introduction and soil formation | 2, 3 | 2 the.  2 tut.  2 lab. | 1 |
| 1-3 of article (12) | 1-8 of article (11) | Phase relationship | 2, 3 | 2 the.  2 tut.  2 lab | 2 |
| 1-3 of article (12) | 1-8 of article (11) | Their derivations | 2, 3 | 2 the.  2 tut.  2 lab | 3 |
| 1-3 of article (12) | 1-8 of article (11) | Soil identification test | 2, 3 | 2 the.  2 tut.  2 lab | 4 |
| 1-3 of article (12) | 1-8 of article (11) | Calculation of the phase relation | 2, 3 | 2 the.  2 tut.  2 lab | 5 |
| 1-3 of article (12) | 1-8 of article (11) | compaction | 2, 3 | 2 the.  2 tut.  2 lab | 6 |
| 1-3 of article (12) | 1-8 of article (11) | Soil classification | 2, 3 | 2 the.  2 tut.  2 lab | 7 |
| 1-3 of article (12) | 1-8 of article (11) | Stress within soil mass | 2, 3 | 2 the.  2 tut.  2 lab | 8 |
| 1-3 of article (12) | 1-8 of article (11) | Mohr circle and principle stress | 2, 3 | 2 the.  2 tut.  2 lab | 9 |
| 1-3 of article (12) | 1-8 of article (11) | Theory of one dimensional flow | 2, 3 | 2 the.  2 tut.  2 lab | 10 |
| 1-3 of article (12) | 1-8 of article (11) | Calculation of one dimensional flow | 2, 3 | 2 the.  2 tut.  2 lab | 11 |
| 1-3 of article (12) | 1-8 of article (11) | Two dimensional flow | 2, 3 | 2 the.  2 tut.  2 lab | 12 |
| 1-3 of article (12) | 1-8 of article (11) | Shear strength of soil | 2, 3 | 2 the.  2 tut.  2 lab | 13 |
| 1-3 of article (12) | 1-8 of article (11) | Compressibility of soils | 2, 3 | 2 the.  2 tut.  2 lab | 14 |
| 1-3 of article (12) | 1-8 of article (11) | Theory of settlement | 2, 3 | 2 the.  2 tut.  2 lab | 15 |
| 1-3 of article (12) | 1-8 of article (11) | Their application | 2, 3 | 2 the.  2 tut. | 16 |
| 1-3 of article (12) | 1-8 of article (11) | Consolidation theory | 2, 3 | 2 the.  2 tut. | 17 |
| 1-3 of article (12) | 1-8 of article (11) | Their application | 2, 3 | 2 the.  2 tut. | 18 |
| 1-3 of article (12) | 1-8 of article (11) | Lateral earth pressure | 1, 2, 3 | 2 the.  2 tut. | 19 |
| 1-3 of article (12) | 1-8 of article (11) | Types of earth pressure | 1, 2, 3 | 2 the.  2 tut. | 20 |
| 1-3 of article (12) | 1-8 of article (11) | Types of retaining wall | 1, 2, 3 | 2 the.  2 tut. | 21 |
| 1-3 of article (12) | 1-8 of article (11) | Analysis of rigid retaining wall | 1, 2, 3 | 2 the.  2 tut. | 22 |
| 1-3 of article (12) | 1-8 of article (11) | Analysis of flexible retaining wall | 1, 2, 3 | 2 the.  2 tut. | 23 |
| 1-3 of article (12) | 1-8 of article (11) | Sheet piles | 1, 2, 3 | 2 the.  2 tut. | 24 |
| 1-3 of article (12) | 1-8 of article (11) | Slope stability analysis | 1, 2, 3 | 2 the.  2 tut. | 25 |
| 1-3 of article (12) | 1-8 of article (11) | Bearing capacity analysis | 1, 2, 3 | 2 the.  2 tut. | 26 |
| 1-3 of article (12) | 1-8 of article (11) | Shallow foundation design | 1, 2, 3 | 2 the.  2 tut. | 27 |
| 1-3 of article (12) | 1-8 of article (11) | Spread footing design | 1, 2, 3 | 2 the.  2 tut. | 28 |
| 1-3 of article (12) | 1-8 of article (11) | Combined footing design | 1, 2, 3 | 2 the.  2 tut | 29 |
| 1-3 of article (12) | 1-8 of article (11) | Revision | 1, 2, 3 | 2 the.  2 tut | 30 |

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| ***15. Infrastructure*** | | |
| Text books   1. Soil Mechanics, SI version by (T. William Lambe and Robert V. Whitman). 2. كتاب هندسة الاسس لدكتور يوسف الشكرجي. 3. Principle of geotechnical Engineering by Braja M. Das 4. Principle of Foundation Engineering by Braja M. Das. | | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHERS |
| Laboratory experiments in the Soil  Lab. of the department. | | Special requirements (include for example workshops, periodicals, IT software, websites) |
|  | | Community-based facilities  (include for example, guest  Lectures , internship , field studies) |
| ***16. Admissions*** | | |
|  | Pre-requisites | |
| / | Minimum number of students | |
| 46 | Maximum number of students | |
|  | ***17. Course Instructors*** | |

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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resources Engineering | ***2. University Department/Centre*** |
| **Irrigation Engineering/ 321 WRIE**  This course introduces the description of principle of irrigation, the topics covered the followings:  Introduction to sources of irrigation, physical soil properties, soil moisture content, soil moisture measurements, soil moisture calculations and units, net and gross depth of water, irrigation and conveyance efficiencies, reference evapotranspiration, crop evapotranspiration, crop coefficient, relation between discharge-depth of water-field area and time of irrigation, continuous and intermittent operations, water duty, irrigation interval, scheduling of irrigation and water budget, soil infiltration and land leveling and grading.  This course is taught through 3 hrs per week, 2 hrs theoretical and 1hr tutorial. | ***3. Course title/code & Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Program(s) to which it Contributes*** |
| Annual system: there is only one mode of delivery, which is a day program. The students are full time students, and on campus. They attend full day program in face- to face mode. The academic year is composed of 30 weeks regular subjects. | ***5. Modes of Attendance offered*** |
| 1st and 2nd, Academic year 2017-2018. | ***6. Semester/Year*** |
| 90 hrs/3 hrs per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| 1. Introduce basic definitions and introductory concepts of irrigation.  2. Introduce the description of soil physical properties, available water, field  capacity, permanent wilting point and readily available water.  3. Introduce the description of soil moisture content, methods of measuring and  calculations.  4. Explain and description of net applied depth, gross depth of irrigation, application  and irrigation efficiency and conveyance irrigation.  5. Introduce the principles of evapotranspiration, reference evapotranspiration, crop  or actual evapotranspiration and crop coefficient.  6. Introduce the principles of relation between discharges, time of irrigation, depth  applied and field area.  7. Description of irrigation interval and the maximum value.  8. Difference between continuous and intermittent irrigation operations.  9. Description the principle of water balance and budget and to learn the procedure  of schedule of irrigation and methods used.  10- Explain the principle of infiltration process, rate of infiltration and basic  infiltration.  11- Description the basic and important of land leveling and grading, introducing  the principle of levelling, methods of calculating the required land slope and  methods used for calculating the volume of cut and fill. | |

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| ***10·*** ***Learning Outcomes*** |
| At the end of the class, the student will be able to:  a. Define soil moisture calculation, readily available, and soil moisture deficit.  b. Calculate; required net depth of irrigation, gross depth of irrigation, application  and irrigation efficiencies, conveyance efficiencies in the canals, and the required  total water applied to the head of the canal.  c. Calculate; the reference evapotranspiration according to different methods, how to  use the weather parameters and applied in the different methods. And define the  crop coefficients for the plants. Additional to know how to calculate crop or  actual evapotranspiration.  d. Calculate; the discharge applied to the field (farm) according to the applied depth  of water, time of irrigation and the field area.  e. Understand and apply the calculated discharge in the operation of irrigation,  continuous and intermittent discharge.  f. Formulate and solve the water duty according to the continuous discharge and the  field area.  g. Define the irrigation intervals and the maximum irrigation intervals.  h. Calculate and managed the schedule of irrigation by using two methods, and  calculate the water budget. And define the difference between the two methods.  i. Define and calculate the infiltration, infiltration rate, instantaneous infiltration rate  and basic infiltration rate. Additional how to use the log-log paper, and the least  squares method to define the equation.  j. Calculate; the land grading, longitudinal and horizontal slopes, cut and fill ratio,  adjusting the plane of the land, and then calculation of volume of fill and cut by  using different methods.`  k. Use the techniques, skills, and modern engineering tools necessary for  engineering practice.  l. Identify and solve engineering machines production problems. |
| ***11.*** ***Teaching and Learning Methods*** |
| a- Lectures  b-Tutorials  c- Homework and Assignments  d-Tests and Exams  e- In-Class Questions and Discussions  f- In class question work |
| ***12. Assessment Methods***  1. Examinations and Quizzes  2. Homework  3. Student Engagement during Lectures  4. In class questions work |
| ***13. Grading Policy***  1. Quizzes:  - There will be a (5 - 8) closed books and notes quizzes  during the academic year.  - The quizzes will count 5% of the total course grade.  2. Tests, 4-6 Nos. and will count 20% of the total course grade.  3. Homework will be count 5%.  4. In class work Activities, this is optional and will count extra  marks (1 – 5 %) for the student, depending on the type of activity -  5. Final Exam:  - The final exam will be comprehensive, closed books and  notes, and will take place on June 2014 from 9:00 AM - 12:00 PM  - The final exam will count 70% of the total course grade. |

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| ***14. Course Structure*** | | | | | |
| Assessment Method | Teaching Method | LOs (article 10) | Topic title | Hours | Week |
| 1-4 of article (12) | a-f of article (11) | a, k | Introduction and review | 3 | 1 |
| 1-4 of article (12) | a-f of article (11) | a, k | Physical soil properties | 3 | 2 |
| 1-4 of article (12) | a-f of article (11) | a, k | Soil moisture content | 3 | 3 |
| 1-4 of article (12) | a-f of article (11) | a, k | Soil moisture measurements | 3 | 4 |
| 1-4 of article (12) | a-f of article (11) | a, k | Readily available water and soil moisture deficit | 3 | 5 |
| 1-4 of article (12) | a-f of article (11) | a, k | Relation between depth of soil, depth of water and soil moisture content | 3 | 6 |
| 1-4 of article (12) | a-f of article (11) | a, k | Relation between depth of soil, depth of water and soil moisture content | 3 | 7 |
| 1-4 of article (12) | a-f of article (11) | b, k | Net and gross depth of applied water | 3 | 8 |
| 1-4 of article (12) | a-f of article (11) | b, k | Net and gross depth of applied water | 3 | 9 |
| 1-4 of article (12) | a-f of article (11) | b, k | Irrigation, application and conveyance efficiencies | 3 | 10 |
| 1-4 of article (12) | a-f of article (11) | c, k | Evapotranspiration | 3 | 11 |
| 1-4 of article (12) | a-f of article (11) | c, k | Evapotranspiration | 3 | 12 |
| 1-4 of article (12) | a-f of article (11) | c, k | Evapotranspiration | 3 | 13 |
| 1-4 of article (12) | a-f of article (11) | d, k | Relation between discharge, time, depth applied and field area | 3 | 14 |
| 1-4 of article (12) | a-f of article (11) | d, k | Relation between discharge, time, depth applied and field area | 3 | 15 |
| 1-4 of article (12) | a-f of article (11) | e, k | Continuous and intermittent operations | 3 | 16 |
| 1-4 of article (12) | a-f of article (11) | f, k | Water duty | 3 | 17 |
| 1-4 of article (12) | a-f of article (11) | f, k | Water duty | 3 | 18 |
| 1-4 of article (12) | a-f of article (11) | g, k | Irrigation Interval | 3 | 19 |
| 1-4 of article (12) | a-f of article (11) | h, k | Schedule of irrigation | 3 | 20 |
| 1-4 of article (12) | a-f of article (11) | h, k | Schedule of irrigation | 3 | 21 |
| 1-4 of article (12) | a-f of article (11) | h, k | Schedule of irrigation | 3 | 22 |
| 1-4 of article (12) | a-f of article (11) | h, k | Schedule of irrigation | 3 | 23 |
| 1-4 of article (12) | a-f of article (11) | i, k, l | Infiltration | 3 | 24 |
| 1-4 of article (12) | a-f of article (11) | i, k, l | Infiltration | 3 | 25 |
| 1-4 of article (12) | a-f of article (11) | i, k, l | Infiltration | 3 | 26 |
| 1-4 of article (12) | a-f of article (11) | j, k, l | Land grading | 3 | 27 |
| 1-4 of article (12) | a-f of article (11) | j, k, l | Land grading | 3 | 28 |
| 1-4 of article (12) | a-f of article (11) | j, k, l | Land grading | 3 | 29 |
| 1-4 of article (12) | a-f of article (11) | j, k | Calculation of volume cat and fill | 3 | 30 |

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| ***15. Infrastructure*** | | |
| **Textbook**  “Irrigation Principle and Practice “ by Israelsen  **References**   1. Note book from web-site 2. “Irrigation Engineering” by R. K. Sharma | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
|  | Special requirements (include for example workshops, periodicals, IT software, websites) | |
|  | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***16. Admissions*** | | |
|  | | Pre-requisites |
| 40 | | Minimum number of students |
| 55 | | Maximum number of students |
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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the programmer specification. |

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| University of Baghdad  College of Engineering | ***1. Teaching Institution*** |
| Department of Water Resources Engineering | ***2. University Department/Centre*** |
| **Irrigation and Drainage Networks, 322 WRID**  This course introduces the description of design Irrigation and Drainage Networks. Topics covered: Types of Irrigation and Drainage Networks, Components, and Functions. Layout of Irrigation and Drainage Networks, Calculation of Discharge for Canals and Drains, Design of Water Course and Farm Channel (Slope), Design of Collector Drain (Slope), Determine the Water Level in Irrigation Canals, Determine the Water Level in Drains, Hydraulic Design of Canal Cross Section, the longitudinal section and synoptic diagram and Canals Lining. | ***3. Course title/code& Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Program(s) to which it Contributes*** |
| Semester System ; There is only one  mode of delivery, which is a “Day  Program”. The students are full time  students, and on campus. They attend  full day program in face-to-face  mode. The semester is composed of 15-week regular subjects. | ***5. Modes of Attendance offered*** |
| 2nd  Semester  Academic Year 2017- 2018 | ***6. Semester/Year*** |
| 45 hrs (3 hrs per week) | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| 1- Types of irrigation and drainage networks, components, and functions.  2- Enable the student to layout of irrigation and drainage networks.  3- Enable the student to calculation of discharge for canals and drains.  4- Enable the student to design of water course and farm channel (slope)  5- Enable the student to design of collector drain and main collector drain (slope).  6- Enable the student to determine the water level in irrigation canals and slopes.  7- Enable the student to determine the water Level in drains and slopes.  8- The student will be introduced to the design of canals cross section and drains.  9- Introduce the design by empirical method, and best hydraulic section method.  10- Regime canal.  11- Enable the student to draw the longitudinal section and synoptic diagram.  12- The student will be introduced to the basic information for Canal lining. | |

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| ***10·Learning Outcomes*** |
| The student will be able to:   1. Understand and define irrigation and drainage networks. 2. Layout of irrigation and drainage networks. 3. Calculation of discharge for canals and drains. 4. Design of water course and farm channel (slope) 5. Design of collector drain and main collector drain (slope). 6. Determine the water level in irrigation canals and slopes. 7. Determine the water Level in drains and slopes. 8. Design requires the use of steady uniform flow equation such as Manning’s and Chezy’s formula. 9. Design by empirical methods 10. Design by best hydraulic section methods. 11. Design by Regime canals. 12. Draw the longitudinal section and synoptic diagram. 13. Understand the canal lining. |
| ***11.Teaching and Learning Methods*** |
| 1. Lectures 2. Tutorials 3. Homework 4. In class Questions and Discussions 5. Exams 6. Connections between Theory and Application 7. Field Trips 8. Reports and Posters |
| ***12. Assessment Methods***   * Examination and Quizzes * Student Engagement during Lectures |
| ***13. Grading Policy***  1. Homework:   * There will be sets of homework during the academic year (2nd Semester).   2. Quizzes:   * There will be **some of closed** books and notes quizzes during the academic year (2nd Semester).   3. Exams:   * There will be a **three** closed books and notes exam during the academic year (2nd Semester). * The term exam will count **30%** of the total course grade.   4. Final Exam:   * The final exam will be comprehensive, closed books and notes. * The final exam will count **70%** of the total course grade. |

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| ***14. Course Structure*** | | | | | |
| Assessment Method | Teaching Method | Topic Title | LO’s  Article (10) | hour | Week |
| 1-2 of article (12) | 1-8 of article (11) | Irrigation Network.  Drainage Network. | 1 | 3 | 16 |
| 1-2 of article (12) | 1-8 of article (11) | Comparison between Irrigation and Drainage Networks.  Names and Numbers of Canals and Drains. | 1 | 3 | 17 |
| 1-2 of article (12) | 1-8 of article (11) | Layout of Irrigation and Drainage Networks. | 1-2 | 3 | 18 |
| 1-2 of article (12) | 1-8 of article (11) | Irrigation Unit.  Water Duty.  Drainage Coefficient. | 3 | 3 | 19 |
| 1-2 of article (12) | 1-8 of article (11) | Calculation of Discharge for Canals and Drains. | 3 | 3 | 20 |
| 1-2 of article (12) | 1-8 of article (11) | Design of Water Course and Farm Channel (Slope). | 4 | 3 | 21 |
| 1-2 of article (12) | 1-8 of article (11) | Design of Collector Drain (Slope). | 5 | 3 | 22 |
| 1-2 of article (12) | 1-8 of article (11) | Determine the Water Level along the Main, Lateral, and Distributory Canal. | 6 | 3 | 23 |
| 1-2 of article (12) | 1-8 of article (11) | Determine the Water Level along the Main, and Main Collector Drain. | 7 | 3 | 24 |
| 1-2 of article (12) | 1-8 of article (11) | Hydraulic Design of Canal Section:  (Manning’s Formula and Chezy’s Formula). | 8 | 3 | 25 |
| 1-2 of article (12) | 1-8 of article (11) | Empirical Methods. | 8-9 | 3 | 26 |
| 1-2 of article (12) | 1-8 of article (11) | Best Hydraulic Section Methods. | 8-10 | 3 | 27 |
| 1-2 of article (12) | 1-8 of article (11) | Regime Canals. | 11 | 3 | 28 |
| 1-2 of article (12) | 1-8 of article (11) | Longitudinal Section and Synoptic Diagram. | 3-4-5-6-7-12 | 3 | 29 |
| 1-2 of article (12) | 1-8 of article (11) | Lining of Canals. | 13 | 3 | 30 |

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| ***15. Infrastructure*** | | |
| **Text book**  **References**   * Design Manual for Irrigation and Drainage / Pencol 1983.   **Others**   * Notebook Prepared by the Instructor. * Collection of Sheets of Solved and Unsolved Problems and Exams Questions. | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
|  | Special requirements (include for example workshops, periodicals, IT software, websites) | |
|  | Community-based facilities  (include for example, guest  Lectures , internship, field studies) | |
| ***16. Admissions*** | | |
|  | | Pre-requisites |
|  | | Minimum number of students |
| 67 | | Maximum number of students |
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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering / University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resources Department | ***2. University Department/Centre*** |
| **Fluid Mechanics / 323 WRFM**  This course introduces the  description of phenomena associated  with fluid flow. Topics covered:  physical properties of fluids; fluid  statics; principles of conservation of  mass, energy and momentum; control  volume technique; Bernoulli  equation; dimensional analysis and  similitude; viscous flow in pipes and  channels; laminar and turbulent flow;  boundary layer theory; drag and lift;  Moody diagram; pipe problems; flow  and fluid measurements; analysis of  pipes and pumps networks, Open channel flow; normal depth, critical depth, specific energy curve, hydraulic jump, best hydraulic section, and water surface profiles.  . The course is  taught through 5 hrs per week, 3  theories, 1 tutorial, and 1  experimental. | ***3. Course title/code & Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Program(s) to which it Contributes*** |
| Annual System ; There is only one  mode of delivery, which is a “Day  Program”. The students are full time  students, and on campus. They attend  full day program in face-to-face  mode. The academic year is  composed of 30-week regular  subjects. | ***5. Modes of Attendance offered*** |
| 1st & 2nd Academic Year 2017 – 2018 | ***6. Semester/Year*** |
| 150 hrs. / 5 hrs. per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| 1. Definitions and introductory concepts of fluid  mechanics.  2. Introduce the description of pressure distribution in a static fluid and  its effects on submerged surfaces and bodies.  3. Introduce the description of phenomena associated with fluid flow  phenomena.  4. Explain and derive the conservation laws that govern fluid motion  (continuity, energy, and momentum equations).  5. Introduce the principles of “Dimensional Analysis” and “Similitude”  and their application to fluid mechanics problems.  6. Introduction to fluid flow in pipes, smooth and rough pipes, laminar and turbulent  flow, computation of major and minor losses in pipes.  7. Enable the student to analyze and design pipes network and pumps  connection.  8. Enable the student to measure the fluid properties and flow  parameters.  9. Provide a good physical and analytical understanding of fluid flows.  10. Provide a background to higher level courses involving open channel and  advance hydrodynamic flow. | |

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| ***10·*** ***Learning Outcomes*** |
| At the end of the class, the student will be able to:  a. Define Fluids and Fluid Mechanics and distinguish between  incompressible and compressible fluids, and understand and define  the basic fluid properties; especially density and viscosity, and apply  Newton’s law of viscosity.  b. Calculate; the pressure in static fluid, hydrostatic forces on submerged  surfaces, buoyancy forces, stability of submerged and floating bodies,  and forces on accelerated fluids.  c. Be familiar with continuity, energy, and momentum equations, and  their applications to fluid flow problems.  d. Understand and apply the principles of dimensional analysis and  similitude to fluid mechanics problems.  e. Estimate drag and lift forces in laminar and turbulent flows for  different immersed bodies.  g. Calculate frictional losses in pipe problems for both laminar and  turbulent flows, by using Moody Diagram.  h. Calculate secondary ( minor ) losses for various pipes fittings and  connections.  i. Know how to measure flow properties ( pressure, velocity, discharge )  and fluid properties ( density and viscosity ).  j. Be able to analyze and design pipes network and connection, and  pumping stations and connection.  k. Be able to use dimensional analysis to similitude different engineering problems.  l. Identify, formulate and solve engineering fluid problems.  m. Use the techniques, skills, and modern engineering tools necessary for  engineering practice in fluid mechanics applications. |
| ***11.*** ***Teaching and Learning Methods*** |
| 1. Lectures.  2. Tutorials.  3. Homework and Assignments.  4. Lab. Experiments.  5. Tests and Exams.  6. In-Class Questions and Discussions.  7. Connection between Theory and Application.  8. Extracurricular Activities. |
| ***12. Assessment Methods***  1. Examinations, Tests, and Quizzes.  2. Extracurricular Activities.  3. Student Engagement during Lectures.  4. Responses Obtained from Students, Questionnaire about  Curriculum and Faculty Member ( Instructor ). |
| ***13. Grading Policy***  1. Quizzes:  - There will be a ( 6 – 8 ) closed books and notes quizzes  during the academic year.  - The quizzes will count 30% of the total course grade.  2. Experimental Tests, 6-8 Nos. and will count 10% of the total course grade.  3. Extracurricular Activities, this is optional and will count extra  marks ( 1 – 5 % ) for the student, depending on the type of activity.  4. Final Exam:  - The final exam will be comprehensive, closed books and  notes, and will take place on January 2014 from 9:00 AM - 12:00 PM  in class rooms (w1+w2)  - The final exam will count 60% of the total course grade |

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| ***14. Course Structure*** | | | | | |
| **Assessment**  **Method** | **Teaching**  **Method** | **Unit/Module or**  **Topic Title** | **LOs**  **( Article**  **10 )** | **Hours** | **Week** |
| 1 – 4 of article (12) | 1-8 of article (11) | Introductory  Concepts To Fluid  Mechanics | a | 5  3 the.  1 tut.  1 exp. | 1 |
| 1 – 4 of article (12) | 1-8 of article (11) | Compressibility, viscosity, and surface tension | a,b | 5  3 the.  1 tut.  1 exp. | 2 |
| 1 – 4 of article (12) | 1-8 of article (11) | Pressure  Measurements and Forces On Immersed Surfaces | a,b | 5  3 the.  1 tut.  1 exp. | 3 |
| 1 – 4 of article (12) | 1-8 of article (11) | Buoyancy And Floatation | a,b | 5  3 the.  1 tut.  1 exp. | 4 |
| 1 – 4 of article (12) | 1-8 of article (11) | Measurements and Forces On Immersed Surfaces | a,b,c | 5  3 the.  1 tut.  1 exp. | 5 |
| 1 – 4 of article (12) | 1-8 of article (11) | Velocity and acceleration | a,b,c | 5  3 the.  1 tut.  1 exp. | 6 |
| 1 – 4 of article (12) | 1-8 of article (11) | continuity equation | a,b,c | 5  3 the.  1 tut.  1 exp. | 7 |
| 1 – 4 of article (12) | 1-8 of article (11) | continuity equation | a,b,c | 5  3 the.  1 tut.  1 exp. | 8 |
| 1 – 4 of article (12) | 1-8 of article (11) | Euler equation | a,b,c | 5  3 the.  1 tut.  1 exp. | 9 |
| 1 – 4 of article (12) | 1-8 of article (11) | Euler equation | a,b,c | 5  3 the.  1 tut.  1 exp. | 10 |
| 1 – 4 of article (12) | 1-8 of article (11) | Bernoullis equation | a,b,c | 5  3 the.  1 tut.  1 exp. | 11 |
| 1 – 4 of article (12) | 1-8 of article (11) | Bernoullis equation | a,b,c | 5  3 the.  1 tut.  1 exp. | 12 |
| 1 – 4 of article (12) | 1-8 of article (11) | Bernoullis equation | a,b,c | 5  3 the.  1 tut.  1 exp. | 13 |
| 1 – 4 of article (12) | 1-8 of article (11) | Momentum principles | a,b,c | 5  3 the.  1 tut.  1 exp. | 14 |
| 1 – 4 of article (12) | 1-8 of article (11) | Momentum application | a,b,c,e | 5  3 the.  1 tut.  1 exp. | 15 |
| 1 – 4 of article (12) | 1-8 of article (11) | Momentum application | a,b,c,e | 5  3 the.  1 tut.  1 exp. | 16 |
| 1 – 4 of article (12) | 1-8 of article (11) | Dimensional  Analysis And  Similitude | a,b,c,d,e,k | 5  3 the.  1 tut.  1 exp. | 17 |
| 1 – 4 of article (12) | 1-8 of article (11) | Dimensional  Analysis And  Similitude | a,b,c,d,e,k | 5  3 the.  1 tut.  1 exp. | 18 |
| 1 – 4 of article (12) | 1-8 of article (11) | Dimensional  Analysis And  Similitude | a,b,c,d,e,k | 5  3 the.  1 tut.  1 exp. | 19 |
| 1 – 4 of article (12) | 1-8 of article (11) | Fundamental and pipe friction | a,b,c,d,e,f,g | 5  3 the.  1 tut.  1 exp. | 20 |
| 1 – 4 of article (12) | 1-8 of article (11) | Turbulent and Smooth pipes | a,b,c,d,e,f,g,h | 5  3 the.  1 tut.  1 exp. | 21 |
| 1 – 4 of article (12) | 1-8 of article (11) | Major (friction) losses computation | a,b,c,d,e,f,g,h | 5  3 the.  1 tut.  1 exp. | 22 |
| 1 – 4 of article (12) | 1-8 of article (11) | Minor losses computation | a,b,c,d,e,f,g,h,i | 5  3 the.  1 tut.  1 exp. | 23 |
| 1 – 4 of article (12) | 1-8 of article (11) | Single and multiple pipeline problems | a,b,c,d,e,f,g,h,I,j | 5  3 the.  1 tut.  1 exp. | 24 |
| 1 – 4 of article (12) | 1-8 of article (11) | Analysis Of Piping  And Pumping  Networks | a,b,c,d,e,f,g,h,I,j | 5  3 the.  1 tut.  1 exp. | 25 |
| 1 – 4 of article (12) | 1-8 of article (11) | Analysis Of Piping  And Pumping  Networks | a,b,c,d,e,f,g,h,I,j,k,l,m | 5  3 the.  1 tut.  1 exp. | 26 |
| 1 – 4 of article (12) | 1-8 of article (11) | Open channel flow | a,b,c,d,e,f,g,h,I,j,k,l,m | 5  3 the.  1 tut.  1 exp. | 27 |
| 1 – 4 of article (12) | 1-8 of article (11) | Normal depth, critical depth computation | a,b,c,d,e,f,g,h,I,j,k,l,m | 5  3 the.  1 tut.  1 exp. | 28 |
| 1 – 4 of article (12) | 1-8 of article (11) | Specific energy curve , momentum principle | a,b,c,d,e,f,g,h,I,j,k,l,m | 5  3 the.  1 tut.  1 exp. | 29 |
| 1 – 4 of article (12) | 1-8 of article (11) | Hydraulic jump, best hydraulic section | a,b,c,d,e,f,g,h,I,j,k,l,m | 5  3 the.  1 tut.  1 exp. | 30 |

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| ***15. Infrastructure*** | | |
| **Textbook**  Elementary fluid mechanics J.K. Vennard &R.L. Street.  **References**   1. Fluid mechanics by R.K. RAJPUT, ISO 9001;2000 2. Fluid mechanics by A.K. mohanty, New Delhi-110001;2009 3. Fluid mechanics by Young, Munson, Okiishi, Huebsch   ***Others***  1. Notebook prepared by the instructor of the course  2. Collection of sheets of solved and  unsolved problems and Exams  question | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| Laboratory experiments in the ( Fluids  Lab ) of the department.  Available websites related to the subject.  Extracurricular activities. | Special requirements (include for example workshops, periodicals, IT software, websites) | |
| * Extra lectures by foreign guest lecturers. | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***16. Admissions*** | | |
| / | | Pre-requisites |
| 45 | | Minimum number of students |
| 75 | | Maximum number of students |
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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resource | ***2. University Department/Centre*** |
| **Structural Analysis, 324 WRSA** | ***3. Course title/code & Description*** |
| The course deals with different aspects of the design of structures. The course provides the knowledge to design various structures, such as beam on elastic foundation, bridges, design of circular and rectangular tanks.  The course also teaches the theory necessary to analyze and design these structures. | ***4. Programme(s) to which it Contributes*** |
| Semester System ; There is only one  mode of delivery, which is a “Day  Program”. The students are full time  students, and on campus. They attend  full day program in face-to-face  mode. The academic semester is  composed of 15-week regular  subjects. | ***5. Modes of Attendance offered*** |
| 1st semester, academic year 2017-2018 | ***6. Semester/Year*** |
| 30 hrs, 2 hrs theoretical per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course***  The students must be able to independently design and analyze the hydraulic structures taught in this course and understand the theory on which the design is based**.** | |
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| ***10·*** ***Learning Outcomes*** |
| At the end of the class, the student will be able to:   1. Design different types of beams on elastic foundation 2. Knowledge of many types of bridges, and the most suitable type depending on the distance, capacity, place condition. 3. Design and analysis of two types of tanks (circular and rectangular). |
| ***11.*** ***Teaching and Learning Methods*** |
| 1. Lectures.  2. Tutorials.  3. Homework and Assignments.  4. Tests and Exams.  5. In-Class Questions and Discussions.  6. Connection between Theory and Application. |
| ***12. Assessment Methods***  1. Examinations, Tests, and Quizzes.  2. Extracurricular Activities.  3. Student Engagement during Lectures.  4. Responses Obtained from Students, Questionnaire about  Curriculum and Faculty Member (Instructor) |
| ***13. Grading Policy***  1. Monthly examination that account 30%  2. The final exam which accounts 70% |

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| ***14. Course Structure*** | | | | | |
| Assessment Method (Article 12) | Teaching Method (Article 11) | Topic title | LO’s  (Article 10) | Hrs | Week |
| 1, 2, 3 | 1, 2, 3 | Introduction | 1 | 2 | 1 |
| 1, 2, 3 | 1, 2, 3 | Design of rigid beams | 1 | 2 | 2 |
| 1, 2, 3 | 1, 2, 3 | Beam on elastic foundation | 1 | 2 | 3 |
| 1, 2, 3 | 1, 2, 3 | Beam on elastic foundation | 1 | 2 | 4 |
| 1, 2, 3 | 1, 2, 3 | Beam on elastic foundation | 1 | 2 | 5 |
| 1, 2, 3 | 1, 2, 3 | Introduction to Bridges | 2 | 2 | 6 |
| 1, 2, 3 | 1, 2, 3 | Introduction to bridges | 2 | 2 | 7 |
| 1, 2, 3 | 1, 2, 3 | Design of bridges | 2 | 2 | 8 |
| 1, 2, 3 | 1, 2, 3 | Design of bridges | 2 | 2 | 9 |
| 1, 2, 3 | 1, 2, 3 | Design of circular tanks | 3 | 2 | 10 |
| 1, 2, 3 | 1, 2, 3 | Design of circular tanks | 3 | 2 | 11 |
| 1, 2, 3 | 1, 2, 3 | Design of rectangular tanks | 3 | 2 | 12 |
| 1, 2, 3 | 1, 2, 3 | Design of rectangular tanks | 3 | 2 | 13 |
| 1, 2, 3 | 1, 2, 3 | Design of rectangular tanks | 3 | 2 | 14 |
| 1, 2, 3 | 1, 2, 3 | Design of rectangular tanks | 3 | 2 | 15 |

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| ***15. Infrastructure*** | | |
| **Analysis of Beams on Elastic Foundations:**Using Finite Difference Theory by [Glyn Jones](http://www.google.iq/search?hl=ar&tbo=p&tbm=bks&q=inauthor:%22Glyn+Jones%22), [Matthew Jones](http://www.google.iq/search?hl=ar&tbo=p&tbm=bks&q=inauthor:%22Matthew+Jones%22). Thomas Telford, 1997  **Design of Bridge Structures** [**M. A. Jayaram**](http://www.google.iq/search?hl=ar&tbo=p&tbm=bks&q=inauthor:%22M.+A.+Jayaram%22) **PHI Learning Pvt. Ltd.**  **Design of circular tanks** | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
|  | Special requirements (include for example workshops, periodicals, IT software, websites) | |
|  | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***16. Admissions*** | | |
|  | | Pre-requisites |
| 3 | | Minimum number of students |
| 60 | | Maximum number of students |
|  | | ***17. Course Instructors*** |

**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resources | ***2. University Department/Centre*** |
| **Design of Concrete Structures, 325 WRDC**  Introduction, working stress design (WSD), ultimate stress design (USD), design of R/C beams for bending and shear, design of R/C one-way and two-way slabs, design of R/C columns. | ***3. Course title/code & Description*** |
| B.Sc. in Water Resources Engineering, (WRE) | ***4. Program (s) to which it Contributes*** |
| Seasonal System ; There is only one mode of delivery, which is a “Day program”. The students are full time students, and on campus. They attend full day program in face-to-face mode. The academic semester is composed of 15-week regular subjects.. This subject is given 2 hrs theoretical and 2 hrs tutorial per week for one semester. There is *no* on-line subject which may be used as supplementary material for the class room instruction. | ***5. Modes of Attendance offered*** |
| 2nd Semester, Academic year 2017-2018 | ***6. Semester/Year*** |
| 60 hrs/4 hrs per week (second semester) | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| To explain the behavior of reinforced concrete under loads and to identify the cross section of reinforced concrete and analyze it. | |

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| ***10·*** ***Learning Outcomes*** |
| 1. The graduate student will be able to design and analyze beams, slabs  and columns.  2. Calculate the allowable load and moment the beam can carry it  3. Find stress in concrete and steel for the reinforced concrete beams.  4. Design singly reinforced rectangular section.  5. Find the necessary area of flexural reinforcement required at the beam.  6. Find the dimensions of the beam.  7. Calculate the effective flange width of T-beam section.  8. Calculate the design strength for T-beam section.  9. Calculate shear strength (nominal strength and required strength).  10. Calculate shear strength provided by concrete and steel).  11. Design stirrup spacing.  12. Define type of slab (one way or two way).  13. Find slab thickness.  14. calculate the allowable load and moment the slab can carry it.  15. calculate the allowable load and moment the column can carry it. |
| ***11.*** ***Teaching and Learning Methods***  1. Lectures.  2. Tutorials.  3. Homework and Assignments.  4. Tests and Exams.  5. In-Class Questions and Discussions.  6. Connection between Theory and Application.  7. Extracurricular Activities.  8. Seminars.  9. In- and Out-Class oral conservations.  10. Reports, Presentations, and Posters. |
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| ***12. Assessment Methods***  1. Examinations and Quizzes.  2. Extracurricular Activities.  3. Student Engagement during Lectures.  4. Responses Obtained from Students, Questionnaire about  Curriculum and Faculty Member ( Instructor ). |
| ***13. Grading Policy***  1. Quizzes:  - There will be (2-5) closed books and notes quizzes during the academic year.  - The quizzes will count 25% of the total course grade.  2. Extracurricular Activities, this is optional and will count extra marks ( 5 % ) for  the student, depending on the type of activity.  3. Final Exam:  - The final exam will be comprehensive, closed books and Notes.)  - The final exam will count 70% of the total course grade |

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| ***14. Course Structure*** | | | | | |
|  |  |  |  |  | Week |
| 1-3 of article (12) | 1-10 of article (11) | Working stress design (WSD) | 1,2,3,4 | 2 the.  2 tut. | 16 |
| 1-3 of article (12) | 1-10 of article (11) | Uncracked section of (WSD) | 1,2,3,4 | 2 the.  2 tut. | 17 |
| 1-3 of article (12) | 1-10 of article (11) | cracked section of (WSD) | 1,2,3,4 | 2 the.  2 tut. | 18 |
| 1-3 of article (12) | 1-10 of article (11) | Ultimate stress design method (SDM) (analysis) | 1,2,4,5 | 2 the.  2 tut. | 19 |
| 1-3 of article (12) | 1-10 of article (11) | Ultimate stress design method (SDM) (design) | 1,2,4,5 | 2 the.  2 tut. | 20 |
| 1-3 of article (12) | 1-10 of article (11) | T-beams section (analysis) | 1,2,5,6,7,8 | 2 the.  2 tut. | 21 |
| 1-3 of article (12) | 1-10 of article (11) | T-beams section (design) | 1,2,5,6,7,8 | 2 the.  2 tut. | 22 |
| 1-3 of article (12) | 1-10 of article (11) | Shear and diagonal tension (analysis) | 1,2,4,5,6,9,10,11 | 2 the.  2 tut. | 23 |
| 1-3 of article (12) | 1-10 of article (11) | Shear and diagonal tension (design) | 1,2,4,5,6,9,10,11 | 2 the.  2 tut. | 24 |
| 1-3 of article (12) | 1-10 of article (11) | Reinforced concrete one way slab (analysis) | 1,13,14 | 2 the.  2 tut. | 25 |
| 1-3 of article (12) | 1-10 of article (11) | Reinforced concrete one way slab (design) | 1,13,14 | 2 the.  2 tut. | 26 |
| 1-3 of article (12) | 1-10 of article (11) | Reinforced concrete two way slab (analysis) | 1,13,14 | 2 the.  2 tut. | 27 |
| 1-3 of article (12) | 1-10 of article (11) | Reinforced concrete two way slab (design) | 1,13,14 | 2 the.  2 tut. | 28 |
| 1-3 of article (12) | 1-10 of article (11) | Reinforced concrete columns (analysis) | 1,15 | 2 the.  2 tut | 29 |
| 1-3 of article (12) | 1-10 of article (11) | Reinforced concrete columns (design) | 1,15 | 2 the.  2 tut | 30 |

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| ***15. Infrastructure*** | | |
| * **Design of Reinforced Concrete**, **ACI 318-05 Code Edition**. Seventh Edition Jack C. McGormac, James K. Nelson, John Wiley, 2006. * **Design of Concrete Structures**, 14th Edition Arthur H. Nilson, David Darwin, Charles W. Dolan, McGraw-Hill, 2010. * **Reinforced Concrete: A Fundamental Approach**, 5th Edition Edward G. Nawy, Prentice Hall, 2005. * **Building Code Requirements for Structural Concrete**, ACI 318M-11, American Concrete Institute, 2011. | | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER |
|  | | Special requirements (include for example workshops, periodicals, IT software, websites) |
|  | | Community-based facilities  (include for example, guest  Lectures , internship , field studies) |
| ***16. Admissions*** | | |
| Mathematics, material science and technology | Pre-requisites | |
| 10 | Minimum number of students | |
| 46 | Maximum number of students | |
|  | ***17. Course Instructors*** | |

**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the programmer specification. |

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| University of Baghdad  College of Engineering | ***1. Teaching Institution*** |
| Department of Water Resources | ***2. University Department/Centre*** |
| **Engineering Analysis, 326 WREA**  This course includes a study of differential equations: Topics include the solution of first and second order differential equations, homogeneous and non-homogeneous differential equations, physical applications, initial value problems, systems of linear differential equations, series solutions, and Fourier Series. | ***3. Course title/code& Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Program(s) to which it Contributes*** |
| Seasonal System ; There is only one mode of delivery, which is a “Day program”. The students are full time students, and on campus. They attend full day program in face-to-face mode. The academic semester is composed of 15-week regular subjects.. This subject is given 3 hrs theoretical and 1 hr tutorial per week for one semester. There is *no* on-line subject which may be used as supplementary material for the class room instruction. | ***5. Modes of Attendance offered*** |
| 1st Semester  Academic Year 2017- 2018 | ***6. Semester/Year*** |
| 60 hrs (4 hrs per week) | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| * Classify differential equations by order, linearity, and homogeneity * Solve any first order differential equation. * Demonstrate variable separable, homogeneous, exact, linear, Bernoulli linear differential equations. * Set up and solve physical problems such as mixture problems. * Solve second order differential equations with constant coefficients and complementary and particular solutions. * Apply the methods of undetermined coefficients, variation of parameters and reduction of order. * Apply second order differential equations to springs. * Solve differential equations using power series. * Set up systems of linear differential equations using characteristic equations. * Solve systems of linear differential equations * Apply Fourier series to periodic functions. * Apply Euler’s Formula * Use the Wronskian determinant to test for linear independence or linear dependence. | |

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| ***10·Learning Outcomes*** |
| After completing this course students will be able to:   1. Classify differential equations by order. 2. Differentiate between linear and non-linear, ordinary and partial and different degreed differential equations. 3. Solve first order linear differential equations. 4. Use separation of variables to solve differential equations. 5. Solve exact differential equations. 6. Identify and solve homogeneous differential equations. 7. Solve linear equations with constant coefficients. 8. Solve the problems of ordinary differential equations. 9. Solve second-degree homogeneous linear equations with constant coefficients 10. Solve second-degree non-homogeneous linear differential equations. 11. Use the method of undetermined coefficients to solve differential equations. 12. Use variation of parameters to solve differential equations. 13. Use the Wronskian and characteristic equations to solve differential equations. 14. Solve second –order differential equations (by using reduction of order). 15. Solve second –order differential equations (Euler-Cauchy Equations). 16. Find solutions to second, third and fourth degree differential equations. 17. Model real-life applications using differential equations. 18. Demonstrate their understanding of differential equations and their applications to scientific and engineering applications problems. 19. Solve systems of linear differential equations. 20. Find the Fourier series of a given function. 21. Able to use series solution methods to obtain solutions and other useful information about the differential equations to which these methods apply. 22. Use analytic techniques to compute solutions to various differential equations. 23. Apply the knowledge of differential equations in order to solve engineering problems. |
| ***11.Teaching and Learning Methods*** |
| 1. Lectures 2. Discussions 3. Problem solving 4. Student Questions 5. Student Participation 6. Oral Presentations 7. Homework 8. Exams 9. Connections between Theory and Application   Students are expected to read the material before coming to class and are strongly encouraged to come to class with a list of questions and to ask those questions. |
| ***12. Assessment Methods***   * Examination and Quizzes * Student Engagement during Lectures |
| ***13. Grading Policy***  1. Homework:   * There will be sets of homework during the academic year   2. Quizzes:   * There will be a **two** closed books and notes quizzes during the academic year   3. Exams:   * There will be a **four** closed books and notes exam during the academic year * The term exam will count **30%** of the total course grade.   4. Final Exam:   * The final exam will be comprehensive, closed books and notes. * The final exam will count **70%** of the total course grade. |

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| ***14. Course Structure*** | | | | | |
| Assessment Method | Teaching Method | Topic Title | LO’s Article (10) | hour | Week |
| 1-2 of article (12) | 1-9 of article (11) | Differential Equations | 1-2 | 4 | 1 |
| 1-2 of article (12) | 1-9 of article (11) | First – Order Differential Equations:  1- Separable equations | 3-4 | 4 | 2 |
| 1-2 of article (12) | 1-9 of article (11) | 2- Exact equation.  3- Homogeneous first-order equations | 3-5-6 | 4 | 3 |
| 1-2 of article (12) | 1-9 of article (11) | 4- First-order linear equations and integrating factors.  5- Bernoulli equations | 3-7 | 4 | 4 |
| 1-2 of article (12) | 1-9 of article (11) | Application of First- Order Differential Equations | 3-8-21-22-23 | 4 | 5 |
| 1-2 of article (12) | 1-9 of article (11) | Second – Order Differential Equations:  Homogeneous Equations with Constant Coefficient | 9 | 4 | 6 |
| 1-2 of article (12) | 1-9 of article (11) | Non-Homogeneous Linear Equations | 10 | 4 | 7 |
| 1-2 of article (12) | 1-9 of article (11) | Method of undermined coefficient | 11 | 4 | 8 |
| 1-2 of article (12) | 1-9 of article (11) | Method of variation of parameters | 12-13 | 4 | 9 |
| 1-2 of article (12) | 1-9 of article (11) | Second –Order Differential Equations (Reduction of order) | 14 | 4 | 10 |
| 1-2 of article (12) | 1-9 of article (11) | Euler-Cauchy Equations | 15 | 4 | 11 |
| 1-2 of article (12) | 1-9 of article (11) | Equation of Higher Order | 16 | 4 | 12 |
| 1-2 of article (12) | 1-9 of article (11) | Application of Second - Order Differential Equations | 17-18-21-22-23 | 4 | 13 |
| 1-2 of article (12) | 1-9 of article (11) | System of Simultaneous Differential Equations | 19-21-22-23 | 4 | 14 |
| 1-2 of article (12) | 1-9 of article (11) | Fourier Series.  Even and Odd Functions | 20-21-22-23 | 4 | 15 |

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| ***15. Infrastructure*** | |
| **Text book**   * Advanced Engineering Mathematics.   **References**   * Ordinary Differential Equations. * Differential Equations with Boundary – Value Problem. * Elementary differential equations and boundary value problems.   **Others**   * Notebook Prepared by the Instructor. * Collection of Sheets of Solved and Unsolved Problems and Exams Questions. | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER |
|  | Special requirements (include for example workshops, periodicals, IT software, websites) |
|  | Community-based facilities  (include for example, guest  Lectures , internship, field studies) |
| ***16. Admissions*** | |
|  | Pre-requisites |
|  | Minimum number of students |
| 43 | Maximum number of students |
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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resources | ***2. University Department/Centre*** |
| **Numerical Analysis,** [**328**](file:///C:\Users\Me\Desktop\المقرارات%20الدراسية\مفردات3,4\EW450%20%20Analysis%20of%20Water%20Resources%20System.doc) **WRNM**  Numerical methods course is a continuation of mathematics for engineers that enables the students to solve mathematical expressions of engineering and scientific problems | ***3. Course title/code & Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Programme(s) to which it Contributes*** |
| One time, day time on campus | ***5. Modes of Attendance offered*** |
| The second semester of the academic year 2017 –2018 | ***6. Semester/Year*** |
| 60 hours, 2 hrs theoretical and 2 hrs laboratory | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course:*** In general, the course was designedto provide the students with computational techniques to solve engineering problems when no mathematical solution exists. | |

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| ***10·*** ***Learning Outcomes*** the student will be able to apply numerical methods to solve different mathematical expressions in engineering including:  a- understanding of numerical methods to obtain solutions of mathematical expressions.  b- finding roots of equations,  c- solving system of linear simultaneous equations,  d- finding values by interpolation,  e- finding values of integration expressions,  f- solving ordinary differential equations,  g- solving boundary value problems,  and an additional out come is:  h- developing of team work. |
| ***11.*** ***Teaching and Learning Methods***  a- lectures,  b- tutorials, and  c- supervised team work. |
| ***12. Assessment Methods***  a- homework**,**  b- quizzes,  c- major examinations during the course, and  d- final examination. |
| ***13. Grading Policy***  - Quizzes and Homework 15%  - Two major in-term examinations 15%  - Final examination 70% |

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| ***14. Course Structure*** | | | | | |
| Assessment  Method  (Article 12) | Teaching  Method  (Article 11) | Unit/Module or  Topic Title | LO's  (Article 10) | Hours | Week |
| a, b, c, and d | a | Introduction | a | 4  2 theo  2 lab | 15 |
| a, b, c, and d | a, b, c, and d | Roots of equations | a, b, and h | 8  4 theo  4 lab | 16, 17 |
| a, b, c, and d | a, b, c, and d | Systems of simultaneous linear equations | a, c, and h | 4  2 theo  2 lab | 18, 19 |
| a, b, c, and d | a, b, c, and d | Interpolation | a, d, and h | 4  2 theo  2 lab | 20 |
| a, b, c, and d | a, b, c, and d | Integration | a, e, and h | 8  4 theo  4 lab | 21, 22 |
|  |  | Examination |  | 4  2 theo  2 lab | 23 |
| a, b, c, and d | a, b, c, and d | First order differential equations | a, f, and h | 8  4 theo  4 lab | 24, 25 |
| a, b, c, and d | a, b, c, and d | Higher order ordinary differential equations | a, f, and h | 4  2 theo  2 lab | 26 |
| a, b, c, and d | a, b, c, and d | Finite differences | a, g, and h | 4  2 theo  2 lab | 27 |
| a, b, c, and d | a, b, c, and d | Solution boundary value problems | a, g, and h | 8  4 theo  4 lab | 28, 29 |
|  |  | Examination |  | 4  2 theo  2 lab | 30 |

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| .***15. Infrastructure*** | | |
| * Amir Wadi Al Khafaji and John R. Tooley, Numerical methods in engineering practice. | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
|  | Special requirements (include for example workshops, periodicals, IT software, websites) | |
|  | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***16. Admissions*** | | |
| GE101, GE201, and WRE350 | | Pre-requisites |
| - | | Minimum number of students |
| 30 | | Maximum number of students |
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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resources Engineering | ***2. University Department/Centre*** |
| **Design of Hydraulic Structures, 429 WRDH**  This course provides a broad understanding of the basic principles of hydraulic structures. The emphasis is on design of regulators, floor thickness, transitions, energy dissipaters, protection of approaches, gates, pipes, culverts, syphon, weirs, drops, escape and aqueducts. | ***3. Course title/code & Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Program(s) to which it Contributes*** |
| Annual System ; There is only one  mode of delivery, which is a “Day  Program”. The students are full time  students, and on campus. They attend  full day program in face-to-face  mode. The academic year is composed of 30-week regular subjects. | ***5. Modes of Attendance offered*** |
| 1st and 2nd / Academic Year 2017 – 2018 | ***6. Semester/Year*** |
| 90 hrs / 3 hrs per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| 1. Introduce basic definitions and introductory concepts of hydraulic structures and their use. 2. Introduce the definition, name, location and direction of regulator. 3. Introduce the hydraulic calculation of regulators (velocity and discharge). 4. Introduce the line of creep and up lift pressure theories (Bligh’s creep theory and Lane’s weighed line of creep method). 5. Introduce the flow net (Khosla’s theory / exit gradient, cut off depths and scouring depth) 6. Introduce the concrete floor thickness. 7. Introduce the transitions (kinds, properties, hydraulics, discharge equation, Mitra’s method, Hind’s method). 8. Introduce the energy dissipation (hydraulic jump, types and efficiency, type of flow D/S of gates and types of stilling basins). 9. Introduce protection of approaches U/S and D/S of concrete floors. 10. Introduce gates (types, water pressure and forces on gates, design principle   for sliding steel gates).   1. Introduce the closed regulating and conveyance structures (concrete pipes,   reinforced concrete culverts, single and multiple barrels and siphons).   1. Introduce the weirs (sharp and broad crested weirs). 2. Introduce the level control structures (canal outlet, canal escape, falls or   drops).   1. Introduce aqueducts. | |

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| ***10·*** ***Learning Outcomes*** |
| 1. Demonstrate an understanding of fluid mechanics principles. 2. Basic definitions and introductory concepts of hydraulic structures and their   use.   1. Definition, name, location and direction of regulator. 2. The hydraulic calculation of regulators (velocity and discharge). 3. The line of creep and up lift pressure theories (Bligh’s creep theory and   Lane’s weighed line of creep method).   1. The flow net (Khosla’s theory / exit gradient, cut off depths and scouring   depth).   1. Calculate hydraulic loads on structures. 2. The concrete floor thickness design. 3. Design and evaluate water surface profile. 4. The transitions (kinds, properties, hydraulics, discharge equation, Mitra’s   method, Hind’s method).   1. The energy dissipation (hydraulic jump, types and efficiency, type of flow   D/S of gates and types of stilling basins).   1. Protection of approaches U/S and D/S of concrete floors. 2. Gates (types, water pressure and forces on gates, design principle for sliding   steel gates).   1. Develop a dimensional design for hydraulic structures appropriate to the flow   regime.   1. Closed regulating and conveyance structures (concrete pipes, reinforced   concrete culverts, single and multiple barrels and siphons).   1. Weirs (sharp and broad crested weirs). 2. Level control structures (canal outlet, canal escape, falls or drops). 3. Hydraulic design of aqueducts. |
| ***11.*** ***Teaching and Learning Methods*** |
| 1. Lectures 2. Tutorials 3. Homework and Assignments 4. Tests and Exams 5. In-Class Questions and Discussions |
| ***12. Assessment Methods*** |
| 1. Examination, tests, and quizzes 2. Student engagement during lectures   ***13. Grading Policy***  1. Quizzes:  - There will be (4 - 5) closed books and notes quizzes during the academic  year.  - The quizzes will count 10% of the total course grade.  2. Tests, 4-5 Nos. and will count 20% of the total course grade.  3. Extracurricular Activities, this is optional and will count extra  marks ( 1 – 5 % ) for the student, depending on the type of activity.  4. Final Exam:  - The final exam will be comprehensive, closed books and  notes, and will take place on June 2014 from 9:00 AM - 12:00 PM  - The final exam will count 70% of the total course grade   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | ***14. Course Structure*** | | | | | | | Assessment Method | Teaching Method | Unit/Module or Topic Title | LOs (Article 10) | Hours | Week | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Review**  **& Rigid Foundations** | 1 | 3 | 1 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Introduction – Types of Hydraulic Structures and their use.** | 2 , 3 | 3 | 2 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Regulators.** | 3 , 4 | 3 | 3 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Hydraulic calculations of regulators.** | 4 | 3 | 4 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Line of creep and uplift pressure / Bligh’s theory** | 5 | 3 | 5 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Weighed line of creep / Lane’s method** | 5 | 3 | 6 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **The cutoff depth &**  **flow net** | 6 | 3 | 7 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Khosla’s theory** | 6 | 3 | 8 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Design example** | 7 | 3 | 9 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Scouring depth / Floor thickness** | 7 , 8 | 3 | 10 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Design example** | 5, 6, 7, 8 | 3 | 11 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Transitions (kinds and properties)** | 9, 10 | 3 | 12 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Design of transition / Metra method + Hind method.** | 9, 10 | 3 | 13 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Design Examples** | 9,10 | 3 | 14 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Energy Dissipation / Hydraulic jump type and efficiency.** | 11 | 3 | 15 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Energy Dissipation / Hydraulic jump type and efficiency.** | 11 | 3 | 16 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Stilling Basins.** | 11 | 3 | 17 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Protection of approaches** | 12 | 3 | 18 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Design Examples** | 12 | 3 | 19 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Gates / Types of gates.** | 13 | 3 | 20 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Design principle for sliding steel gates.** | 13 | 3 | 21 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Pipes / losses in pipes.** | 15 | 3 | 22 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Reinforced concrete culverts / single barrel.** | 15 | 3 | 23 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Reinforced concrete culverts / multiple barrels.** | 15 | 3 | 24 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Siphons / Design example.** | 15 | 3 | 25 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Design example.** | 15 | 3 | 26 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Weirs (sharp and broad crested).** | 16 | 3 | 27 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Weirs (sharp and broad crested).** | 16 | 3 | 28 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Escapes** | 17 | 3 | 29 | | **1 – 2 of**  **Article (12)** | **1 – 5 of**  **Article (11)** | **Flumes, Aqueduct and Drops.** | 17, 18 | 3 | 30 | |

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| ***15. Infrastructure*** | | |
| ***Textbook***  **Varshney –Gupta– Gupta 1977 "Theory and Design of Irrigation Structures" 3rd. Edition Vol. II**  ***References***   1. Chow, V.T.,1959 “Open Channel Hydraulics” 2. Davis, C.V., 1969 “Handbook of Applied Hydraulics” 3rd Edition. 3. U.S.B.R. 1958 “Hydraulic Design of Stilling Basins and Bucket Energy Dissipaters 4. Linsley and Franzini, 1972 “Water Resources Engineering” 2nd Edition. 5. U.S.B.R. 1974 “Design of Small Canal Structures” 6. FAO 1975 “Small Hydraulic Structures”. 7. Varshney – Gupta – Gupta 1977 "Theory and Design of Irrigation Structures" 3rd. Edition Vol. II 8. Punmia .B.C. & Pande B.B. Lal 1981 “Irrigation and Water Power”. 9. Santosh Kumar Garg 1997 “Irrigation Eng. & Hyd. Str.” 10. Larry W. Mays 2005 “Water Resources Eng.” 11. R.K. Sharma & T.K. Sharma 2008 “Irrigation Eng.”.   Dr.K.R. Arora 2009 “Irrigation, Water Power & Water Resources Eng.”. | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| / | Special requirements (include for example workshops, periodicals, IT software, websites) | |
| / | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***16. Admissions*** | | |
| WRE 320 | | Pre-requisites |
| / | | Minimum number of students |
| 75 | | Maximum number of students |
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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resources | ***2. University Department/Centre*** |
| **Design of Irrigation Systems:** **430 WRDI**  The course covers a review of the basic irrigation principles and leads the student gradually through the basic principles of designing on-farm irrigation systems. The contents of the course introduce the main types of mechanized on-farm irrigation systems and then go through a detailed analysis and design of the various components. | ***3. Course title/code & Description*** |
| B Sc degree in Water Resources Engineering | ***4. Program(s) to which it Contributes*** |
| Annual System: There is only one mode of delivery, which is a "Day Program". The students are full time students and on campus. They attend full day program in face-to-face mode. The academic year is composed of 30-week regular subjects. There is no on-line subject which may be used as supplementary material for the class room instruction. | ***5. Modes of Attendance offered*** |
| 2017-2018 | ***6. Semester/Year*** |
| 120 | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| 1. Review basic irrigation principles 2. Introduce the main types of mechanized on-farm irrigation systems 3. Present the main steps followed to design irrigation systems 4. Analyze each component of the various irrigation systems 5. Discuss various methods of selecting each component of the systems 6. Discuss the methods of selecting alternative designs 7. Present the main methods to evaluate the performance of mechanized irrigation systems | |

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| ***10·*** ***Learning Outcomes***  The student will be able to have:   1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct experiments as well as to analyze and interpret data. 3. An ability to design a system, or components, or process to meet desired needs. 4. An ability to function on multi-disciplinary teams (multi-disciplinary teams mean teams of individuals with similar educational backgrounds focusing on different aspects of a project as well as teams of individuals with different educational backgrounds). 5. An ability to select proper design alternative. 6. An understanding of professional and ethical responsibility. 7. An ability to communicate effectively. 8. The broad education necessary to understand the impact of engineering solutions in a global and societal context. 9. A recognition of the need for and an ability to engage in life-long learning (this includes teaching students that the underlying theory is important because the technology changes, coupled with enhancing their self-learning ability). 10. Knowledge of contemporary issues (this includes presenting students with issues such as the impact of globalization, the outsourcing of both engineering and other supporting jobs as practiced by modern international users). 11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. |
| ***11.*** ***Teaching and Learning Methods*** |
| 1. Lectures 2. Tutorials 3. Homework and assignments 4. Laboratory experiments 5. Tests and examinations 6. In-class questions and discussions 7. Connection between theory and application 8. In- and out-class oral conversations |
| ***12. Assessment Methods***  1. Monthly examinations  2. Home works  3. Class discussions  4. Final examination  5. Laboratory reports |
| ***13. Grading Policy***   1. Monthly examinations (minimum 4) 2 during each semester, 20%, 2. Home works, 5%, 3. Class discussion and attendance, 5%, 4. Final examination, 70%. |

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| ***14. Course Structure*** | | | | | |
| Assessment Method  (Article 12) | Teaching Method  (Article 11) | Unit Module or Topic Title | LO's  (Article 10) | Hours | Week |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Review of irrigation principles** | a, b, d, f, h, i , j, k | 4  2 th  2 tut | 1 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Review of irrigation principles** | a, b, d, f, h, i , j, k | 4  2 th  2 tut | 2 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Review of basic fluid mechanics principles** | a, b, d, f, h, i , j, k | 4  2 th  2 tut | 3 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Introduction to mechanized irrigation systems** | e, f, g, h | 4  2 th  2 tut | 4 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Types of sprinkle irrigation systems** | e, f, g, h | 4  2 th  2 tut | 5 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Basic components of sprinkle systems** | e, f, g, h | 4  2 th  2 tut | 6 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Sprinkler selection** | c, h, i, k | 4  2 th  2 tut | 7 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Sprinkler selection** | c, h, i, k | 4  2 th  2 tut | 8 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Sprinkler selection** | c, h, i, k | 4  2 th  2 tut | 9 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Lateral design** | a, c, e, h, k | 4  2 th  2 tut | 10 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Lateral design** | a, c, e, h, k | 4  2 th  2 tut | 11 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Lateral design** | a, c, e, h, k | 4  2 th  2 tut | 12 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Lateral design** | a, c, e, h, k | 4  2 th  2 tut | 13 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Mainline discharges** | a, c, i | 4  2 th  2 tut | 14 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Methods of designing a mainline** | c, e, g, j, k | 4  2 th  2 tut | 15 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Methods of designing a mainline** | c, e, g, j, k | 4  2 th  2 tut | 16 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Methods of designing a mainline** | c, e, g, j, k | 4  2 th  2 tut | 17 |
| 5 | 4 | **Evaluation of fixed-grid sprinkle systems** | b, f, j | 4  2 th  2 tut | 18 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Introduction to trickle irrigation systems** | e, f, g, h | 4  2 th  2 tut | 19 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Basic components of trickle systems** | e, f, g, h | 4  2 th  2 tut | 20 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Emitter selection** | c, h, i, k | 4  2 th  2 tut | 21 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Emitter selection** | c, h, i, k | 4  2 th  2 tut | 22 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Lateral design** | a, c, e, h, k | 4  2 th  2 tut | 23 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Mainline design** | c, e, g, j, k | 4  2 th  2 tut | 24 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Emission Uniformity** | f, j | 4  2 th  2 tut | 25 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Emission Uniformity** | f, j | 4  2 th  2 tut | 26 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Sample designs of subunits** | b, c, d, e, h | 4  2 th  2 tut | 27 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Sample designs of subunits** | b, c, d, e, h | 4  2 th  2 tut | 28 |
| 5 | 4 | **Evaluation of trickle systems** | b, f, j | 4  2 th  2 tut | 29 |
| 1, 2, 3, 4 | 1, 2, 3, 5, 6, 7, 8 | **Design of gated pipes** | c, e, g, j, k | 4  2 th  2 tut | 30 |

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| ***15. Infrastructure*** | | |
| هندسة الري الحقلي – د أحمد يوسف حاجم وحقي إسماعيل  Handouts  Lectures on farm irrigation, Utah State University | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| Compact discs containing pertinent literature | Special requirements (include for example workshops, periodicals, IT software, websites) | |
| Field experiments | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***16. Admissions*** | | |
| WRE 261, WRE 262, WRE 320, WRE 340, WRE 341 | | Pre-requisites |
| 30 | | Minimum number of students |
| 60 | | Maximum number of students |
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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| University of Baghdad  College of Engineering | ***1. Teaching Institution*** |
| Department of Water Resources | ***2. University Department/Centre*** |
| **Groundwater, 431 WRGW**  The course introduces the basic definition of ground water aquifers, steady state porous media flow, and well hydraulics | ***3. Course title/code& Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Program(s) to which it Contributes*** |
| Semester System ; There is only one  mode of delivery, which is a “Day  Program”. The students are full time  students, and on campus. They attend  full day program in face-to-face  mode. The semester is composed of 15-week regular subjects. | ***5. Modes of Attendance offered*** |
| 1st Semester, Academic year 2017-2018 | ***6. Semester/Year*** |
| 45 hrs/2 theoretical and 1 tutorial per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| Teaching Principles of Groundwater Hydraulics. | |

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| ***10·Learning Outcomes*** |
| Students will learn:   1. The applications of Darcy’s law 2. The applications of the continuity equation in groundwater flow systems 3. The numerical solution of Laplace’s equation in 1D and 2D flow regions 4. The solution of steady state groundwater flow equations 5. The solution of non-steady state equations of groundwater flow systems 6. The application of the method of superposition to groundwater flow systems 7. The effect of barrier boundaries on the flow of groundwater |
| ***11.Teaching and Learning Methods*** |
| 1-Lecture notes  2-Computer Software  3- Internet sources |
| ***12. Assessment Methods***  1-Written Exams  2-Computer project |
| ***13. Grading Policy***  1- Three monthly exams =30%  2- Final exam = 70% |

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| ***14. Course Structure*** | | | | | |
| Assessment Method  (Article 12) | Teaching Method (Article 11) | Topic Title | LO’s  (Article 10) | Hours | Week |
| 1,2 | 1,2,3 | Groundwater and Aquifers | 1,2 | 3 | 1 |
| 1,2 | 1,2,3 | Applications of DARCY’s law | 1,2 | 3 | 2 |
| 1,2 | 1,2,3 | Applications of DARCY’s law | 1,2 | 3 | 3 |
| 1,2 | 1,2,3 | Applications of DARCY’s law | 1,2 | 3 | 4 |
| 1,2 | 1,2,3 | Numerical solution of Laplace’s equation. | 3 | 3 | 5 |
| 1,2 | 1,2,3 | Numerical solution of Laplace’s equation. | 3 | 3 | 6 |
| 1,2 | 1,2,3 | Steady groundwater flow systems. | 4 | 3 | 7 |
| 1,2 | 1,2,3 | Steady groundwater flow systems. | 4 | 3 | 8 |
| 1,2 | 1,2,3 | Steady groundwater flow systems. | 4 | 3 | 9 |
| 1,2 | 1,2,3 | Steady groundwater flow systems. | 4 | 3 | 10 |
| 1,2 | 1,2,3 | Unsteady groundwater flow systems. | 5 | 3 | 11 |
| 1,2 | 1,2,3 | Unsteady groundwater flow systems. | 5 | 3 | 12 |
| 1,2 | 1,2,3 | Superposition and Bounded aquifers | 6 | 3 | 13 |
| 1,2 | 1,2,3 | Superposition and Bounded aquifers | 6 | 3 | 14 |
| 1,2 | 1,2,3 | Superposition and Bounded aquifers | 6 | 3 | 15 |

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| ***15. Infrastructure*** | | |
| Groundwater Hydrology.  Seepage and groundwater flow. | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| Fundamentals of Ground Water plus EXCEL spread sheet design of Laplace’s Equation | Special requirements (include forexample workshops, periodicals,IT software, websites) | |
|  | Community-based facilities  (include for example, guest  Lectures , internship,field studies) | |
| ***16. Admissions*** | | |
|  | | Pre-requisites |
|  | | Minimum number of students |
| 45 – 50 | | Maximum number of students |
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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| University of Baghdad  College of Engineering | ***1. Teaching Institution*** |
| Department of Water Resources | ***2. University Department/Centre*** |
| **Drainage Engineering, 432 WRDE**  The course introduces the basic principles of drainage engineering including flow pattern of a pipe drainage system, analysis of the horizontal, vertical and radial components of flow, derivation and application of the steady and non-steady state equations, and application of the theory of an anisotropic model in drainage engineering. | ***3. Course title/code& Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Program(s) to which it Contributes*** |
| Semester System ; There is only one  mode of delivery, which is a “Day  Program”. The students are full time  students, and on campus. They attend  full day program in face-to-face  mode. The semester is composed of 15-week regular subjects. | ***5. Modes of Attendance offered*** |
| 2nd Semester, 2017-2018 | ***6. Semester/Year*** |
| 45 hrs / 3 hrs per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| Teaching Drainage Engineering principles and help to the student to design drainage systems.. | |

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| ***10·Learning Outcomes*** |
| Students will learn:   1. Flow pattern of a pipe drainage system 2. Analysis of the horizontal, vertical and radial components of flow 3. Derivation and application of the steady state equations 4. Derivation and applications of the non-steady state equations 5. Application of the theory of an anisotropic model in drainage engineering 6. How to design composite pipe collectors. 7. How to design interceptor drainage system. |
| ***11.Teaching and Learning Methods*** |
| 1. Lecture notes 2. Computer software 3. Internet sources |
| ***12. Assessment Methods***  1- Written exams  2- Quizzes and a computer project |
| ***13. Grading Policy***  1- Three monthly exams each= 10%  2-Final exam =70% |

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| ***14. Course Structure*** | | | | | |
| Assessment Method | Teaching Method | Topic Title | LO’s | Hours | Week |
| 1,2 | 1,2,3 | Groundwater Drainage Systems | 1,2 | 3 | 17 |
| 1,2 | 1,2,3 | Design of Pipe Drainage Systems for Groundwater Control | 1,2 | 3 | 18 |
| 1,2 | 1,2,3 | Design of Pipe Drainage Systems for Groundwater Control | 1,2 | 3 | 19 |
| 1,2 | 1,2,3 | Steady State Pipe Drainage Design Equations. | 3 | 3 | 20 |
| 1,2 | 1,2,3 | Steady State Pipe Drainage Design Equations. | 3 | 3 | 21 |
| 1,2 | 1,2,3 | Steady State Pipe Drainage Design Equations. | 3 | 3 | 22 |
| 1,2 | 1,2,3 | Unsteady State Pipe Drainage Design Equations. | 4 | 3 | 23 |
| 1,2 | 1,2,3 | Unsteady State Pipe Drainage Design Equations. | 4 | 3 | 24 |
| 1,2 | 1,2,3 | Unsteady State Pipe Drainage Design Equations. | 4 | 3 | 25 |
| 1,2 | 1,2,3 | Pipe Drainage Design of Anisotropic Soils. | 5 | 3 | 26 |
| 1,2 | 1,2,3 | Pipe Drainage Design of Anisotropic Soils. | 5 | 3 | 27 |
| 1,2 | 1,2,3 | Hydraulic Design of Lateral and Collector Pipe Drains. | 6 | 3 | 28 |
| 1,2 | 1,2,3 | Hydraulic Design of Lateral and Collector Pipe Drains. | 6 | 3 | 29 |
| 1,2 | 1,2,3 | Interceptor Drainage | 7 | 3 | 30 |

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| ***15. Infrastructure*** | | |
| Land Drainage Planning and Design.  Computing Drain spacing’s. | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| Guidelines and computer programs for the planning and design of land drainage systems.  Software DRAIN. | Special requirements (include for example workshops, periodicals, IT software, websites) | |
|  | Community-based facilities  (include for example, guest  Lectures , internship field studies) | |
| ***16. Admissions*** | | |
|  | | Pre-requisites |
|  | | Minimum number of students |
| 45 - 50 | | Maximum number of students |
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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resources Engineering | ***2. University Department/Centre*** |
| **Projects Management, 434 WRPM**  This course introduces the description of engineering projects management, methods procedure and equipment. Topics covered:  Principle of management and engineering projects, stages of executions engineering projects, engineering contract, methods of executions engineering projects, types of contracts, planning for schedule projects, method technique for evaluation review method, allocated resources, planning the work layout, equipment and machines for earth work, types of tractors, gradability, bulldozer, shovel, scrapers, power hovel, dragline, trucks, compacting machines and methods, stabilization of the soil, grader, and estimation.  This course is taught through 3 hrs per week, 2 hrs theoretical and 1 hr tutorial. | ***3. Course title/code & Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Programme(s) to which it Contributes*** |
| Annual system: there is only one mode of delivery, which is a day program. The students are full time students, and on campus. They attend full day program in face- to face mode. The academic year is composed of 30 weeks regular subjects. | ***5. Modes of Attendance offered*** |
| 1st and 2nd, Academic year 2017-2018. | ***6. Semester/Year*** |
| 90 hrs/3 hrs per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| 1. Introduce basic definitions and introductory concepts of management.  2. Introduce the description for construction projects stages.  3- Introduce the description of engineering contract, parts of the contract, and  description of responsibility for each party.  4. Explain and description of methods of execution the works, advantages and  disadvantages for each method.  5. Introduce the principles of planning for schedule projects, description of bar chart  method and analysis the network methods by using the critical path method.  6. Introduce the principles of techniques evaluation review project, statistical  distribution method for estimation probability of completion the project.  7. Description how to planning the layout the project and distribution layout for the  project campus.  8. General description of machines required for earth work and the production,  physical properties of soil, swelling, shrinkage, rolling resistance, and slopes.  9. Description the types of tractors, their moving, loads, speed and slopes required  for best efficiencies and production.  10- Explain the principle of gradability, and effecting on production of the machines  infiltration process, rate of infiltration and basic infiltration.  11- Description the basic work of bulldozer and calculation the production of the  machine.  12- Description the basic work of shovel and calculation the production of the  machine.  13- Description the basic work of scraper and calculation the production of the  machine.  14- Description the basic work of power shovel and calculation the production of  the machine.  15- Description the basic work of dragline and calculation the production of the  machine.  16- Description the basic work of trucks and calculation the production of the  machine.  17- Description and definition of the compaction, theory of bulb for load  distribution, procedure methods and equipment and machines used.  18- Calculation for production of compaction machines.  19- Description the basic work of grader and calculation the production of the  machine.  20- Definition of estimation, how to estimate the materials for engineering projects. | |

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| ***10·*** ***Learning Outcomes*** |
| a. Define the management and engineering projects.  b. Define the stages for engineering projects, the parts of the projects, owner,  engineer and the contractor, and their responsibility.  c. Define and description the engineering contract, parts of the contract and  conditions of the contract.  d. Description methods of execution the projects, advantages and disadvantages for  each methods, and to learn how to select the proper method for construction an  engineering project.  e. Understand the procedure for the planning of schedule the engineering project by  using bar chart method and network analysis method and find the completion data  of the project by critical path method (CPM).  f. Formulate and solve the probability completion of the project by using techniques  evaluation review method (PERT), and knowing how to use the normal  distribution method.  g. Define the method procedure for allocation resources, knowing the procedure for  allocation for materials, labor, and equipment, and to estimates the cost per day or  for the total cost required for the resources of the project.  h. Describe the layout of the work in the project area, how to arranged the campus  of the project, engineers, labors, materials, equipment, stores fence, entrance,  street, and movement of the machines.  i. Define the machine required for the earth work and calculate the production,  physical properties of the soil, types of the soil to be deal with, power required to  move the machines on the surface, rolling resistance power to overcome the  surface slope and the rolling resistance, factors affecting the efficiency of the  machines (altitude and temperature), cycle time, define the fixed and variable  times, cycle time and numbers of cycle.  j. Calculate the gradability required for the machine and related that with the  production of the machine.  k. Describe the type of the tractors, crawler and rubber tires types.  l. Describe the bulldozer and to know how to calculate the production of the  bulldozer for different speed and cycle time.  m. Describe the shovel and to know how to calculate the production of the shovel  for different speed and cycle time.  n. Describe the scraper and to know how to calculate the production of the  scraper for different speed and cycle time.  o. Describe the power shovel and to know how to calculate the production of the  power shovel for different speed and cycle time.  p. Describe the dragline and to know how to calculate the production of the  dragline for different speed and cycle time.  q. Describe the truck and to know how to calculate the production of the truck for  different speed and cycle time.  r. Describe and define the compaction, procedure test for the compaction, theory  of the bulb for load distribution, types of equipment for compaction, and  calculating the production of the compactor machine.  s. Describe and define the stabilization of the soil, methods used for the  stabilization.  t. Describe and define the estimation, estimation for earth excavation for  foundation, estimation for tiles work, external and internal walls plastering,  concrete preparing, mixing, transporting, and putting in the place, steel work,  paintings work for external and internal works and construction concrete works.  u. Be able to apply mathematics science and statistical tools to projects planning.  v. Identify, and solve engineering machines production problems. |
| ***11.*** ***Teaching and Learning Methods*** |
| a- Lectures  b- Tutorials  c- Homework and Assignments  d- Tests and Exams  e- In-Class Questions and Discussions  f- In class question work |
| ***12. Assessment Methods***  1. Examinations and Quizzes  2. Homework  3. Student Engagement during Lectures  4. In class questions work |

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| ***14. Course Structure*** | | | | | |
| Assessment Method | Teaching Method | LOs (article 10) | Topic title | Hours | Week |
| 1-4 of article (12) | a-f of article (11) | a, b | Introduction to Management and engineering projects | 3 | 1 |
| 1-4 of article (12) | a-f of article (11) | C | Engineering contract | 3 | 2 |
| 1-4 of article (12) | a-f of article (11) | D | Procedure for execution projects | 3 | 3 |
| 1-4 of article (12) | a-f of article (11) | e, f | Methods for execution projects | 3 | 4 |
| 1-4 of article (12) | a-f of article (11) | e, f, u | Planning for scheduling the projects | 3 | 5 |
| 1-4 of article (12) | a-f of article (11) | e, f, u | Planning for scheduling the projects | 3 | 6 |
| 1-4 of article (12) | a-f of article (11) | e, f, u | Techniques for estimation review project | 3 | 7 |
| 1-4 of article (12) | a-f of article (11) | G | Allocation resources | 3 | 8 |
| 1-4 of article (12) | a-f of article (11) | h, i, v | Machines for earth work | 3 | 9 |
| 1-4 of article (12) | a-f of article (11) | h, i, v | Machines for earth work | 3 | 10 |
| 1-4 of article (12) | a-f of article (11) | J | Gradability | 3 | 11 |
| 1-4 of article (12) | a-f of article (11) | k, v | Tractor | 3 | 12 |
| 1-4 of article (12) | a-f of article (11) | k, v | Tractor | 3 | 13 |
| 1-4 of article (12) | a-f of article (11) | l, v | Bulldozer | 3 | 14 |
| 1-4 of article (12) | a-f of article (11) | m, v | Shovel |  | 15 |
| 1-4 of article (12) | a-f of article (11) | n, v | Scraper | 3 | 16 |
| 1-4 of article (12) | a-f of article (11) | o, v | Power shovel | 3 | 17 |
| 1-4 of article (12) | a-f of article (11) | o, v | Power shovel | 3 | 18 |
| 1-4 of article (12) | a-f of article (11) | p, v | Dragline | 3 | 19 |
| 1-4 of article (12) | a-f of article (11) | p, v | Dragline | 3 | 20 |
| 1-4 of article (12) | a-f of article (11) | q, v | Trucks | 3 | 21 |
| 1-4 of article (12) | a-f of article (11) | q, v | Trucks | 3 | 22 |
| 1-4 of article (12) | a-f of article (11) | R | Soil compaction | 3 | 23 |
| 1-4 of article (12) | a-f of article (11) | r, v | Methods of compaction machines | 3 | 24 |
| 1-4 of article (12) | a-f of article (11) | S | Soil stabilization | 3 | 25 |
| 1-4 of article (12) | a-f of article (11) | S | Soil stabilization | 3 | 26 |
| 1-4 of article (12) | a-f of article (11) | T | Estimation | 3 | 27 |
| 1-4 of article (12) | a-f of article (11) | T | Estimation | 3 | 28 |

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| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | 1-4 of article (12) | a-f of article (11) | t | Estimation | 3 | 29 | | 1-4 of article (12) | | a-f of article (11) | t | Estimation | 3 | 30 |   ***15. Infrastructure*** | | |
| **Textbook**  “Construction Planning, Equipment and Methods” by R.L. Peurifoy.  **References**   1. “Project Management- A managerial Approach” by Merdith Mantel, Wiely. 2. Web-Site notebooks and research papers. | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
|  | Special requirements (include for example workshops, periodicals, IT software, websites) | |
|  | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***16. Admissions*** | | |
|  | | Pre-requisites |
| 40 | | Minimum number of students |
| 55 | | Maximum number of students |
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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resources | ***2. University Department/Centre*** |
| **Analysis of Water Resources Systems,** [**435**](file:///D:\maysam\UNIVERCITY\ادارية\قسم%20الموارد%20المائية\لجنة%20الجودة%20والاعتمادية\2016\اكتمل%20وسلم\استمارة%20وصف%20البرنامج%20الاكاديمي%202016\وصف%20البرنامج%20الاكاديمي\مفردات3,4\EW450%20%20Analysis%20of%20Water%20Resources%20System.doc) **WRAS**  Water Resources Systems Analysis refers to the application of science of optimization in the field of water resources engineering. The course provides a basic concepts and methods that can help the water resources engineer in making his decision. The course is focused on the concepts and procedures used in formulation and solving problems in the field of water resources engineering. The students will be familiar with the applications in this field of engineering that can be addressed using linear and nonlinear optimization. | ***3. Course title/code & Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Program(s) to which it Contributes*** |
| One time, day time on campus | ***5. Modes of Attendance offered*** |
| 1st and 2nd Semesters, Academic year 2017 –2018 | ***6. Semester/Year*** |
| 60 hours, 2 hrs theoretical per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course:***  to teach the student the basic concepts and methods to select the optimal solution among the feasible solutions and its applications in water resources. | |

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| ***10·*** ***Learning Outcomes*** the student in the field of water resources engineering will be able to:   1. understand the concepts of optimization, 2. formulate optimization problems in mathematical forms, 3. manipulate the mathematical forms, 4. solve linear mathematical forms, and 5. solve nonlinear mathematical forms. |
| ***11.*** ***Teaching and Learning Methods***  a- lectures,  b- tutorials, and  c- supervised team work.. |
| ***12. Assessment Methods***  a- homework**,**  b- quizzes,  c- major examination during the course, and  d- final examination. |
| ***13. Grading Policy***  - Quizzes and Homework 15%  - Thee major examinations 15%  - Final examination 70% |

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| ***14. Course Structure*** | | | | | |
| Assessment  Method  (Article 12) | Teaching  Method  (Article 11) | Unit/Module or  Topic Title | LO's  (Article 10) | Hours | Week |
| a, b, c and d | a | Introduction | a | 2 | 1 |
| a, b, c and d | a, b, and c | Mathematical formulation | a and b | 4 | 2-3 |
| a, b, c and d | a, b, and c | Problem manipulation | a, b and c | 2 | 4 |
| a, b, c and d | a, b, and c | Linear problems: graphical method | a and d | 4 | 5-6 |
| a, b, c and d | a, b, and c | One phase simplex method | a and d | 4 | 7-8 |
| a, b, c and d | a, b, and c | Two phase simplex method | a and d | 2 | 9 |
|  |  | Examination |  | 2 | 10 |
| a, b, c and d | a, b, and c | Duality in linear problems | a and d | 4 | 11-12 |
| a, b, c and d | a, b, and c | Transportation problems | a and d | 4 | 13-14 |
| a, b, c and d | a, b, and c | Assignment problems | a and d | 2 | 15 |
| a, b, c and d | a, b, and c | Examination |  | 2 | 16 |
| a, b, c and d | a, b, and c | Network problems | a and d | 4 | 17-18 |
| a, b, c and d | a, b, and c | Introduction to nonlinear problems | a and e | 2 | 19 |
| a, b, c and d | a, b, and c | Extreme values of functions | a and e | 2 | 20 |
| a, b, c and d | a, b, and c | Methods of solution | a and e | 2 | 21 |
| a, b, c and d | a, b, and c | Newton method | a and e | 2 | 22 |
| a, b, c and d | a, b, and c | Hook and Jeeves Method | a and e | 2 | 23 |
| a, b, c and d | a, b, and c | Nelder and Mead method | a and e | 2 | 24 |
| a, b, c and d | a, b, and c | Steepest ascent method | a and e | 2 | 25 |
| a, b, c and d | a, b, and c | Rosenbrook method | a and e | 2 | 26 |
|  |  | Examination |  | 2 | 27 |
| a, b, c and d | a | Optimal management of water resources |  | 4 | 28-29 |
|  |  | Examination |  | 2 | 30 |

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| ***15. Infrastructure*** | | |
| * Hamdy A. Taha , Operation Research. * McCormick, G.P., Nonlinear Programming: Theory and Applications, Wiley, Hoboken, NJ. * Lectures notes of Prof. Dr. A. M. Ali | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
|  | Special requirements (include for example workshops, periodicals, IT software, websites) | |
|  | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***16. Admissions*** | | |
| GE101, GE201, and WRE355 | | Pre-requisites |
| - | | Minimum number of students |
| 30 | | Maximum number of students |
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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| University of Baghdad  College of Engineering | ***1. Teaching Institution*** |
| Department of Water Resources | ***2. University Department/Centre*** |
| **Dams Engineering 436 WRDE**  This course introduces the description of Dams type, investigation ,studies ,design and supervision of dams ,reservoir and hydropower projects  The course is  taught through 3 hrs per week, 2  Theoretical, 1 tutorial | ***3. Course title/code & Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Program(s) to which it Contributes*** |
| Annual System ; There is only one  mode of delivery, which is a “Day  Program”. The students are full time  Students and, on campus. They attend full day program in face-to-face mode. The academic year is composed of 30-week regular subjects. | ***5. Modes of Attendance offered*** |
| 1st and 2nd , Academic Year 2017 – 2018 | ***6. Semester/Year*** |
| 90 hrs / 3 hrs per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| 1. Definitions of Dams and dam investigation. 2. Definitions reservoir and determination capacity of reservoir 3. Determine reservoir sedimentation and dam grouting 4. Definitions of earth dam and type section 5. Explain Preliminary design of Earth dams 6. Explain the seepage analysis and control 7. Definitions dam failure and Stability of earth dams 8. Explain types of gravity dams and forces acting on gravity dams 9. Explain Preliminary design of gravity dams 10. Definition and types of spillways 11. Planning for power house and Energy dissipaters | |

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| ***10·*** ***Learning Outcomes*** |
| At the end of the class, the student will be able to:   1. Understand general introduction about dam and investigation 2. Understand dam foundation and grouting 3. Determination capacity of reservoir 4. Understand Preliminary design of Earth dams 5. Understand the seepage analysis and control for earth dam 6. dam failure and Stability of earth dams 7. Understand types of gravity dams and forces acting 8. Understand and Explain Preliminary design of gravity dams 9. Understand and Definition types of spillways 10. Planning for power house and Energy dissipaters |
| ***11.*** ***Teaching and Learning Methods*** |
| 1. Lectures  2. Tutorials  3. Homework and Assignments  4. Tests and Exams  5. In-Class Questions and Discussions  6. Connection between Theory and Application  7. Extracurricular Activities |
| ***12. Assessment Methods***  1. Examinations, Tests, and Quizzes  2. Extracurricular Activities  3. Student Engagement during Lectures  4. Responses Obtained from Students, Questionnaire about  Curriculum and Faculty Member (Instructor) |
| ***13. Grading Policy***  1. Quizzes:  - There will be a (6 – 8) closed books and notes quizzes during the academic  year.  - The quizzes will count 5% of the total course grade.  2. Extracurricular Activities, this is optional and will count extra marks ( 1 – 5 % )  for the student, depending on the type of activity.  3. Exams:  - There will be three exams during the academic course,  - The exams will count 20% of the total course grade.  4. Final Exam:  - The final exam will be comprehensive, closed books and  notes, and will take place on January 2014 from 9:00 AM - 12:00 PM  in class rooms (w1+w2)  - The final exam will count 70% of the total course grade |

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| ***14. Course Structure*** | | | | | |
| **Assessment**  **Method** | **Teaching**  **Method** | **Unit/Module or**  **Topic Title** | **LO’s**  **( Article**  **10 )** | **Hours** | **Week** |
| 1 – 4 of article (12) | 1-7 of article (11) | Introduction | a | 2 (theo.) +1 (tut.) | 1 |
| 1 – 4 of article (12) | 1-7 of article (11) | Investigation for dams | a,b | 2 (theo.) +1 (tut.) | 2 |
| 1 – 4 of article (12) | 1-7 of article (11) | Determination capacity of reservoir | a,b,c | 2 (theo.) +1 (tut.) | 3 |
| 1 – 4 of article (12) | 1-7 of article (11) | Reservoir sedimentation | a,b,c,d | 2 (theo.) +1 (tut.) | 4 |
| 1 – 4 of article (12) | 1-7 of article (11) | Types of dams | a,b,c,d | 2 (theo.) +1 (tut.) | 5 |
| 1 – 4 of article (12) | 1-7 of article (11) | Dams grouting | a,b,c,d | 2 (theo.) +1 (tut.) | 6 |
| 1 – 4 of article (12) | 1-7 of article (11) | Types of earth dams | a,b,c,d | 2 (theo.) +1 (tut.) | 7 |
| 1 – 4 of article (12) | 1-7 of article (11) | Preliminary section | a,b,c,d | 2 (theo.) +1 (tut.) | 8 |
| 1 – 4 of article (12) | 1-7 of article (11) | Design of preliminary section | a,b,c,d,e | 2 (theo.) +1 (tut.) | 9 |
| 1 – 4 of article (12) | 1-7 of article (11) | Seepage analysis | a,b,c,d,e | 2 (theo.) +1 (tut.) | 10 |
| 1 – 4 of article (12) | 1-7 of article (11) | Seepage control | a,b,c,d,e | 2 (theo.) +1 (tut.) | 11 |
| 1 – 4 of article (12) | 1-7 of article (11) | Dams failures | a,b,c,d,e,f | 2 (theo.) +1 (tut.) | 12 |
| 1 – 4 of article (12) | 1-7 of article (11) | Stability of earth dams | a,b,c,d,e,f | 2 (theo.) +1 (tut.) | 13 |
| 1 – 4 of article (12) | 1-7 of article (11) | Types of gravity dams | a,b,c,d,e,f,g | 2 (theo.) +1 (tut.) | 14 |
| 1 – 4 of article (12) | 1-7 of article (11) | Forces acting on gravity dams | a,b,c,d,e,f,g | 2 (theo.) +1 (tut.) | 15 |
| 1 – 4 of article (12) | 1-8 of article (11) | Forces acting on gravity dams | a,b,c,e | 2 (theo.) +1 (tut.) | 16 |
| 1 – 4 of article (12) | 1-8 of article (11) | Preliminary design | a,b,c,d,e, | 2 (theo.) +1 (tut.) | 17 |
| 1 – 4 of article (12) | 1-8 of article (11) | Stability of gravity dams | a,b,c,d,e, | 2 (theo.) +1 (tut.) | 18 |
| 1 – 4 of article (12) | 1-8 of article (11) | Arch dams | a,b,c,d,e, | 2 (theo.) +1 (tut.) | 19 |
| 1 – 4 of article (12) | 1-8 of article (11) | Types of spillways | a,b,c,d,e,f,g | 2 (theo.) +1 (tut.) | 20 |
| 1 – 4 of article (12) | 1-8 of article (11) | Types of spillways | a,b,c,d,e,f,g,h | 2 (theo.) +1 (tut.) | 21 |
| 1 – 4 of article (12) | 1-8 of article (11) | Design of ogee spillway | a,b,c,d,e,f,g,h | 2 (theo.) +1 (tut.) | 22 |
| 1 – 4 of article (12) | 1-8 of article (11) | Design of ogee spillway | a,b,c,d,e,f,g,h, | 2 (theo.) +1 (tut.) | 23 |
| 1 – 4 of article (12) | 1-8 of article (11) | Energy dissipaters | a,b,c,d,e,f,g,h,I, | 2 (theo.) +1 (tut.) | 24 |
| 1 – 4 of article (12) | 1-8 of article (11) | Energy dissipaters | a,b,c,d,e,f,g,h,I, | 2 (theo.) +1 (tut.) | 25 |
| 1 – 4 of article (12) | 1-8 of article (11) | Energy dissipaters | a,b,c,d,e,f,g,h,I,j, | 2 (theo.) +1 (tut.) | 26 |
| 1 – 4 of article (12) | 1-8 of article (11) | Planning for power house | a,b,c,d,e,f,g,h,I,j, | 2 (theo.) +1 (tut.) | 27 |
| 1 – 4 of article (12) | 1-8 of article (11) | Planning for power house | a,b,c,d,e,f,g,h,I,j, | 2 (theo.) +1 (tut.) | 28 |
| 1 – 4 of article (12) | 1-8 of article (11) | Flow and power duration curves | a,b,c,d,e,f,g,h,I,j, | 2 (theo.) +1 (tut.) | 29 |
| 1 – 4 of article (12) | 1-8 of article (11) | Elements of powerhouse | a,b,c,d,e,f,g,h,I,j, | 2 (theo.) +1 (tut.) | 30 |

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| ***15. Infrastructure*** | | |
| **Textbook**  “Irrigation Drawing”, Arabic book by Abd Al-Riza, Abd Al-Rasool, Baghdad, 1992  .  **References**   * Irrigation Water Power and Water Resources Engineering By K.R.Arrora * Earth –Rock Dams By James.LSherard * Design of small dams U.S.B.R   ***Others***  1. Notebook prepared by the instructor of the course  2. Collection of sheets of solved and  unsolved problems and Exams questions | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| Available websites related to the subject.  Extracurricular activities. | Special requirements (include for example workshops, periodicals, IT software, websites) | |
| * Extra lectures by foreign guest lecturers. | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***16. Admissions*** | | |
| GE 101 and GE 201 | | Pre-requisites |
| 40 | | Minimum number of students |
| 60 | | Maximum number of students |
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**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resources | ***2. University Department/Centre*** |
| **Applied Hydraulics,** [**437**](file:///D:\maysam\UNIVERCITY\ادارية\قسم%20الموارد%20المائية\لجنة%20الجودة%20والاعتمادية\2016\اكتمل%20وسلم\استمارة%20وصف%20البرنامج%20الاكاديمي%202016\وصف%20البرنامج%20الاكاديمي\مفردات3,4\EW450%20%20Analysis%20of%20Water%20Resources%20System.doc) **WRAH**  This course is designed to be given to students in the field of water resources engineering. The hydraulic principles will applied to solve different practical problems related to: pumping stations, water distribution networks, hydraulic turbines, and unsteady flow in pipes and open channels. | ***3. Course title/code & Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Program(s) to which it Contributes*** |
| One time, day time on campus | ***5. Modes of Attendance offered*** |
| The second semester of the academic year 2017 –2018 | ***6. Semester/Year*** |
| 45 hours, 2 hrs theoretical and 1 hr tutorial per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course:***  To apply the theoretical basics of hydraulics, which students had learned in previous years, in different practical applications. | |

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| ***10·*** ***Learning Outcomes*** the student will be able to:   1. analyze and design of pumping systems hydraulics, 2. estimate the water demand 3. analyze water distribution networks, 4. analyze turbine systems hydraulics, 5. understand water hammer phenomenon and analyze some simple cases, 6. understand unsteady flow in open channels, and 7. work in teams. |
| ***11.*** ***Teaching and Learning Methods***  a- lectures,  b- tutorials, and  c- supervised team work. |
| ***12. Assessment Methods***  a- homework**,**  b- quizzes,  c- major examination during the course, and  d- final examination. |
| ***13. Grading Policy***  - Quizzes and Homework 15%  - Two major examinations 15%  - Final examination 70% |

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| ***14. Course Structure*** | | | | | |
| Assessment  Method  (Article 12) | Teaching  Method  (Article 11) | Unit/Module or  Topic Title | LO's  (Article 10) | Hours | Week |
| a, b, c, and d | a, b, and c | Introduction, Pumps types and its hydraulics | a and g | 3  2 theo  1 tut | 16 |
| a, b, c, and d | a, b, and c | Pumps curves and pumps connection | a and g | 3  2 theo  1 tut | 17 |
| a, b, c, and d | a, b, and c | Similarity, cavitation and selection of pumps | a and g | 6  4 theo  2 tut | 18, 19 |
| a, b, c, and d | a, b, and c | Estimation of Water demand | b and g | 3  2 theo  1 tut | 20 |
| a, b, c, and d | a, b, and c | Water distribution system analysis: Hardy Cross method | c and g | 6  4 theo  2 tut | 21, 22 |
|  |  | Review and examination |  | 3  2 theo  1 tut | 23 |
| a, b, c, and d | a, b, and c | Hydraulic Turbines | d and g | 6  4 theo  2 tut | 24, 25 |
| a, b, c, and d | a, b, and c | Water Hammer | e and g | 6  4 theo  2 tut | 26, 27 |
| a, b, c, and d | a, b, and c | Unsteady flow in open channels | f and g | 6  4 theo  2 tut | 28, 29 |
|  |  | Review and examination |  | 3  2 theo  1 tut | 30 |

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| ***15. Infrastructure*** | | |
| * *Chaudary, M. H., Transient analysis*. * Karassik, H. et al., *Pumps Hand Book*. | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
|  | Special requirements (include for example workshops, periodicals, IT software, websites) | |
| Field visits | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***16. Admissions*** | | |
| WRE320 | | Pre-requisites |
| - | | Minimum number of students |
| 30 | | Maximum number of students |

**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Department of Water Resources Engineering | ***2. University Department/Centre*** |
| **Engineering Economy, 438 WREE**  This course introduces a preliminary description of engineering economy. It is also useful for engineers in business-related curricula concerned with economic analysis of alternatives by using sophisticated nonmathematical methods. The course is designed to provide a background of the working system to finance companies. The course provides a means to evaluate engineering projects and their alternatives. | ***3. Course title/code& Description*** |
| B.Sc. in Water Resources Engineering (WRE) | ***4. Program(s) to which it Contributes*** |
| Annual system; There is only 0ne mode of delivery, which is a "Day Program ".The students are full time students, and on campus. They attend full day program in face-to-face. The academic year is composed of 15-week regular subjects. Each week there are three lectures, and each lecture 50-mintues. | ***5. Modes of Attendance offered*** |
| 1st Semester | ***6. Semester/Year*** |
| 45 | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course***  1- Graduate water resources engineers to serve in water resource management.  2- Improving the teaching and the administrative activities to meet international  accreditation standards and the mission of department.  3- Improving the academic abilities of the faculty and attracting highly skilled  personnel.  4- Improve the abilities of management and technical support staff and attract the  highly skilled for employment.  5-Optimum use of resources and potential of the department. | |
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| ***10·Learning Outcomes***  At the end of the class, the student will be able to:  a-Define economics in general and all terms that will be used at the course .  b- Know about types of interest and their effects on present value and estimation  of the future value.  c- Give the students a sound understanding of the basic aspects of the subject and  some insight into approaches that can be used for making sound economic  decisions concerning the type of problem he is likely to encounter in his  engineering career.  d- Know about the depreciation and its effect on the asset.  e- Acquire a solid base for further studies after graduation ,which will permit him to  understand and use more advanced, and constantly developing ,procedures  needed to help in analyzing the more complex economic problem that he may  encounter in his career.  f- Evaluate engineering projects.  g- Be able to carry out economics studies and alternatives. |
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| ***11.Teaching and Learning Methods***  1-Lectures  2- Tutorials  3-Homework and Assignment  4-Test and Exams  5-In class Questions and Discussion |
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| ***12. Assessment Methods***  Survey of Alumni.-  -The related committees in the department such as scientific, QA, student affair.  -Employment trends of our graduates will be tracked, e.g., place of employment  and job title. |
| ***13. Grading Policy***  1-There will be 3 - 4 closed book and notes examinations, these  examinations will count 30% of the total grade.  2-The final exam will be comprehensive, closed book and notes, and will  take place in January 2014.  -The final exam will count 70% of total course grade |

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| ***14. Course Structure*** | | | | | |
| Assessment Method | Teaching Method | Topic Title | LO’s | Hours | Week |
| 1-3 of article (12) | 1-5 of article (11) | Introduction | a | 3 th | 1 |
| 1-3 of article (12) | 1-5 of (11) article | Interest –Simple | a, b | 3 th | 2 |
| 1-3 of article (12) | 1-5of article (11) | Compound Interest | a, b | 3 th | 3 |
| 1-3 of article (12) | 1-5 of article (11) | Nominal Interest | b, c | 3 th | 4 |
| 1-3 of article (12) | 1-5 of article (11) | Depreciation and Valuation | d | 3 th | 5 |
| 1-3 of article (12) | 1-5of article (11) | Straight Line Method | d | 3 th | 6 |
| 1-3 of article (12) | 1-5 of article (11) | Declining Balance Method | d | 3 th | 7 |
| 1-3 of article (12) | 1-5 of article (11) | The Sum of Year Digits Method | d | 3 th | 8 |
| 1-3 of article (12) | 1-5 of article (11) | The Sinking Fund Method | d | 3 th | 9 |
| 1-3 of article (12) | 1-5 of article (11) | Basic Method for Making Economic Studies | e, f | 3 th | 10 |
| 1-3 of article (12) | 1-5 of article (11) | I.R.R Method | e, f | 3 th | 11 |
| 1-3 of article (12) | 1-5 of article (11) | E.R.R. Method | f, g | 3 th | 12 |
| 1-3 of article (12) | 1-5 of article (11) | A.W. Method | f, g | 3 th | 13 |
| 1-3 of article (12) | 1-5 of article (11) | P.W. Method | f, g | 3 th | 14 |
| 1-3 of article (12) | 1-5 of article (11) | Alternatives | g | 3 th | 15 |

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| ***15. Infrastructure*** | | |
| Text Book  Engineering Economy  (fifth edition ),by E. Paul De Garmo ,Jhon R. Canada.1973,Macmillan Publishing Co.,Inc. | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
|  | Special requirements (include forexample workshops, periodicals,IT software, websites) | |
|  | Community-based facilities  (include for example, guest  Lectures , internship ,field studies) | |
| ***16. Admissions*** | | |
|  | | Pre-requisites |
| / | | Minimum number of students |
| 50 | | Maximum number of students |

**FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAM REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification. |

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| University of Baghdad  College of Engineering | ***1. Teaching Institution*** |
| Department of Water Resources | ***2. University Department/Centre*** |
| **Water Quality 439 WREC**  This course introduces description of water quality in water surface and lake and groundwater  The course is  taught through 3 hrs per week, 2  Theoretical, 1 tutorial. | ***3. Course title/code & Description*** |
| B Sc degree in Water Resources Engineering (WRE) | ***4. Programme(s) to which it Contributes*** |
| Semester System ; There is only one  mode of delivery, which is a “Day  Program”. The students are full time  Students and, on campus. They attend  full day program in face-to-face mode. The academic semester is composed of 15-week regular subjects. | ***5. Modes of Attendance offered*** |
| 2nd Semester, Academic year 2017 – 2018 | ***6. Semester/Year*** |
| 45 hrs / 3 hrs 2 theoretical and 1 hr tutorial per week | ***7. Number of hours tuition (total)*** |
| 2017 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| 1. General review of open channel hydraulic 2. Definitions and introductory concepts of water quality. 3. Definitions and introductory concepts of water and pollution processes in rivers, lakes and ground water 4. Definitions of surface water pollution 5. Explain and definition source of pollution type 6. Explain discharge of pollutant into river and mixing zone 7. Definitions conservative and non-conservative pollutant 8. Explain and definition surface water impurities 9. Definitions BOD and Oxygen sag curve 10. Definition Iraqi law for water quality protection in river No. 25 for 1967 11. Assessment the water quality in Iraq rivers and surface water | |

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| ***10·*** ***Learning Outcomes*** |
| At the end of the class, the student will be able to:   1. Define and introduce concepts of water quality 2. Understand and apply concepts of water quality and pollution processes in rivers and lakes 3. Understand and apply the different steps of the monitoring cycle in rivers and lakes; 4. Understand the basic concepts of groundwater quality and monitoring; 5. Apply common statistical techniques for water quality data evaluation; 6. Design sound and sustainable freshwater quality monitoring and assessment programs under specified conditions. 7. Understand modeling BOD/DO in a river system 8. Understand and apply the Iraqi law for water quality protection in river No. 25 for 1967 9. Understand and apply the water quality in Iraq rivers and water surface |
| ***11.*** ***Teaching and Learning Methods*** |
| 1. Lectures  2. Tutorials  3. Homework and Assignments  4. Tests and Exams  5. In-Class Questions and Discussions  6. Connection between Theory and Application  7. Extracurricular Activities |
| ***12. Assessment Methods***  1. Examinations, Tests, and Quizzes  2. Extracurricular Activities  3. Student Engagement during Lectures  4. Responses Obtained from Students, Questionnaire about  Curriculum and Faculty Member (Instructor) |
| ***13. Grading Policy***  1. Quizzes:  - There will be a (6 – 8) closed books and notes quizzes during the academic  year.  - The quizzes will count 5% of the total course grade.  2. Extracurricular Activities, this is optional and will count extra marks (1 – 5 %)  for the student, depending on the type of activity.  3. Exams:  - There will be three exams during the academic course,  - The exams will count 20% of the total course grade.  4. Final Exam:  - The final exam will be comprehensive, closed books and will take place on  Monday June 2014 from 9:00 AM - 11:30 PM. in class rooms (w1+w2)  - The final exam will count70% of the total course grade |

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| ***14. Course Structure*** | | | | | |
| **Assessment**  **Method** | **Teaching**  **Method** | **Unit/Module or**  **Topic Title** | **LOs**  **( Article**  **10 )** | **Hours** | **Week** |
| 1 – 4 of article (12) | 1-7 of article (11) | General review of open channel hydraulic | a | 2 (theo.) +1 (tut.) | 1 |
| 1 – 4 of article (12) | 1-7 of article (11) | concepts of water quality | a,b | 2 (theo.) +1 (tut.) | 2 |
| 1 – 4 of article (12) | 1-7 of article (11) | Concentration expressing | a,b,c | 2 (theo.) +1 (tut.) | 3 |
| 1 – 4 of article (12) | 1-7 of article (11) | pollution type | a,b,c,d | 2 (theo.) +1 (tut.) | 4 |
| 1 – 4 of article (12) | 1-7 of article (11) | pollutant discharge into river | a,b,c,d | 2 (theo.) +1 (tut.) | 5 |
| 1 – 4 of article (12) | 1-7 of article (11) | conservative pollutant | a,b,c,d | 2 (theo.) +1 (tut.) | 6 |
| 1 – 4 of article (12) | 1-7 of article (11) | non conservative pollutant | a,b,c,d | 2 (theo.) +1 (tut.) | 7 |
| 1 – 4 of article (12) | 1-7 of article (11) | Impurities in surface water | a,b,c,d | 2 (theo.) +1 (tut.) | 8 |
| 1 – 4 of article (12) | 1-7 of article (11) | Impurities in lake | a,b,c,d,e | 2 (theo.) +1 (tut.) | 9 |
| 1 – 4 of article (12) | 1-7 of article (11) | Impurities in ground water | a,b,c,d,e | 2 (theo.) +1 (tut.) | 10 |
| 1 – 4 of article (12) | 1-7 of article (11) | BOD curve | a,b,c,d,e | 2 (theo.) +1 (tut.) | 11 |
| 1 – 4 of article (12) | 1-7 of article (11) | Oxygen sag curve | a,b,c,d,e,f | 2 (theo.) +1 (tut.) | 12 |
| 1 – 4 of article (12) | 1-7 of article (11) | Oxygen sag curve | a,b,c,d,e,f | 2 (theo.) +1 (tut.) | 13 |
| 1 – 4 of article (12) | 1-7 of article (11) | Iraqi law No. 25 for 1967 | a,b,c,d,e,f,g | 2 (theo.) +1 (tut.) | 14 |
| 1 – 4 of article (12) | 1-7 of article (11) | water quality in Iraq rivers | a,b,c,d,e,f,g | 2 (theo.) +1 (tut.) | 15 |

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| ***15. Infrastructure*** | | |
| **Textbook**  Principles of Water Quality Control by T.H.Y. Tebbutt 5ed. 1998  **References**   1. Environmental Engineering by Davis& Cornwell 3rd ed. McGrawHill 2. Environmental Engineering by Kiely McGrawHill 3. Water Resources Engineering by Linsley &Franzini 3rd ed.   ***Others***  1. Notebook prepared by the instructor of the  course  2. Collection of sheets of solved and  solved problems and Exams questions | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| Available websites related to the subject.  Extracurricular activities. | Special requirements (include for example workshops, periodicals, IT software, websites) | |
| * Extra lectures by foreign guest lecturers. | Community-based facilities  (include for example, guest  Lectures , internship , field studies) | |
| ***16. Admissions*** | | |
|  | | Pre-requisites |
| 40 | | Minimum number of students |
| 60 | | Maximum number of students |

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