



# Students Manual for the Exam

*General Engineering  
and  
Computer 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 Computer 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 Computer 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:

- Digital Systems
- Electronics
- Signals and Systems
- Control systems
- Embedded Systems
- Parallel Processing System

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

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

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

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

**Reference Sheet:** None

**Remarks:** The objective of this question is to test the examinee ability to solve a simple linear algebra problem involving a  $2 \times 2$  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.

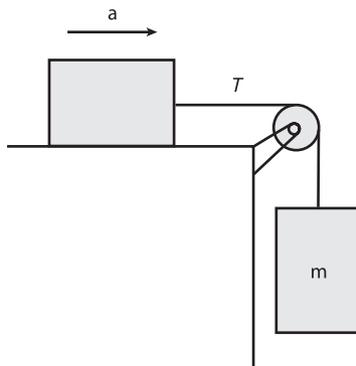
### Question #4

#### Question Statement:

If the tension,  $T$ , is  $14\text{ N}$  and the magnitude of the acceleration,  $a$ , is  $3.0\text{ m/s}^2$ , the mass,  $m$  (kg) of the suspended object is :

(Assume that all surfaces and the pulley are frictionless. Take  $g = 10\text{ m/s}^2$ )

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



**Reference Sheet:** None

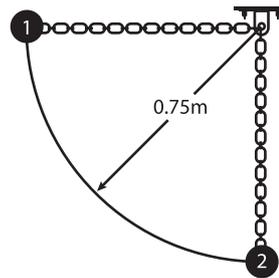
**Remarks:** This question tests the examinee ability to apply the Newton law and the understanding of the gravity force.

## 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 ( $\Omega$ ) of a 2 meter wire having a cross sectional area of  $2 \text{ mm}^2$  and a resistivity of  $5 \times 10^{-8} \text{ } \Omega \cdot \text{m}$  is:

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

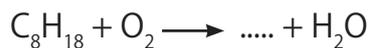
**Reference Sheet:** None

**Remarks:** This question is to test the examinee knowledge of basic laws of electricity.

## Question #7

### Question Statement:

Consider the complete oxidation of  $\text{C}_8\text{H}_{18}$ .



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  $\text{CO}_2$  and the coefficients are 4, 4, 32, and 36
- D) The product is  $\text{CO}_2$  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  $260^{\circ}\text{C}$  and  $110^{\circ}\text{C}$ . 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.

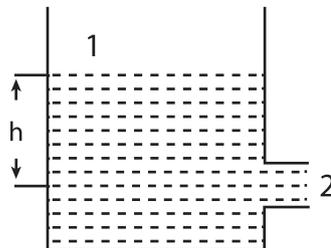
### Question #9

**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  $g=9.8\text{ m/s}^2$



**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.

## 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

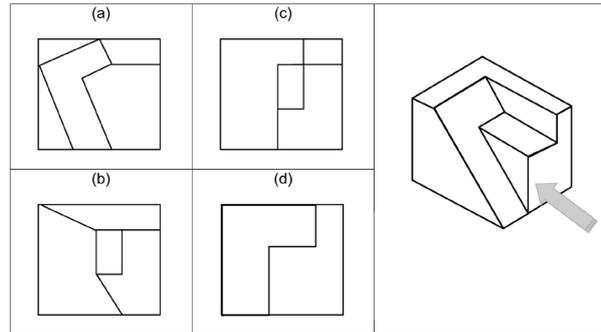
**Remarks:** This question is intended to test the examinee ability to recognize the properties of materials.

## 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 Computer Engineering (session 2)

### Question #1

#### Question Statement:

Convert the binary number  $(1101101.11101)_2$  into its equivalent octal base and decide which of the following answers is correct:

- A) 132.77
- B) 145.78
- C) 155.72
- D) 165.78

**Reference Sheet:** None

**Remark:** The objective of the question is to test the examinee's understanding of the number systems.

### Question #2

#### Question Statement:

Consider a 7-bit signed binary number 10011001 where bit 8 is the sign bit. Which of the following decimal numbers presents the 2's complement of this number?

- A) +102
- B) + 25
- C) +10
- D) -103

**Reference Sheet:** None

**Remark:** The objective of the question is to test the examinee's understanding of the number systems.

### Question #3

#### Question Statement:

Which of the following options corresponds to the required number of bits to represent the decimal number 120?

- A) 7
- B) 8
- C) 9
- D) 10

**Reference Sheet:** None

**Remark:** The objective of the question is to test the examinee's understanding of the number systems.

### Question #4

#### Question Statement:

Consider a logic circuit that has four input variables (A, B, C, D) and an output F. The output is high when **exactly three input variables are high**. Identify the Sum-of-Minterms (SOM) for the above circuit by choosing one of the following cases as the right answer:

- A)  $F = A'B'CD + ABCD + ABC'D + ABCD'$
- B)  $F = ABCD + AB'C'D' + ABC'D + AB'CD'$
- C)  $F = ABCD' + A'BCD + ABC'D + AB'CD$
- D)  $F = AB'C'D' + A'B'C'D' + ABCD + ABCD'$

**Reference Sheet:** None

**Remark:** The objective of the question is to test the examinee's knowledge in applying Boolean algebra.

## Question #5

### Question Statement:

Simplify the following Boolean expression using algebraic manipulation. Choose the right answer from the following options.

$$F(A, B, C) = AB'C + A'BC + A'B'C$$

- A)  $AC + B$
- B)  $AB + C$
- C)  $A'C + B'C$
- D)  $A + C$

**Reference Sheet:** None

**Remark:** The objective of the question is to test the examinee's knowledge in using different rules of the Boolean algebra in order to simplify the Boolean equations.

## Question #6

### Question Statement:

Write the Boolean equation in the form of the Sum-of-Product for a logic circuit that has three inputs A, B, C and an output F. The output is high for each of the following conditions:

$$\begin{aligned} A=B=1 \\ B=C=0 \end{aligned}$$

Drive your equation with the least number of literals. Choose the right answer from the following options:

- A)  $A'B' + BC$
- B)  $A + BC$
- C)  $AB + B'C'$
- D)  $A + B'C'$

**Reference Sheet:** None

**Remark:** The objective of the question is to test the examinee's knowledge in using different rules of the Boolean algebra in order to simplify the Boolean equations

## Question #7

### Question Statement:

Consider the following shorthand version of the Boolean equation for the three variables A, B, C. Decide which of the following options shows the minimum Sum-of Product for this Boolean equation:

$$F(A,B,C) = \sum_m(1,3,5,6)$$

- A)  $B'C + A'C + ABC'$
- B)  $AB + BC + ABC$
- C)  $B'C + ABC'$
- D)  $A'C + ABC'$

**Reference Sheet:** None

**Remark:** The objective of the question is to test the examinee's knowledge in using different rules of the Boolean algebra in order to simplify the Boolean equations.

## Question #8

### Question Statement:

What is the majority of the carriers in the p-type and n-type semiconductor materials?

- A) Pn semiconductor junction does not carry any majority carriers;
- B) Majority of carriers in p-type are electrons and that in n-type are holes
- C) Majority of carriers in n-type are electrons and that in p-type are holes
- D) Minority of carriers in p-type are holes and in n-type are electrons.

**Reference Sheet:** None

**Remark:** The objective of the question is to test the examinee's knowledge in the structure and properties of different semiconductor materials and their applications.

## Question #9

### Question Statement:

Suppose a signal is defined as :

$$x(t) = \begin{cases} 1, & -1 \leq t < 1 \\ -1, & 1 \leq t < 3 \\ 2, & t = 4 \\ 0, & \textit{otherwise} \end{cases}$$

Which of the following sequences can express  $x(t)$ ?

- A)  $x(t) = u(t+1) - \delta(t-1) + 2\delta(t-4)$
- B)  $x(t) = u(t+1) - 2u(t-1) + u(t-3) + 2\delta(t-4)$
- C)  $x(t) = \delta(t+1) - u(t-1) + \delta(t-3) + 2\delta(t-4)$
- D)  $x(t) = \delta(t+1) - u(t-1) + \delta(t-3)$

**Reference Sheet:** None

**Remark:** The objective of the question is to test the examinee's knowledge in expressing signals in terms of the unit step function, the rectangular pulse, and the unit impulse function for analysis purposes.

## Question #10

### Question Statement:

Select the correct transfer function  $\frac{Q(s)}{V(s)}$  of a series RLC circuit from the following options; where: Capacitor = C (F), Inductor = L (H), Resistor = R (Ohms),  $v(t)$  is the applied voltage and  $q(t)$  is the charge.

- A)  $\frac{Q(s)}{V(s)} = 1/(Ls + Rs^2 + 1/C)$
- B)  $\frac{Q(s)}{V(s)} = 1/(L + Rs + 1/C^2)$
- C)  $\frac{Q(s)}{V(s)} = 1/(Ls^2 + Rs + 1/C)$
- D)  $\frac{Q(s)}{V(s)} = 1/(Ls + R + C)$

**Reference Sheet:** None

**Remark:** The objective of the question is to test the examinee's understanding of the Laplace transform.

## Question #11

### Question Statement:

What is the Laplace transform of a periodic repetitive sawtooth waveform with an amplitude of  $V$  and period of  $p$ ?

- A)  $\frac{V(1 - e^{-sp} - pse^{-sp})}{p(1 + e^{-sp})}$
- B)  $\frac{V(1 - e^{-sv} - vse^{-sv})}{ps(1 + e^{sp})}$
- C)  $\frac{V(1 - e^{-sp} - pse^{-sp})}{ps^2(1 - e^{-sp})}$
- D)  $\frac{V(1 + e^{-sp} - pse^{-sp})}{ps^2(1 + e^{sp})}$

**Reference Sheet:** None

**Remark:** The objective of the question is to test the examinee's understanding of Laplace transform.

## Question #12

### Question Statement:

Suppose you are interested in interfacing a 64K bytes memory to your microprocessor. How many exact bits of memory are you going to use in your design?

- A) 262144
- B) 524288
- C) 671088
- D) 856433

**Reference Sheet:** None

**Remark:** The objective of the question is to test the examinee's ability to design and interface different types of memories to processors.

### Question #13

#### Question Statement:

In interfacing a 64M bits memory module to your microprocessor, how many address lines are you going to utilize? Choose your answer from the following options:

- A) 18
- B) 20
- C) 22
- D) 26

**Reference Sheet:** None

**Remark:** The objective of the question is to test the examinee's ability to design and interface different types of memories to processors.

## Question #14

### Question Statement:

With regard to the control hazard in a pipeline mechanism, which of the following statements is most appropriate?

- A) A control hazard in a pipeline scheme does not deal with conditional branch instruction;
- B) In a pipeline scheme there is no overlapping mechanism among different execution phases;
- C) A control hazard refers to the situation where a conditional branch instruction is currently in the pipeline, hence it cannot be immediately determined which instruction would be next to be fed into the pipeline.
- D) Among different hazards in pipeline scheme we do not have any criteria under the control hazard category.

**Reference Sheet:** None

**Remark:** The objective of the question is to test the examinee's ability to identify hazards in pipelining

## Question #15

### Question Statement:

Which of the following statements supports the principle of operation of the cache memory? :

- A) To delay the amount of information extracted from the main memory;
- B) Level 1 cache is located outside the CPU;
- C) To improve the access time in extracting information from the main memory;
- D) Cache memory goes through the system bus to transfer the data.

**Reference Sheet:** None

**Remark:** The objective of the question is to test the examinee's recognition of the main categories of memory technologies.



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