



# PAKISTAN ENGINEERING COUNCIL

## Sample MCQs

### Chemical Engineering

### (Process Synthesis, Design and Optimization)

Please read all the instructions carefully and do not start the paper unless asked to do so.

1. Fill in your particulars (Name, Roll Number, PEC Registration Number, CNIC and Discipline) in BLOCK letters in the space provided.
2. You are not allowed to change your seat during the test.
3. Hand over your answer sheet to the invigilator at the end of each part and keep seated until allowed to leave the centre.
4. The examination is divided into three Parts viz Part-I, Part-II and Part-III, with 30 minutes break.
5. All questions are to be attempted and carry equal marks.
6. Passing marks for each part is 60%, and passing all three parts is mandatory to qualify EPE.
7. Use only the provided pencil to fill completely the correct choice circle on answer sheet.
8. Programmable calculator, laptop, mobile phone, iPod, and any storage device/electronic gadget are not allowed.
9. No extra sheet will be provided; any calculation may be worked out on the back of the paper.
10. No candidate is allowed to indulge in any Law and Order situation to affect the exam process, and responsible(s) will be disqualified.
11. Use of unfair means will also lead to disqualification.

#### **Instructions for Part-I**

This part is common to all disciplines, comprising 30 multiple choice questions of one mark each (Total Marks=30) with the duration of two hours.

#### **Instructions for Part-II**

This is a discipline based open book breadth examination, comprising 30 multiple choice questions of one mark each (Total Marks=30), with the duration of two hours.

#### **Instructions for Part-III**

This is a discipline based open book depth examination comprising 40 multiple choice questions of one mark each (Total Marks=40), with duration of three hours. The candidates will be allowed only for the specialized field / area of practice, for which already applied at the time of application.

# **Chemical Engineering**

## **(Process Synthesis, Design and Optimization)**

### **Part-I**

**Total Marks: 30**

**Total Time: 2 hours**

<b>Name:</b>	<b>S/o, D/o, w/o:</b>
<b>Roll Number:</b>	<b>PEC Reg#:</b>
<b>CNIC:</b>	<b>Discipline:</b>

**Q.1:** Quality control is aimed at:

- a. Maintaining the desired quality
- b. Exceeding the desired quality
- c. Continuously improving the quality
- d. Following the quality

**Q.2:** Which of these is correct with respect to a product developed or a service performed?.

- a. Bad quality is acceptable, but bad grade is not.
- b. Bad grade is acceptable, but bad quality is not.
- c. Neither bad grade nor quality is acceptable.
- d. Grade and quality is the same thing.

**Q.3:** Project A has an internal rate of return (IRR) of 21 percent. Project B has an IRR of 7 percent. Project C has an IRR of 31 percent. Project D has an IRR of 25 percent. Which of these would be the BEST project?

- a. Project A
- b. Project B
- c. Project C
- d. Project D

**Q.4:** What characteristic best describes the cost baseline?

- a. Total budget for the project
- b. Time phased budget for the project
- c. Total budget for the project including the contingency budget

- d. Total budget for the project including the contingency budget and the management reserve.

**Q.5:** Present worth is:

- a. The discounted future cash flows to the present
- b. The compounding present cash flows to the future
- c. The current market value of the investment
- d. The opportunity cost at the present value.

**Q.6:** The first preferred way to resolve a dispute between the contracting parties is:

- a. Arbitration
- b. Litigation
- c. Negotiation
- d. Mediation

**Q.7:** Following document define the legal rights and obligations of the parties and may be described as the regulations under which the contract will be performed.

- a. Specifications
- b. General Conditions of Contract
- c. Special provisions
- d. Bill of Quantities

**Q.8:** The minimum notice period for National Competitive bidding is:

- a. 30 days
- b. 45 days
- c. 35 days
- d. 15 days

**Q.9:** Tsunamis' is generated by:

- a. Earthquake
- b. Air currents
- c. Tidal waves
- d. Large Ocean waves

**Q.10:** Globalization has direct impact on:

- a. National security
- b. Economy
- c. Society
- d. All above

**Q.11:** The passive voice for the sentence "He is writing a letter" is;

- a. A letter is wrote by him
- b. A letter is written by him
- c. A letter is being written by him
- d. A letter is been written by him

**Q.12:** Choose the correct sentence

- a. He is elder than me
- b. He is older than me
- c. He is ager than me
- d. He is older than I

**Q.13:** Effective communication is

- a. The transfer of message from sender to receiver
- b. Sending of message
- c. Receiving of message
- d. The transfer of message from sender to receiver and get the desired response.

**Q.14:** Body language is form of;

- a. Personality and attitudes
- b. Non verbal communication
- c. Individual preference for expression
- d. The body expression

**Q.15:** Project feasibility report is aimed at;

- a. Informing the people
- b. Attracting the customer
- c. Justifying the investment
- d. Giving details of resources

**Q.16:** Research Proposal synopsis is developed at;

- a. Final stage of research
- b. Initial stage of research
- c. Before approval of research proposal
- d. In the middle of research

**Q.17:** Project monitoring is required:

- a. Before commencement of the project
- b. During implementation of the project
- c. After completion of the project
- d. At any stage of the project deemed necessary

**Q.18:** Re-appropriation Statement is form of

- a. Progress report
- b. Budget report
- c. Financial report
- d. Normal report

**Q.19:** PC-III (A) is used for

- a. For weekly progress report of public sector projects
- b. Monthly progress report of public sector projects
- c. Yearly progress report of public sector projects
- d. Quarterly progress report of public sector projects.

**Q.20:** Acquiring management and leadership skills are \_\_\_\_\_ for a Professional Engineer

- a. Wastage of time
- b. Not important
- c. Highly important
- d. Not necessary

**Q.21:** Engineering ethics refers to:

- a. The rules and standards given by an institution for Engineering practice
- b. The rules and regulation relating to obligations and rights of others.
- c. The professional regulation
- d. The rules and standards which govern the conduct of Engineers as professional Engineers.

**Q.22:** How many commandments are given in PEC Code of Ethics?

- a. 20
- b. 30
- c. 10
- d. 05

**Q.23:** As per PEC Code of Conduct a member shall report unethical professional practices of an engineer or a member with substantiating data to

- a. Court of Law
- b. Concerned Department
- c. Pakistan Engineering Council
- d. Law enforcing Agency

**Q.24:** When a member uses designs, plans, specifications, data and notes supplied to him by a client or an employer or are prepared by him in reference to such client or the employer's work such designs, plans, specifications, data and notes shall remain the property of the \_\_\_\_\_ and shall not be duplicated for any use without the express permission of the \_\_\_\_\_.

- a. Member, Member
- b. Client, Client
- c. Member, Client
- d. Client, Member

**Q.25:** As per PEC Code of Conduct to maintain, uphold and advance the honor and dignity of the engineering professional, a member shall do following except:

- a. uphold the ideology of Pakistan
- b. be honest, impartial and serve the country, his employer, clients and the public at large with devotion.
- c. Uphold personal interest first
- d. use his knowledge and skill for the advancement and welfare of mankind

**Q.26:** Conflicts are faced when:

- a. There are more than one expected outcomes
- b. There are more than one expected benefits and losses
- c. There is choice between two or more moral values each having its own merits.
- d. There are opposing outcomes.

**Q.27:** An example of a conflict of interest would be:

- a. As a responsible official you make a decision about a contract award that will benefit you personally
- b. You and a functional manager disagree with a task cost estimate
- c. Your sponsor decides to cancel your project because it no longer supports the company strategy
- d. Your personality conflicts with that of a key member of your project team.

**Q.28:** Adherence to professional ethics is \_\_\_\_\_ an engineer to society.

- a. Not obligation of
- b. An obligation of
- c. Optional for
- d. None of above

**Q.29:** While designing a project by an engineer, \_\_\_\_\_ should be taken into account to protect cultural heritage

- a. All possible alternates
- b. No protection
- c. Minimum protection
- d. No care

**Q.30:** Close interpersonal relationships are characterized by high intimacy whereas distressed relationships tend to involve reciprocation of \_\_\_\_\_ behaviour.

- a. positive
- b. negative
- c. normal
- d. casual

## **Answers:**

1. a
2. b
3. c
4. b
5. a
6. c
7. a
8. d
9. a
10. d
11. c
12. b
13. d
14. b
15. c
16. c
17. b
18. c
19. b
20. c
21. d
22. c
23. c
24. b
25. c
26. c
- 27.
28. b
29. a
30. b

## Part-II (Breadth of discipline)

Total Marks: 30

Total Time: 2 hours

**Q.1:** An  $n \times n$  matrix is said to be symmetric if;

- a. If it is equal to its transpose
- b. If its determinant is equal to zero
- c. If it is of 2<sup>nd</sup> order
- d. None of the above

**Q.2:** The correlation coefficient provides:

- a. a measure of the extent to which changes in one variable cause changes in another variable.
- b. a measure of the strength of the linear association between two categorical variables.
- c. a measure of the strength of the association (not necessarily linear) between two categorical variables.
- d. a measure of the strength of the linear association between two quantitative variables.

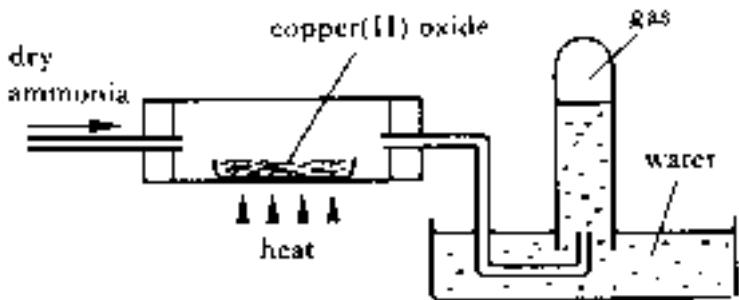
**Q.3:** Which one of the following is sodium thiosulfate:

- a. Na<sub>2</sub> SO<sub>4</sub>
- b. Na<sub>2</sub> SO<sub>3</sub>
- c. Na<sub>2</sub> S<sub>2</sub> O<sub>3</sub>
- d. Na<sub>2</sub> S<sub>4</sub> O<sub>6</sub>

**Q.4:** Triphenylphosphine is often given the abbreviated formula PPh<sub>3</sub>. The correct name for Rh(PPh<sub>3</sub>)<sub>3</sub> Cl is:

- a. chlorotriphenylphosphinerhodium
- b. chlorotriphenylphosphinerhodium(I)
- c. tris(triphenylphosphine)chlororhodium(I)
- d. chlorotris(triphenylphosphine)rhodium(I)

**Q.5:** Copper (II)oxide was heated in the apparatus shown below and dry ammonia was passed over it. After a few seconds, the test tube was placed in position and a gas collected. The gas collected was:

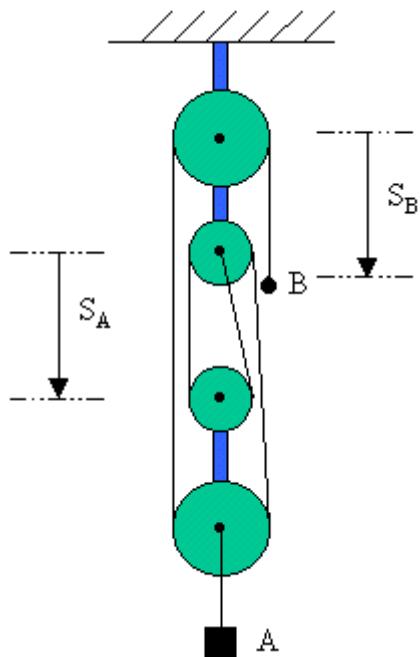


- a. Nitrogen
- b. Nitrogen monoxide
- c. Nitrogen dioxide
- d. Hydrogen

**Q.6:** Triangle rule is used to find the resultant of how many forces?

- a. 3 forces
- b. 2 forces
- c. Options (a) and (b) are correct
- d. None of the above options is correct

**Q.7:** Select the equation which relates the position of the end of the cable B to the position of block A

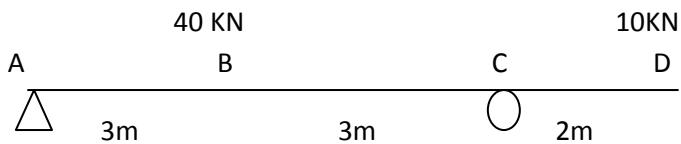


- a.  $3S_A + S_B = L$
- b.  $4S_A + S_B = L$
- c.  $S_A + 2S_B = L$
- d. none of the above

**Q.8:** Every direct stress is always accompanied by a strain in its own direction and an opposite kind of strain in every direction at right angles to it. Such a strain is known as:

- a. Linear strain
- b. Lateral strain
- c. Volumetric strain
- d. Shear strain

**Q.9:** For beam loaded as shown in figure below, what will be the location of point from A where bending moment will change sign:



- a. 2.2
- b. 3.0
- c. 5.2
- d. 5.8

**Q.10:** The maximum current will pass through:

- a. Resistance
- b. Inductance
- c. Capacitance
- d. None of above

**Q.11:** A 1000W heater is rated to operate at a direct current (DC) of 10A. If the heater is supplied alternating current (AC) for producing the same quantity of heat the value of current should be

- a.  $I_{av}=10A$
- b.  $I_{rms}=10A$
- c.  $I_{peak}=10A$
- d.  $I_{rms}=10\sqrt{2}A$

**Q.12:** 100 mol/hr of Butane ( $\text{CH}_4$ ) and 133 mol/hr of air are fed into a combustor. The percent excess air used is:

- a. 40%
- b. 30%

- c. 20%
- d. 10%

**Q.13:** The objective of bypass stream is to:

- a. Control the composition of final exit stream
- b. Utilize valuable reactants
- c. Get high extent of reaction
- d. All of the above

**Q.14:** Can one piece of equipment be treated as a set of several subsystems:

- a. Yes
- b. No
- c. Depends on the equipment type
- d. Both 'a' and 'c'

**Q.15:** A closed stationery system consists of a 5 kg mass. During a certain process 50 kJ of work are done on the system and internal energy increased by 5000 J per kg. The total amount of heat exchange with the system is:

- a. -100 kJ
- b. -75 kJ
- c. -50 kJ
- d. -25 kJ

**Q.16:** If a system consists of two immiscible liquids (such as CCL4 and CH3OH), how many phases are there:

- a. 1
- b. 2
- c. 3
- d. 4

**Q.17:** The frictional resistance of a pipe varies approximately with \_\_\_\_\_ of the liquid:

- a. pressure
- b. velocity
- c. square of velocity
- d. cube of velocity

**Q.18:** The lifting of a Helicopter is based on:

- a. Torricelli Theorem
- b. Bernoulli's principle
- c. Law of gravitation
- d. Coulomb's law

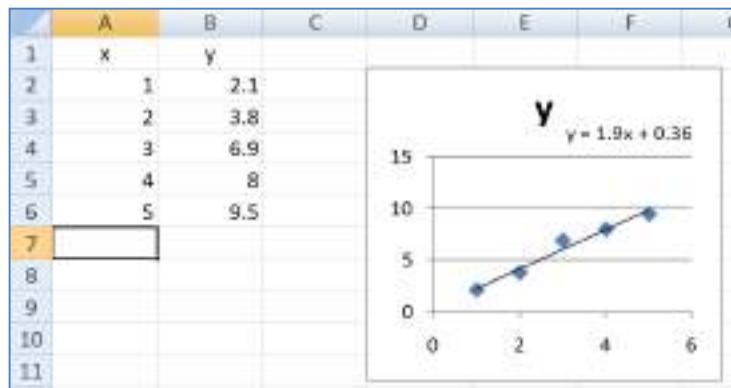
**Q.19:** A flow in which liquid particle has definite path of flow and don't cross each other is called:

- a. streamline flow
- b. turbulent flow
- c. laminar flow
- d. both 'a' and 'c'

**Q.20:** If  $y=f(x)$  is a linear equation then a definite integral  $\int_{x_1}^{x_2} f(x)dx$  can exactly be found by:

- a. Trapezoidal rule
- b. Newton-Raphson method
- c. Jacobi algorithm
- d. Central difference scheme

**Q.21:** A data set  $(x,y)$  is to be analyzed using a spreadsheet. One way to get a mathematical relation between  $x$  and  $y$  is through scatter graph as shown in figure below. The tool used for this purpose is:



- a. Line Graph
- b. Data Analysis
- c. Equation
- d. Trend Line

**Q.22:** The wall of an oven consists of two layers of insulating bricks. In between the layers there is an air gap. The pressure of air gap will be:

- a. Cause an increase in heat transfer rate through the composite wall
- b. Cause a decrease in heat transfer rate through the composite wall
- c. Have no influence on the rate of heat transfer
- d. Both 'a' and 'b' are correct

**Q.23:** A shell - and - tube heat exchanger is used to heat sugar solution by using steam. No data about the exchanger is given. Which film resistance is likely to control the overall heat transfer process:

- a. Steam film resistance
- b. Sugar solution film resistance
- c. Both steam and sugar film resistances
- d. Nothing can be said about the controlling resistance

**Q.24:** Fouling factor is obviously \_\_\_\_\_ for a new heat exchanger and \_\_\_\_\_ with time as the solid deposits build up on the heat exchanger surface.

- a. Zero, increases
- b. One, increases
- c. One, decreases
- d. Zero, decreases

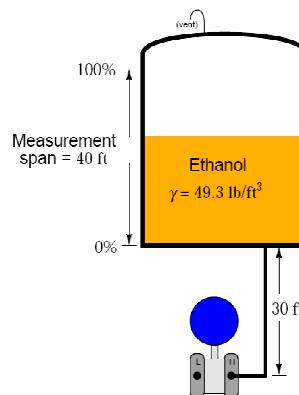
**Q.25:** If a control system should respond to long term errors, but not respond to sudden changes, what type of control equation should be used?

- a. PID
- b. PI
- c. PD
- d. PLC

**Q.26:** Dead Weight Tester is used for the calibration of:

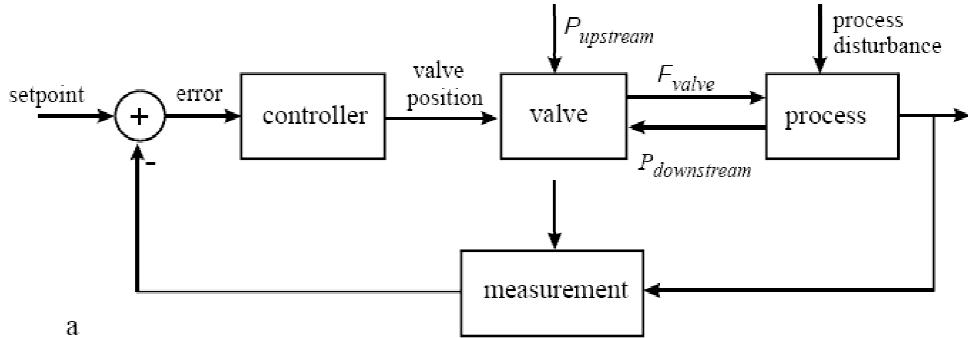
- a. Pressure
- b. Weight
- c. Temperature
- d. Time

**Q.27:** A storage tank for Ethanol is shown above. If the tank is empty, the pressure is 10.3 psi, and at an ethanol height in tank of 20 feet, the pressure is 17.1 psi. What would be the pressure, when the tank is full, (means ethanol height in tank is 40feet)?



- a. 20 psi
- b. 24 psi
- c. 34.2 psi
- d. 10.3 psi

**Q.28:** The figure below is representing:



- a. Proportional control
- b. A feedback control
- c. Domain control
- d. Feed forward control

**Q.29:** A thin sphere of copper, with its internal surface highly oxidized ( $\epsilon = 0.57$ ), has a diameter of 4 inches. How small a hole must be made in the sphere to make an opening that will have an absorptivity of 0.99:

- a. 0.463
- b. 0.694
- c. 0.926
- d. 0.800

**Q.30:** The flow rate of a liquid (density 1.26 gm/cm<sup>3</sup>) flowing under isothermal conditions in a pipe of length 1ft and inside diameter 1 inch for a pressure drop of 40psi is 0.00398 ft/min. What is the entrance length in feet?

- a. 0.0007
- b. 0.007
- c. 0.07
- d. 0.08

## **Answers:**

1. a
2. d
3. c
4. d
5. a
6. b
7. b
8. b
9. c
10. c
11. b
12. a
13. a
14. a
15. d
16. c
17. c
18. b
19. d
20. a
21. d
22. b
23. b
24. a
25. b
26. a
27. b
28. b
29. a
30. a

## Part-III-A

(Depth: Heat Transfer, Mass Transfer, Chemical Reaction Engineering, Plant Design & Operation)

**Total Marks/ MCQs: 20**

**Total Time: 1.5 hours**

**(Sample MCQs = 10)**

**Q.1:** If your eyes are to mutate and become sensitive to slightly shorter wavelengths than they are now, what portion of the spectrum would become visible:

- a. X-ray
- b. Infrared wavelengths
- c. Red wavelengths
- d. Ultraviolet wavelengths

**Q.2:** For a counter-current heat exchanger the clean overall heat transfer coefficient is 500 W/m<sup>2</sup>.K and the overall fouling factor is 0.00035 m<sup>2</sup> K/W. What will be the value of the design overall heat transfer coefficient:

- a. 485.6 W/m<sup>2</sup>.K
- b. 425.5 W/m<sup>2</sup>.K
- c. 392.8 W/m<sup>2</sup>.K
- d. None of the above

**Q.3:** The equilibrium constant for the reaction CO(g) + H<sub>2</sub>O(g) ⇌ CO<sub>2</sub>(g) + H<sub>2</sub>(g) is K = 1.03 × 10<sup>5</sup> at 298.15 K. Calculate the standard reaction Gibbs energy at this temperature.

- a. -28.6 kJ mol<sup>-1</sup>
- b. -12.4 kJ mol<sup>-1</sup>
- c. -2.40 kJ mol<sup>-1</sup>
- d. -255 kJ mol<sup>-1</sup>

**Q.4:** A 1000 rpm 4-stroke engine will have .....power strokes per minute, but at the same rpm a 2-stroke engine will have .....power strokes per minute.

- a. 1000, 500
- b. 500, 1000
- c. 1000, 2000
- d. 2000, 1000

**Q.5:** As the temperature for an exothermic reactions increases, the equilibrium constant

- (a) increases

- (b) decreases
- (c) unchanged
- (d) increases and then decrease

**Q.6:** OSHA stands for .....

- a. occupational safety and health administration
- b. organization standard and health administration
- c. organization support and hygiene allowance
- d. OSHA

**Q.7:** A shell-and-Tube exchanger is designed assuming design coefficient of 600. The prediction of the design coefficient reveal its value to be 400. What should be done by the designer:

- a. Decrease the value of design co-efficient and re-design
- b. Decrease the flow area to increase Reynolds number and hence heat transfer coefficient
- c. Change tube dimensions and layout
- d. all of the above

**Q.8:** Preliminary design are ordinarily used as a basis for ..... whether further work should be done on the proposed process.

- a. Evaluating
- b. Determining
- c. Defining
- d. knowing

**Q.9:** If the cost of a process/piece of equipment in year B and the cost indices in years A and B are given; the cost in year A is given by:

- a. cost index in year A x Cost in year B/cost index in year B
- b. cost index in year B x Cost in year A/cost index in year A
- c. cost index in year B x Cost in year B/cost index in year A
- d. cost index in year A x cost index in year B /Cost in year B

**Q.10:** If the additional Safety Valves on boiler are used the highest pressure setting shall not exceed the maximum allowable working pressure by more than ----- percent.

- a. 3%
- b. 30%
- c. 20%
- d. 25%

**Answers:**

1. d
2. b
3. a
4. b
5. b
6. a
7. d
8. b
9. a
10. a