

**SIXTH SEMESTER B.TECH DEGREE EXAMINATION**

**(Model Question)**

**(2013 scheme)**

**13.601 MASS TRANSFER OPERATIONS I**

**Maximum-100 marks**

**Time 3 hours**

**Part A**

*Answer **all** questions. Each question carries 2 marks.*

- 1) Write Fick's law of diffusion and explain the terms.
- 2) State Colburn analogy between heat, mass and momentum transfer and define the dimensionless groups involved
- 3) Write the significance of absorption and stripping factor
- 4) Define wet bulb depression and how it is related to psychrometric ratio
- 5) Distinguish between humidification and dehumidification
- 6) Define absolute humidity and dew point.
- 7) List the factors which affect the zone of unsaturated drying
- 8) Explain  $\propto L$  law of crystal growth
- 9) Describe Meir's super saturation theory
- 10) Distinguish between bound and unbound moisture. (10 x2 = 20 marks)

**Part B**

*Answer **one full** question from each module. Each question carries 20 marks*

*Module-1*

- 11) a) derive the equation to calculate the molar flux under steady state diffusion through a stagnant gas
- b) Describe the salient features of the penetration theory of mass transfer.

OR

12) Chloroform vapor is diffusing from the surface of the liquid contained in a capillary in to ambient air at 298K and 101.3kPa. The diffusivity of chloroform in air at this condition is  $9.5 \times 10^{-6} \text{m}^2/\text{s}$ . The vapor pressure of chloroform at 298K is 30Kpa. If the length of diffusion path is 70mm from the surface of the liquid, estimate the rate of steady state diffusion in  $\text{Kmol}/\text{m}^2\text{s}$ . Also estimate the mole fraction of chloroform halfway along the length of the diffusion path.

*Module-II*

- 13) a. Compare packed c columns versus plate columns for gas absorption  
b. Derive kremser equation and describe its applications

OR

14) It is decide to absorb 95% of acetone from an acetone air mixture containing 2 percent (mole) acetone in a counter current packed tower. The gas flow rate is 4000  $\text{Kg}/\text{hm}^2$  pure water is used the solvent at a rate of 7000  $\text{Kg}/\text{hm}^2$ . The equilibrium solubility of acetone in water is given by  $y^* = 2.53 x$  where x and y are the mole fractions of acetone in the liquid and gas phases respectively. The heights of individual transfer units are 0.32 m and 0.53 m respectively for the liquid phases. Assume dilute solutions and calculate the height of the tower

*Module-III*

15) Describe with a neat s sketch the types of cooling towers used in process industries.

- (b) Derive Lewis relation and explain its significance

OR

16) Air at a temperature of 30°C and a pressure of 100KPa has a relative humidity of 80%.

- a) Calculate the molar humidity of air  
b) Calculate molar humidity of air if its is reduced to 15°C and its pressure is increased to 200KPa, condensing out some water  
c) Calculate the weight of water condensed from 100m<sup>3</sup> of original wet air in cooling to 15°C and compressing to 200KPa.

#### *Module-IV*

17) It takes 9 hours for a porous solid to reduce the moisture content from 45 to 10% when dried in a batch dryer under constant drying conditions. The critical moisture content was found to be 25% and the equilibrium moisture 3%. All moisture contents are on dry basis. Assuming that the rate of drying during the falling rate period is proportional to the free moisture content, how long should it take to dry a sample of the same solid from 35 to 5% under the same drying conditions

OR

18. a) Explain Rast's law of crystal growth

b) 200Kg of 15% and 100Kg of 5% solution of  $\text{Na}_2\text{SO}_4$  by weight are mixed in a crystallizer and crystallization takes place. If 50Kg of  $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$  crystals are formed, compute the composition of mother liquor

# Sample Questions for Quiz-A-Thon

## Basic IT

1. The cloud acts like a disk drive which may be owned by Google or Apple and stores files in a remote location. One can access:
  - A. Photos
  - B. Documents
  - C. Videos
  - D. All of the above
2. Which one of the following is Cloud Platform by Amazon?
  - A. Azure
  - B. AWS
  - C. Cloudera
  - D. All of the above
3. The Force.com and windows Azure are examples of which of the following?
  - A. IaaS
  - B. PaaS
  - C. SaaS
  - D. Both (a) and (b)
4. Which of the following provides the Graphic User Interface (GUI) for interaction with the cloud?
  - A. Client
  - B. Client Infrastructure
  - C. Application
  - D. Server
5. Which one of the following is a kind of technique that allows sharing the single physical instance of an application or the resources among multiple organizations?
  - A. Virtualization
  - B. Service-Oriented Architecture
  - C. Grid Computing
  - D. Utility Computing
6. On which one of the following utility computing is based?
  - A. Grid Computing Model
  - B. SOA Model
  - C. Virtual Isolation Model
  - D. Pay-per-Use Model

7. In Grid Computing, which types of computer resources are there?
- A. Heterogeneous Dispersed
  - B. Geographically Dispersed
  - C. Both (A) and (B)
  - D. None of the Above
8. Managed IT services are based on the concept of which one of the following?
- A. Virtualization
  - B. Utility Computing
  - C. Grid Computing
  - D. SOA
9. Which of the following is the correct full form of SaaS?
- A. Storage-as-a-Service
  - B. Server-as-a-Software
  - C. Software-as-a-Service
  - D. None of the above
10. Which one of the following of PaaS type that involves on-demand scaling and application security?
- A. Stand-alone development environments
  - B. Open Platform as a service
  - C. Application delivery-only environments
  - D. Add-on development facilities
11. Type of PaaS -
- A. Public
  - B. Private
  - C. Hybrid
  - D. All of These
12. The infrastructure as a service (IaaS) provides a type of isolated environment to each customer individually by using\_\_\_\_\_.
- A. Renting
  - B. Virtual Machine Sprawl
  - C. Security Vulnerabilities
  - D. Hypervisor
13. Which of the following is the deployment model?
- A. Public
  - B. Private
  - C. Hybrid
  - D. All of the Above

14. Speed of laser printer is measured by-
- A. CPM
  - B. DPI
  - C. PPM
  - D. LPM
15. Which one of the following is not the auxiliary or secondary memory of the computer?
- A. Magnetic Tape
  - B. Floppy Disc
  - C. Hard Disc
  - D. RAM
16. Which key of the keyboard is mainly used to cancel the program?
- A. Del Key
  - B. Enter Key
  - C. Ins Key
  - D. ESC
17. Which of the following is used for manufacturing chips?
- A. Control Bus
  - B. Semiconductor
  - C. Control Unit
  - D. Parity Unit
18. The computer that processes both analog and digital is called –
- A. Analog Computer
  - B. Digital Computer
  - C. Hybrid Computer
  - D. Mainframe Computer
19. Which of the following is a sequential device?
- A. Magnetic Disk
  - B. Optical disk
  - C. Magnetic tape
  - D. All of the above
20. To convert assembly language program to machine language, ..... is used.
- A. Compiler
  - B. Assembler
  - C. Interpreter
  - D. Converter

## **Logical Reasoning**

1. Raja started walking towards north. He walked for 1009 m. and took a turn to his right from a police station. From there he covered 1008 m. distance. Now he turned left and walked 1007 m. Which direction is the Raja facing now?
  - A. East
  - B. West
  - C. North
  - D. South
  
2. A girl walked 100 meters towards north from her school. Now she turned left and walked 200 metres. After this she took two consecutive right turns. Which direction is the girl facing now?
  - A. East
  - B. West
  - C. North
  - D. South
  
3. Arrange the following words according to the dictionary. 1. Mask 2. Mate 3. Meal 4. Mart 5. Mash
  - A. 1, 2, 3, 5, 4
  - B. 4, 5, 3, 2, 1
  - C. 4, 5, 1, 2, 3
  - D. 3, 4, 5, 2, 1
  
4. Sheela is the sister-in-law of Ravi. Ram is the brother of Ravi and Sheela is the wife of Ram. Deepa is the sister of Ravi. Deepa's mother is Shanti. Accordingly, how is Sheela related to Shanti?
  - A. Daughter
  - B. Mother-In-Law
  - C. Daughter in law
  - D. Grand daughter
  
5. Pointing to a person's picture, Vijay said that his mother is the wife of my father's son. If Vijay does not have any real brother and real sister, then how is this picture related to Vijay?
  - A. Nephew
  - B. Son
  - C. Uncle
  - D. Cousin

6. Introducing a person, Shyamlal said, 'The only son of that person is my father' What is the relation between Shyamlal and that person?
- A. Grandfather
  - B. Brother
  - C. Father
  - D. Son
7. After colouring a big solid cube of 8 CM with pink colour it is cut into 2-2 CM small cubes, then tell What is the total number of small cubes?
- A. 25
  - B. 50
  - C. 65
  - D. 64
8. A cube is painted red on all 6 sides. Then it is cut into 27 equal cubes. How many such cubes are there which are coloured on one side only?
- A. 0
  - B. 6
  - C. 8
  - D. 18
9. Sita is 18th from the left and 30th from the right, then how many people are there in the queue?
- A. 37
  - B. 47
  - C. 39
  - D. None of These
10. In a row of people, Rohan's position is 15th from the left and Sohan's position is 25th from the right. If both of them interchange their positions, Rohan's new position becomes 35th from the left, then how many people are there in the queue?
- A. 59
  - B. 70
  - C. 75
  - D. 80
11. Roshan is at 17th position from the front in a row. If Himesh is 8th behind Roshan and 16th from the back of the row, then how many people are there in the row?
- A. 41
  - B. 40
  - C. 51
  - D. 31



12. What is the next number in this sequence? 1, 3, 8, 19, 42, 89, ....?
- A. 108
  - B. 184
  - C. 167
  - D. 97
13. In a row Ram is sitting 16th from the left and 15th from the right, how many more persons should be included to make the total 50 persons?
- A. 19
  - B. 20
  - C. 21
  - D. 22
14. Anup is 26th from the right and Vinod is 25th from the left in a row of 50 students, how many students are there between them?
- A. 4
  - B. 2
  - C. 3
  - D. None
15. Meena's position is 15th from the right and Geeta's position is 25th from the left. If 12 persons are sitting between them then how many persons are there in the queue?
- A. 52
  - B. 75
  - C. 80
  - D. 62
16. Ram is 10th from the left and Shyam is 15th from the right in a row of students, if they interchange their positions then Ram becomes 20th from the left. What will be the new position of Shyam from the right?
- A. 35
  - B. 15
  - C. 25
  - D. 20
17. If the English alphabet is written in reverse order, then what will be the 6th letter to the right of the 15th letter from the left?
- A. J
  - B. F
  - C. N
  - D. L

18. A bus plies from town R, in which the number of women is half that of men. In city S, 10 men get down and five women get on. Now both the numbers become equal. How many passengers had boarded the bus initially?
- A. 45
  - B. 50
  - C. 55
  - D. 40
19. A group of 1200 soldiers and captains are traveling by train. If there is one captain for every 15 soldiers, then how many captains are there in that group?
- A. 85
  - B. 75
  - C. 70
  - D. 80
20. A number leaves a remainder 1 when divided by 2, 3, 4, 5 and 6, but is divisible by 7. What is that number?
- A. 301
  - B. 273
  - C. 61
  - D. 231
21. In a family there are three fathers, three sons, two grandsons and one great grandson, then the minimum number of members that can make up this family is-
- A. 4
  - B. 5
  - C. 6
  - D. None
22. There are 19 hockey players in a club. On a particular day 14 players were wearing the prescribed hockey shirts none of them were without hockey pants or shirts. 11 players were wearing prescribed hockey pants how many players were in full uniform?
- A. 7
  - B. 8
  - C. 6
  - D. 9
23. Look at this series: 2, 1,  $(1/2)$ ,  $(1/4)$ , ... What number should come next?
- A.  $(1/3)$
  - B.  $(1/8)$
  - C.  $(2/8)$
  - D.  $(1/16)$

24. What number should come next in the given series - 26, 12, 10, 16,....?

- A. 50
- B. 52
- C. 53
- D. 56

25. In the following question, a number series is given with one term missing. Choose the correct option that will fill in the blank based on the same pattern.: 1, 4, 9, 16, 25, x

- A. 35
- B. 36
- C. 48
- D. 49

26. Which number will fit into the blank 4, 7, 12, ..., 28, 39

- A. 19
- B. 24
- C. 14
- D. 16

27. What should come in place of the question mark '?' in the following number series?

2916, 972,...?..., 108, 36, 12

- A. 324
- B. 234
- C. 248
- D. 391

28. What number would come next in the series 17, 22, 27, 32, .....?

- A. 33
- B. 35
- C. 38
- D. 37

29. Which number in the series is wrong? 2 11 38 197 1172 8227 65806

- A. 11
- B. 38
- C. 197
- D. 1172

30. Find the wrong number in the series 16 19 21 30 46 71 107

- A. 19
- B. 21
- C. 30
- D. 46

31. What comes next? ZA5, Y4B, XC6, W3D, \_\_\_\_\_
- A. E7V
  - B. V2E
  - C. VE5
  - D. VE7
32. In a code, CORNER is written as GSVRIV. How can CENTRAL be written in that code?
- A. DFOUSBM
  - B. GIRXVEP
  - C. GNFKER
  - D. None of these
33. What comes next in the series? JAK, KBL, LCM, MDN, \_\_\_\_\_
- A. OEP
  - B. NEO
  - C. MEN
  - D. PFQ
34. Fill in the blank with the correct option SCD, TEF, UGH, \_\_\_\_\_, WKL
- A. CMN
  - B. UJI
  - C. VIJ
  - D. IJT
35. What comes next? FAG, GAF, HAI, IAH, \_\_\_\_\_
- A. JAK
  - B. HAL
  - C. HAK
  - D. JAI
36. What will come in the blank space? ELFA, GLHA, ILJA, \_\_\_\_\_, MLNA
- A. OLPA
  - B. KLMA
  - C. LLMA
  - D. KLLA
37. What will come in the blank space? DEF, DEF2, DE2F2, \_\_\_\_\_, D2E2F3
- A. DEF3
  - B. DEF3
  - C. D3E3F
  - D. D2E2F2

38. What will come in the blank space? QPO, NML, KJI, \_\_\_\_, EDC
- A. HGF
  - B. JKL
  - C. CAB
  - D. GHI
39. In a certain code, TRIPPLE is written as SQHOOKD. How is DISPOSE written in that code?
- A. CHRONRD
  - B. DSOESPI
  - C. ESJTPTF
  - D. ESOPSID
40. What will be next pair of letters in the series? Z, S, W, O, T, K, Q, G, ?, ?
- A. N,C
  - B. N,D
  - C. O,C
  - D. O,D

## **Numerical Ability**

1. If the weight of a 45 m uniform rod is 171 kg., then what will be the weight of 12 m of the same rod?
- A. 45 kg
  - B. 50.3 kg
  - C. 63.2 kg
  - D. 33.9 kg
2. The simple interest on Rs.1800 for 2 years 4 months 20 days at the rate of 9% will be –
- A. Rs 352
  - B. Rs 378
  - C. Rs 382
  - D. Rs 387
3. How much amount will become Rs. 400 in 5 years at an annual simple interest rate of 12%?
- A. Rs 200
  - B. Rs 378
  - C. Rs 382
  - D. Rs 387

4. At a certain rate of simple interest, a sum amounts to Rs.2100 in 2 years and Rs.2250 in 5 years. The principal and the rate of interest are-
- A. Rs. 1800, 3%
  - B. Rs. 1800, 3.5%
  - C. Rs. 2000, 3%
  - D. Rs. 2000, 2.5%
5. A certain sum of money triples in 6 years at some rate of simple interest. In how many years will it become five times?
- A. 8 Years
  - B. 10 Years
  - C. 11 Years
  - D. 12 Years
6. A certain sum of money triples itself in 20 years at simple interest. In how many years does it double itself at the same rate of simple interest?
- A. 10 Years
  - B. 12 Years
  - C. 9 Years
  - D. 11.5 Years
7. The simple interest on Rs. 24,000 at 8.5% per annum for 8 months is-
- A. Rs 1560
  - B. Rs 1620
  - C. Rs 1480
  - D. 1360
8. Rs. 4,000 is divided into two parts in such a way that the first part is invested at 3% and the second part at 5% per annum. If the simple interest on the entire investment for one full year is Rs. 144, then the amount of the first part is?
- A. Rs 2700
  - B. Rs 2800
  - C. Rs 2500
  - D. Rs 2400
9. A sum amounts to Rs 1344 in 3 years and Rs 1536 in 7 years. What is the principal amount where the simple interest rate is to be charged?
- A. Rs 4000
  - B. Rs 1500
  - C. Rs 1200
  - D. Rs 2800

10. If a sum of money doubles at simple interest in 12 years, then in how many years will that sum get to triple?
- A. 36 Years
  - B. 18 Years
  - C. 24 Years
  - D. 30 Years
11. What will be the amount of interest on an amount of Rs. 4800 at 5% per annum simple interest in 2 years?
- A. Rs 700
  - B. Rs 480
  - C. Rs 500
  - D. Rs 600
12. By selling buttons at the rate of 20 for Re 1, a shopkeeper makes a loss of 4%. At what rate should they be sold for Re 1 to make a profit of 20%?
- A. 25
  - B. 24
  - C. 16
  - D. 20
13. The cost price of an article is Rs 100, after giving a discount of 50%, what should be the marked price of the article in order to make a profit of 50%?
- A. Rs 200
  - B. Rs 400
  - C. Rs 350
  - D. Rs 300
14. By selling a table for Rs.350 instead of Rs.400, the loss percentage increases by 5%. What is the cost price of this table?
- A. Rs 435
  - B. Rs 417.50
  - C. Rs 1000
  - D. Rs 1050
15. By selling an article for Rs. 8000, there is a loss equal to  $\frac{1}{5}$  of the cost price, what is the cost price of this article?
- A. Rs 10000
  - B. Rs 9000
  - C. Rs 9500
  - D. Rs 10500

16. Selling a book for Rs 60, the publisher suffers a loss of  $\frac{1}{11}$  part of its cost. What is its cost?
- A. Rs 65
  - B. Rs 64.50
  - C. Rs 65.50
  - D. Rs 66
17. By selling a watch for Rs. 1140 there is a loss of 5%, at what price should the watch be sold to make a profit of 5%?
- A. Rs 1240
  - B. Rs 1260
  - C. Rs 1250
  - D. Rs 1280
18. A person has Re. 1, Rs. 5 and Rs. 10 notes in Rs. 480. What is the total number of notes if the number of each type of note is the same?
- A. 45
  - B. 60
  - C. 90
  - D. 75
19. A bag contains Re. 1, 50 paise and 25 paise coins in the ratio of 5: 9: 25. If the total money in the bag is Rs. 1008, then what is the number of Rs. 1 coin?
- A. 320
  - B. 300
  - C. 340
  - D. 360
20. The ratio of spending and saving of a person is 26 : 3. If his monthly income is Rs.7250, what is his monthly savings?
- A. Rs 290
  - B. Rs 350
  - C. Rs 750
  - D. Rs 780
21. A bag contains 25 paise, 10 paise and 5 paise coins in the ratio 1 : 2 : 3. If the total in the bag is Rs. 30, then what is the number of 5 paise coins in it?
- A. 50
  - B. 100
  - C. 150
  - D. 200



22. Which number must be subtracted from 23, 30, 57 and 78 so that the remainder becomes proportional?
- A. 6
  - B. 5
  - C. 7
  - D. 13
23. The salaries of A and B are in the ratio 3 : 5. The salaries of C and B are in the ratio 4 : 6. If their total income is Rs. 6800, then what is the salary of C?
- A. Rs 2500
  - B. Rs 2000
  - C. Rs 1800
  - D. Rs 2300
24. A bag contains Re. 1, 50 paise and 25 paise coins. The number of coins are in the ratio 2.5 : 3 : 4. If the total amount is Rs. 420, the number of 50 paise coins is-
- A. 332
  - B. 222
  - C. 454
  - D. 252
25. Which number should be added to the numbers 4, 8, 16, 26 to make them proportional?
- A. 2
  - B. 4
  - C. 6
  - D. 8
26. The ratio of two numbers is 7 : 11 and their LCM is 154. The first number is-
- A. 14
  - B. 7
  - C. 22
  - D. 32
27. A box contains one rupee, 50 paise and 25 paise coins. If these coins are in the ratio 2, 3 and 10 respectively and their value is Rs. 336, then the number of 50 paise coins will be-
- A. 160
  - B. 480
  - C. 168
  - D. 186

28. 12 men can do a piece of work in 10 days. How many men are required to do that work in 8 days?
- A. 15
  - B. 14
  - C. 16
  - D. 18
29. The marks of two candidates P and Q are in the ratio 2 : 5. If P's marks are 120 then Q's marks are-
- A. 360
  - B. 120
  - C. 300
  - D. 240
30. The shares of Sunil and Rajeev are in the ratio of 3 : 2. If Sunil's share is Rs. 500 more than Rajeev's share, then what will be Rajeev's share?
- A. Rs 1000
  - B. Rs 1200
  - C. Rs 1500
  - D. Rs 1800
31. 400 is to be divided between A and B in the ratio 3 : 5, what is the difference between A's share and B's share?
- A. Rs 80
  - B. Rs 100
  - C. Rs 120
  - D. Rs 140
32. The ratio of boys and girls in a college is 8 : 5. If the number of girls is 460, then how many students are there in the college ?
- A. 1316
  - B. 1236
  - C. 1196
  - D. 1072
33. The average age of Soni and Tony is 28 years. If Moni's age is also included, then the average age of all three remains only 26 years. Moni's age is-
- A. 24 Years
  - B. 23 Years
  - C. 22 Years
  - D. 21 Years

34. A father is three times as old as his son. After Twelve years his age will be twice that of his son. What is the present age of the father?
- A. 32 Years
  - B. 36 Years
  - C. 40 Years
  - D. 48 Years
35. A man's age after 15 years will be four times of his age 15 years ago. What is his present age (in years)?
- A. 20
  - B. 35
  - C. 30
  - D. 25
36. The respective ratio of the present ages of X and Y is 4 : 5. Six years from now their ages will be 6 : 7 respectively. How far is it between their ages?
- A. 3 Years
  - B. 5 Years
  - C. 2 Years
  - D. 4 Years
37. Today is Varun's birthday. One year from now, He will be twice as old as He was 12 years ago. What is Varun's age now?
- A. 20 Years
  - B. 22 Years
  - C. 25 Years
  - D. 27 Years
38. A man goes from his home to his office on foot at a speed of 4 km/hr. Comes back by cycle at a speed of 16 km/h. His average speed is ----- km/h.
- A. 10
  - B. 6
  - C. 6.4
  - D. None of These
39. The diameter of the wheel of a bus is 2.1 m. If the bus is running at a speed of 79.2 km/hr., how many revolutions will the wheel make in 1 minute?
- A. 150
  - B. 175
  - C. 200
  - D. 225

40. Ram covers some distance in 12 minutes at the speed of 30 kmph and covers the remaining distance in 8 minutes at the speed of 45 kmph. What is his average speed?

- A. 30 kmph
- B. 36 kmph
- C. 40 kmph
- D. 44 kmph