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

Students Manual for the Exam

General Engineering and Architectural 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 Architectural 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 Architectural 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:

- Building materials
- Construction systems
- Environmental studies
- Structure analysis
- Architecture Design

- Building materials
- Heating, Ventilation, and Air conditioning
- Working Drawings
- Building Mechanical Systems
- Human-Environments Interactions
- Construction management
- History and Theory of Architecture
- Computer Applications in building Design
- Building economy

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

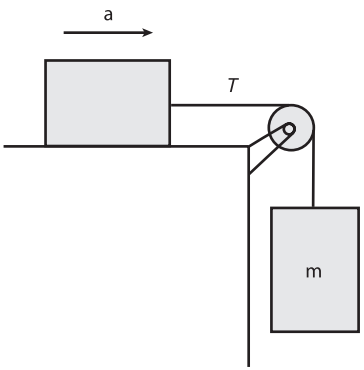
Remarks: The objective of this question is to test the examinee ability to understand the basic concepts of mean and standard deviation.

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

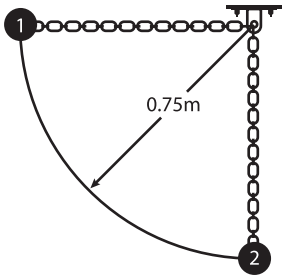
Remarks: This question tests the examinee ability to apply the Newton law and the understanding of the gravity force.

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.

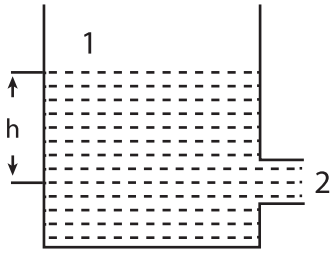
Question #9

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

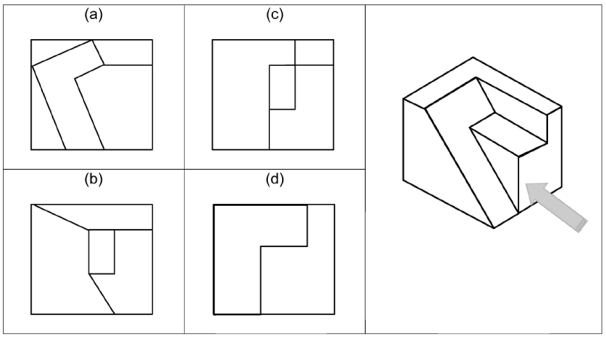
Reference Sheet: None

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 Architectural Engineering (session 2)

Question #1

Question Statement:

How do learning structural courses enhanced your ability in architecture design of building?.

A) Did not contribute
B) Structural systems helped me to design more creative structures
C) Structural courses helped me to estimate the size of beams, columns and foundations.
D) None of the above

Reference Sheet: None

Remarks: The objective of this question is to ensure that the examinee has the ability to use the structural analysis to design more advanced building structures.

Question #2

Question Statement:

What is the main function of a structure in a facility?

A) To provide beauty to the facility.
B) To protect from rain and other environmental effects.
C) To support safely the different types of expected loads.
D) None of the above.

Reference Sheet: None

Remarks: The objective of this question is to ensure that the examinee has the basic knowledge about the function of structural systems.

Question #3

Question Statement:

The basic concept of a structure is to keep a structural system:

A) In state of equilibrium and stability
B) Unstable condition
C) Moving condition
D) All of the above

Reference Sheet: None

Remarks: The objective of this question is to ensure that the examinee can recognize the procedure of structure analysis using equilibrium conditions and equations and stability

Question #4

Question Statement:

Choose an appropriate material to cover a large space with heavy loads:

A) Concrete
B) Steel
C) Timber
D) Aluminum

Reference Sheet: None

Remarks: The objective of this question is to ensure that the examinee is capable to choose a material for a structural system for specific condition.

Question #5

Question Statement:

For residential buildings, what kind of slab systems would be better to use?

A) Two way flat slab
B) Hurdy slab
C) Waffle slab
D) None of the above

Reference Sheet: None

Remarks: The objective of this question is to ensure that the examinee has the ability to understand the difference between the slab systems based on the performance of each system to design the building.

Question #6

Question Statement:

For the building envelope, we select the building systems and materials based on:

A) Performance
B) Durability
C) Thermal and moisture protection
D) All the above

Reference Sheet: None

Remarks: The objective of this question is to make sure that the examinee understands how to select the proper building systems and materials for building envelope.

Question #7

Question Statement:

For the project of university colleges' complex, what is the best system to use from the following for air-conditioning the buildings?

A) District cooling
B) Chillers on the top of each building
C) Split units
D) None of the above

Reference Sheet: None

Remarks: The objective of this question is to make sure that the examinee understands the air-conditioning systems in order to be able to design an integrated building project.

Question #8

Question Statement:

The environmental sustainable design of building is that which is:

A) Using solar panels
B) Using design shading elements
C) Using sustainable building material
D) All the above

Reference Sheet: None

Remarks: The objective of this question is to ensure that the examinee understands how to design sustainable buildings.

Question #9

Question Statement:

The integration of engineering systems with architectural design starts at which stage in the design process?

A) Sketch design
B) Design development
C) Working drawings
D) None of the above

Reference Sheet: None

Remarks: The objective of this question is to ensure that the examinee recognizes the necessity of taking engineering systems in mind at the early stages in the design processes.

Question #10

Question Statement:

During the emergency cases, in the multistory building, the distance (in meters) the user has to cut in the building to reach a staircase is not more than:

A) 30
B) 40
C) 60
D) 70

Reference Sheet: None

Remarks: The objective of this question is to ensure that the examinee is aware of the life safety requirements in projects design.

Question #11

Question Statement:

Near to the ground surface, the natural features available in the site create vertical and horizontal changes in the characteristics of the prevailing climate, thus creating:

A) Macro climate
B) Local climate
C) Micro climate
D) None of the above

Reference Sheet: None

Remarks: The objective of this question is to ensure that the examinee can recognize the effect of natural and manmade environmental conditions on the prevailing climate in order to consider it in the design of buildings to create a climatically comfortable environment.

Question #12

Question Statement:

If you are asked to design a building in an area of a traditional style of architecture, which concept of design you will follow?

A) The traditional style of the existing architecture
B) A modern concept which goes with the modern way of life.
C) A new concept with new technique and advanced systems but reflecting the traditional and environmental values
D) None of the above

Reference Sheet: None

Remarks: The objective of this question is to ensure that the examinee has the ability to design the architecture which reflects the local and traditional values.

Question #13

Question Statement:

To prevent sewer gases from vertical stacks to enter the building we use:

A) Vadding points
B) P or S-craps
C) Vent pipes
D) None of the above

Reference Sheet: None

Remarks: The objective of this question is to ensure that the examinee is capable to identify the sanitary system that is appropriate to the building design.

Question #14

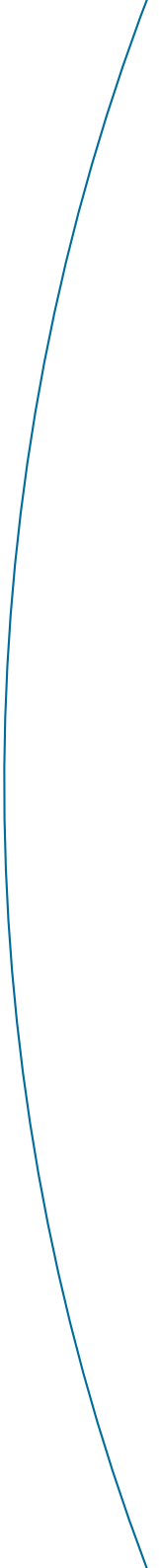
Question Statement:

In building design process, there are three bodies that are directly involved, the developer, the architect and the user. The role of the architect is to:

A) Respect the developer objectives whatever the user's needs
B) Put the design to achieve the developer's objectives and user's needs and take the advantages of site constraint
C) Respect the user's needs whatever the developer's needs
D) Respect both the developer and user needs

Reference Sheet: None

Remarks: The objective of this question is to ensure that the examinee can recognize the responsibility of the architect engineer when he is practicing.



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