المركز الوطني للقياس والتقويم في التعليم العالي
National Center for Assessment in Higher Education

Students Manual for the Exam

General Engineering and Civil Engineering Discipline

- March 2014 -

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1. Aim of Manual

The aim of this Manual is to provide information to the students about the exam objective, structure, timing, and general rules.

2. Overview of Exam

- This engineering exam is planned by the ministry of higher education and administered by Qiyas center.
- It is aimed at examining engineering students in all Saudi Engineering Colleges in their last year of study.
- The exam is Multiple Choice Questions (MCQ) and is divided into two sessions: a morning session devoted to General Skills and General Engineering, and an evening session devoted to disciplines (chemical, civil, computer, electrical, industrial, mechanical and architecture).
- One purpose of the exam is to assess the educational learning outcomes in various programs across the engineering colleges in Saudi Arabia.
- The exam tests the students in the General Skills and also in the four key learning areas:
    - Basic Sciences and Engineering Fundamentals
    - Engineering Analysis and Investigation
    - Engineering Design
    - Engineering Practice
- The results of the students in this exam are kept confidential and are used for statistical analysis.

3. Exam Structure and Organization

3.1 Eligibility for Exam

Bachelor degree holders in Civil Engineering and those who are in the final year of such program are eligible to take the exam.

3.2 Exam Structure

The exam consists of two sessions (3-hours each) during one day (one session in the morning and the other in the afternoon) with two hours break between the two sessions, as follows:

Session 1:

The 3-hours morning session consists of 1 hour (44 questions) for General Skills and 2 hours (60 questions) for General Engineering Skills.

The General Skills consist of:

- Communication skills
- Numeracy and calculation skills
- Computer literacy skills
- Interpersonal skills
- Problem solving skills
- Learning and performance improvement skills

The General Engineering Skills cover the following topics:

- Mathematics
- Numerical Techniques
- Probability and Statistics
- Physics
- Statics and Dynamics
- Electricity and Magnetism
- Chemistry
- Thermodynamics
- Fluid mechanics
- Materials Science
- Engineering Drawing
- Process Economics
- Project management
- Codes, Ethics, Environment and Social issues

Each question is a multiple choice question with 4 choices for the answer.

Session 2:

The 3-hours evening session is devoted to subjects of Civil Engineering Discipline. The session consists of 50 questions carrying a maximum of 100 marks. Each question is a multiple choice question with 4 choices for the answer. In this session, the following subjects are covered:

- Engineering Mechanics
- Fluid Mechanics
- Material Sciences
- Surveying
- Structural Analysis
- Construction Materials

- Geotechnical Engineering
- Transportation Engineering
- Water / Waste Engineering
- Construction Management
- Environmental Engineering
- Water Resources Engineering
- Construction Management
- Structural Engineering

3.3 Exam Type

The exam is paper based and all questions are multiple choice questions. Each question has 4 choices for the answer. There is no negative marking for wrong answers.

3.4 Exam Rules

- Books, lecture notes, or another type of material are not allowed in the exam
- Approved calculators are allowed to do the necessary calculations
- Admission in the examination center will be only through authorities admit card issued by examination authority
- Necessary reference sheets, monographs, equations and/or relevant data will be provided during the exam.

4. Sample Questions for General Engineering (session 1)

Question #1

Question Statement:

The inverse (if it exists) of the matrix $\begin{pmatrix} \alpha & -\beta \\ \beta & \alpha \end{pmatrix}$ is:

A) $\begin{pmatrix} \boldsymbol{\alpha} & \boldsymbol{-\beta} \\ \boldsymbol{\beta} & \boldsymbol{\alpha} \end{pmatrix}$

B) $\frac{1}{\alpha^2+\beta^2}\begin{pmatrix} \boldsymbol{\alpha} & \boldsymbol{-\beta} \\ \boldsymbol{\beta} & \boldsymbol{\alpha} \end{pmatrix}$

C) $\frac{1}{\alpha^2+\beta^2}\begin{pmatrix} \boldsymbol{\alpha} & \boldsymbol{\beta} \\ \boldsymbol{-\beta} & \boldsymbol{\alpha} \end{pmatrix}$

D) $\frac{1}{\alpha^2-\beta^2}\begin{pmatrix} \boldsymbol{\alpha} & \boldsymbol{-\beta} \\ \boldsymbol{\beta} & \boldsymbol{\alpha} \end{pmatrix}$

Reference Sheet: None

Remarks: The objective of this question is to test the examinee ability to solve a simple linear algebra problem involving a 2x2 matrix inversion.

Question #2

Question Statement:

Consider the following instructions:

1. Start
2. Set x = 10, y = 5
3. If x> y then go to step 4; otherwise go to step 6
4. Replace x by x + 1 and y by 2(y − 1)
5. Go to step 3
6. Print y, x
7. End

After executing these instructions, the numbers that are printed are:

A) 8, 11
B) 8,12
C) 12,14
D) 14,12

Reference Sheet: None

Remarks: The objective of this question is to test the examinee ability to solve an iteration-based problem.

Question #3

Question Statement:

Consider the following data: −1, 1, 2, 3 and 7. The mean and the standard deviation of the data are:

A) 2.4 and 2.653
B) 2.4 and 7.040
C) 2.4 and 5.931
D) 12 and 2.653

Reference Sheet: None

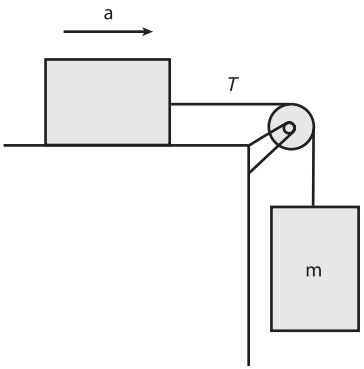
Remarks: The objective of this question is to test the examinee ability to understand the basic concepts of mean and standard deviation.

Question #4

Question Statement:

If the tension, *T*, is 14 N and the magnitude of the acceleration, a, is 3.0 m/s^2, the mass, *m* (kg) of the suspended object is :
(Assume that all surfaces and the pulley are frictionless. Take g = 10 m/s^2)

A) 3.1
B) 2.8
C) 2.0
D) 1.2



Reference Sheet: None

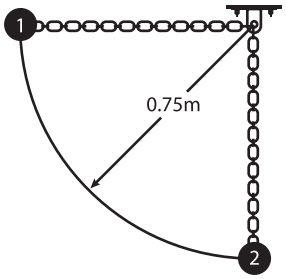
Remarks: This question tests the examinee ability to apply the Newton law and the understanding of the gravity force.

Question #5

Question Statement:

If the pendulum is released from position 1, its velocity (m/s) in position 2 is:

A) 3.8
B) 6.9
C) 14.7
D) 21.0



Reference Sheet: None

Remarks: This question is an illustration of the application of conservation of energy.

Question #6
Question Statement:

The resistance (Ω) of a 2 meter wire having a cross sectional area of 2 mm^2 and a resistivity of 5 x 10^{-8} Ω.m is:

A) 0.001
B) 0.03
C) 0.05
D) 1000

Reference Sheet: None
Remarks: This question is to test the examinee knowledge of basic laws of electricity.

Question #7
Question Statement:

Consider the complete oxidation of C_8H_{18}.

$$C_8H_{18} + O_2 \longrightarrow \ldots\ldots + H_2O$$

The missing product and the coefficients of the balanced reaction are:

A) The product is CO and the coefficients are 2, 17, 16, and 18
B) The product is CO and the coefficients are 4, 34, 16, and 36
C) The product is CO_2 and the coefficients are 4, 4, 32, and 36
D) The product is CO_2 and the coefficients are 2, 25, 16, and 18

Reference Sheet: None

Remarks: This question tests the examinee ability to understand the complete oxidation of hydrocarbons and balance it accordingly.

Question #8

Question Statement:

A heat engine operates between 260°C and 110°C. The maximum (Carnot) efficiency (%) of this heat engine is:

A) 28.1
B) 42.3
C) 57.7
D) 71.8

Reference Sheet: None

Remarks: This question is to test the examinee ability to recall and use the theoretical efficiency of a Carnot heat engine.

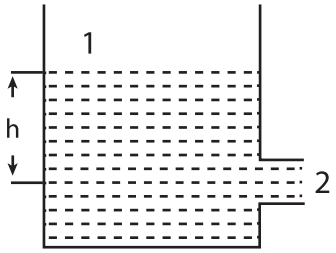
Question #9

Question Statement:

Consider the liquid flowing in the tank shown in the figure. The height (h) of the liquid is 3 m. Assume the tank to be open to the atmosphere. The velocity (m/s) of the liquid at point (2) is:

A) 0
B) 5.42
C) 7.67
D) 58.8

Take g=9.8 m/s^2



Reference Sheet: The Bernoulli equation applied between two points (1) and (2) is:

$$\frac{P_1}{\rho g} + \frac{V_1^2}{2g} + z_1 = \frac{P_2}{\rho g} + \frac{V_2^2}{2g} + z_2$$

(P) denotes the pressure, (V) the velocity and (z) the height.

Remarks: This question aims to test the examinee ability to apply Bernoulli equation.

Question #10
Question Statement:

What is the group of materials that are hard and brittle, but they are good insulators?:

A) metals
B) polymers
C) ceramics
D) composites

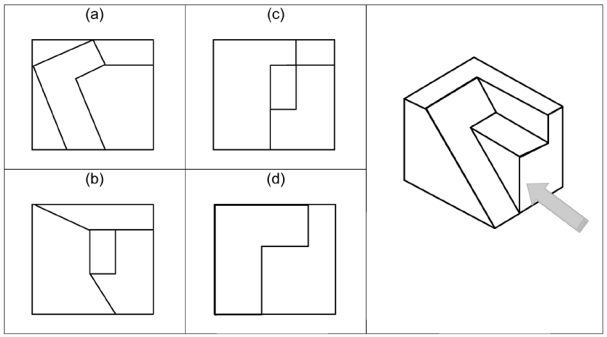
Reference Sheet: None

Remarks: This question is intended to test the examinee ability to recognize the properties of materials.

Question #11
Question Statement:

The orthogonal projection according to the arrow's direction would be:

A) a
B) b
C) c
D) d



Reference Sheet: None
Remarks: This question is intended to test the examinee skills in engineering drawing.

Question #12
Question Statement:

Which of the following devices converts chemical energy directly into electrical energy?

A) A battery.
B) An electrical power plant.
C) A solar cell
D) A car engine.

Reference Sheet: None
Remarks: This question is intended to test the examinee recognition of the basics of other engineering disciplines.

Question #13
Question Statement:

Professional engineers are first obliged to:

A) The welfare of the community.
B) The engineering profession.
C) Their employer.
D) Their customer.

Reference Sheet: None

Remarks: This question is intended to test the examinee understanding of the priority they should give, when they become engineers, to the public welfare.

Question #14

Question Statement:

The objective of Project Management is to finish the project

A) within budget, time and required quality.
B) having high safety record.
C) as required by the contract specifications.
D) having profit for the project.

Reference Sheet: None

Remarks: This question is intended to test the examinee understanding of the objective of project management.

Question #15

Question Statement:

A machine shop is considering the purchase of a new machine. The new machine price is $4,000 and has useful life of 10 years. The estimated value of the machine at the end of its useful life is zero. Hence, the annual depreciation amounts ($), using the straight line method is:

A) 400
B) 512
C) 640
D) 800

Reference Sheet: None

Remarks: This question is intended to test the examinee ability to perform engineering economics analysis.

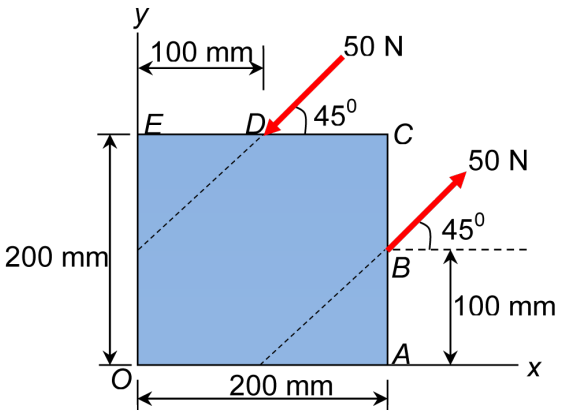
5. Sample Questions for Civil Engineering (session 2)

Question #1

Question Statement:

A square plate of 20 cm × 20 cm is subjected to two forces, each of magnitude 50 N, as shown in the figure. The moment of the forces (N.mm) about point O is:

A) 2500
B) 5000
C) 7070
D) 10000



Reference Sheet: None

Remarks: The objective of this question is to ensure that the examinee has ability to express fundamentals of statics.

Question #2

Question Statement:

Segregation in concrete occurs when:

A) cement gets separated from mixture due to excess water
B) cement fails to give adequate binding quality
C) coarse aggregates tries to separate out from the finer materials
D) two mixtures of different strengths are used in the same structure

Reference Sheet: None

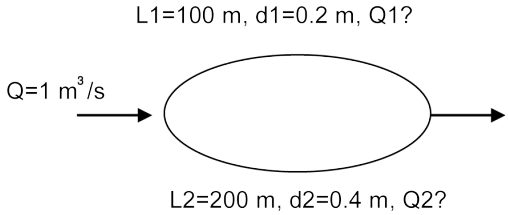
Remarks: The objective of this question is to ensure that the examinee has ability to understand the behavior of construction material.

Question #3

Question Statement:

Using Darcy-Weisbach`s equation for head loss assuming constant friction coefficient (f), the discharge distribution in the loop is:

A) Q1 = 0.2 m^3/s; Q2 = 0.8 m^3/s
B) Q1 = 2 m^3/s; Q2 = 8 m^3/s
C) Q1 = 10 m^3/s; Q2 = 4 m^3/s
D) Q1 = 0.8 m^3/s; Q2 = 0.2 m^3/s



Reference Sheet: Reference sheet #1

Remarks: The objective of the question is to ensure that the examinee is able to apply the concepts of conservation of mass and energy.

Reference sheet # 1

Darcy-Weisbach Equation

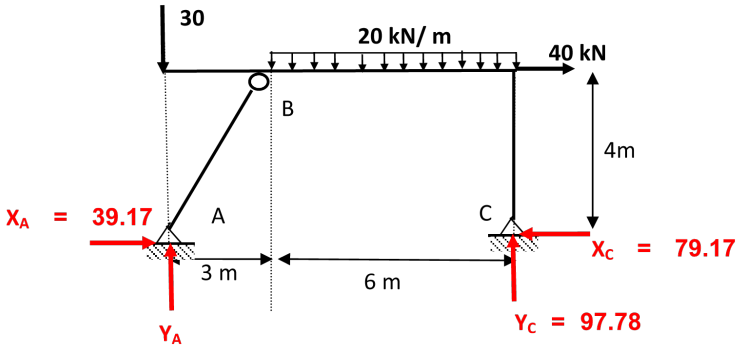
$$h_f = fLQ^2/(\pi^2.g.d^5)$$

Question #4

Question Statement:

For each of the shown frame, the values of reactions (at pin A and C) X_A, X_C and Y_C are given in kN. The vertical reaction Y_A (kN) at pin A is:

A) 50.00
B) 52.22
C) 97.78
D) 187.78



Reference Sheet: None

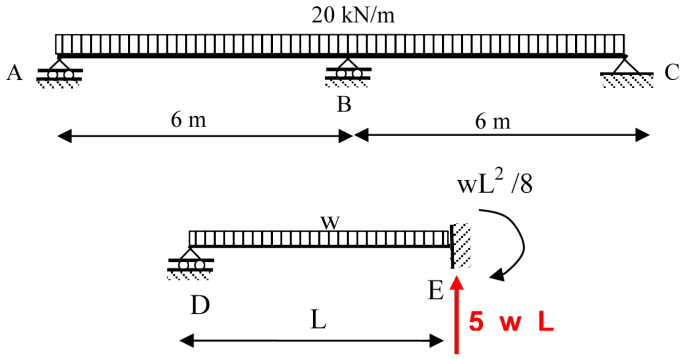
Remarks: The objective of this question is to ensure that the examinee has ability to analyze component of a structure.

Question #5

Question Statement:

The shown loaded symmetrical indeterminate beam "ABC " has a constant cross section. Given that; the moment at fixed end "E" of the shown beam "DE" with length of "L" and due to uniform load "w" is equal to $wL^2/8$. The vertical reaction (kN) at support "B" will be equal to:

A) 120
B) 150
C) 240
D) 300



Reference Sheet: None

Remarks: The objective of this question is to ensure that the examinee can analyze indeterminate beams

Question #6

Question Statement:

A 4-feet diameter circular concrete pipe is to convey 100 cfs of storm water on a slope, S of 0.5%. The normal flow depth, y_n (ft) is:

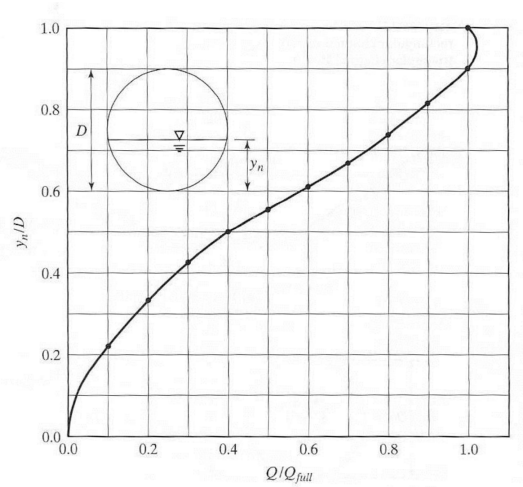
A) 33
B) 10
C) 3.3
D) 0.3

Reference Sheet: Reference #2

Remarks: The objective of the question is to ensure that the examinee is able to design a rigid-boundary open channel.

Reference sheet # 2

Mannings Equation: $Q = 1.49\ AR^{2/3} S^{0.5} / n$



Question #7

Question Statement:

In a reinforced concrete beam, if reinforcement is placed both at the bottom as well as at the top of the beam then the maximum shear stress occurs:

A) along neutral axis
B) along the centroid
C) on planes between neutral axis and the compressive reinforcement
D) on planes between neutral axis and the tensile reinforcement

Reference Sheet: None

Remarks: The objective of this question is to ensure that the examinee has the knowledge of design parameters of reinforced concrete

Question #8

Question Statement:

The maximum pressure which the soil can carry safely without the risk of shear failure is called:

A) allowable bearing capacity
B) the safe bearing capacity
C) the ultimate bearing capacity
D) bearing capacity in shear

Reference Sheet: None

Remarks: The objective of this question is to ensure that the examinee has the knowledge of basic design parameters of geotechnical engineering

Question #9

Question Statement:

In water & wastewater treatment plants, the design parameters to govern the efficiency of gravity settling basins are:

A) the overflow rate
B) the detention time
C) the overflow rate and the detention time
D) the runoff and the overflow rate

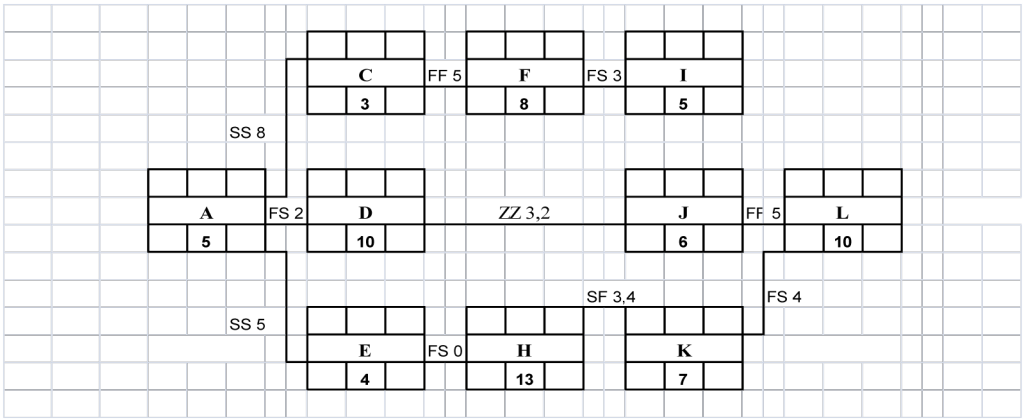
Reference Sheet: None

Remarks: The objective of this question is to examine the ability to design different units of water & wastewater treatment plants

Question #10

Question Statement:

Given the precedence network for a small engineering project with activity durations in working days. Identify the critical path and expected project completion time.



A) Critical path is AEHKL and expected completion time is 35 days
B) Critical path is ACFI and expected completion time is 30 days
C) Critical path is ADJL and expected completion time is 40 days
D) Critical path is AEHKL and expected completion time is 30 days

Reference Sheet: None

Remarks: The objective of this question is to ensure that the examinee has the ability to make the necessary network computation

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