



Name: Roll No.:

Branch: Signature of Invigilator:

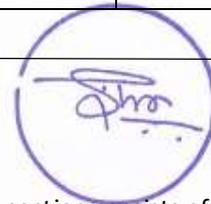
Semester: VIth

Date: 25/04/2022 (MORNING)

Subject with Code: BE307 BIOPROCESS ENGINEERING

Marks Obtained	Section A (30)	Section B (20)	Total Marks (50)

INSTRUCTION TO CANDIDATE



1. The booklet (question paper cum answer sheet) consists of two sections. First section consists of MCQs of 30 marks. Candidates may mark the correct answer in the space provided / may also write answers in the answer sheet provided. The Second section of question paper consists of subjective questions of 20 marks. The candidates may write the answers for these questions in the answer sheets provided with the question booklet.
2. The booklet will be distributed to the candidates before 05 minutes of the examination. Candidates should write their roll no. in each page of the booklet.
3. Place the Student ID card, Registration Slip and No Dues Clearance (if applicable) on your desk. All the entries on the cover page must be filled at the specified space.
4. Carrying or using of mobile phone / any electronic gadgets (except regular scientific calculator)/chits are strictly prohibited inside the examination hall as it comes under the category of unfair means.
5. No candidate should be allowed to enter the examination hall later than 10 minutes after the commencement of examination. Candidates are not allowed to go out of the examination hall/room during the first 30 minutes and last 10 minutes of the examination.
6. Write on both side of the leaf and use pens with same ink.
7. The medium of examination is English. Answer book written in language other than English is liable to be rejected.
8. All attached sheets such as graph papers, drawing sheets etc. should be properly folded to the size of the answer book and tagged with the answer book by the candidate at least 05 minutes before the end of examination.
9. The door of examination hall will be closed 10 minutes before the end of examination. Do not leave the examination hall until the invigilators instruct you to do so.
10. Always maintain the highest level of integrity. Remember you are a BITian.
11. Candidates need to submit the question paper cum answer sheets before leaving the examination hall.

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI

(END SEMESTER EXAMINATION)

CLASS: B. TECH

SEMESTER: VI

BRANCH: BIOENGINEERING

SESSION: SP/22

SUBJECT: BIOPROCESS ENGINEERING (BE 307)

TIME: 2 HOURS

FULL MARKS: 50

PART A (30 Marks)

Q1: The K used in the equation for $X_{10} = 2.303/K$ depends upon:

- (A) Nature of the filter material; (B) Linear velocity of the air passing through filter; (C) Both (a) and (b) (D) Thickness of the filter

Q2: Monod (K_s) and Michealis-Menten constant (K_m) are same:

- (A) True (B) False

Q3: The Yield Factor (Y) does not vary upon which of the following?

- (A) pH; (B) Growth rate; (C) Temperature (D) Amount of enzyme

Q4: During batch culture/fermentation, nutrients in the fermenter are utilized at a fast rate.

- (A) True (B) False

Q5: During the exponential phase, the maximum specific growth rate equals to the specific growth rate as:

- (A) Concentration of the growth limiting substrate is much less than the monod constant; (B) Concentration of growth limiting substrate is much greater than the monod constant; (C) Specific growth rate increases exponentially; (D) Specific growth rate decreases

Q6: Heat transfer rates (per unit volume) will be lowest in:

- (A) Stirred tank bioreactor with biomass recycle; (B) Continuous air lift bioreactor; (C) Continuous packed bed reactor; (D) Continuous fluidized bed bioreactor

Q7: The number of baffles in a standard stirred tank bioreactor is

- (A) 8; (B) 2; (C) 4 (D) 6

Q8: The main function(s) of a draft tube in an air lift fermenter is/are to:

- (A) Increase the solubility of oxygen; (B) Distribute shear forces throughout the reactor and minimise bubble coalescence; (C) Concentrate shear forces around the sparger; (D) Concentrate shear forces near the disengagement zone

Q9: The del factor (Δ) increases as the final number of cells:

- (A) Decreases (B) Increases; (C) Zero (D) Constant

Q10: The X_{90} value for a filtration system is:

(A) The time required reducing microbial population by 90%; (B) The time required to traverse survivor curve by one log cycle; (C) The depth required to reduce population by 90%; (D) The depth of the filter required to reduce population by 99%

Q11: In the production, kinetics -----is produced at the same time as cell growth which constitutes constitutive enzymes and metabolic intermediates:

(A) Growth associated; (B) Non-growth associated;(C) Mixed-growth associated; (D) Variable-growth associated

Q12: Estimation of biomass can be done by using stoichiometric calculation with the help of: (A) Biomass yield; (B) Product yield; (C) Both a and b; (D) None of the above

Q13. In addition to elemental balance ----- are required to be balanced to determine the stoichiometric coefficient: (A) Substrate and product; (B) Cellular materials; (C) Substrates; (D)Electron and proton

Q14: The contamination cannot be avoided by sterilizing the fermenter vessels only:

(A) True (B) False

Q15: The filter material used for air filtration system is/are:

(A) Cloth fiber; (B) Filter paper; (C) Thin metal sieve; (D) None of the above

Q16: The kinetics behavior of a bound enzyme is different to that of free enzyme because the property of the enzyme may get modified by the immobilization protocols:

(A) True; (B) False

Q17: The productivity of the batch culture is at its maximum at the end of the process while the productivity of continuous culture is steady and constantly at its maximum level:

(A) True; (B) False

Q18: ----- is the most commonly used filter with a pore size of -----

(A) Filter paper, 0.22 μ ; (B) Nitrocellulose, 0.22 μ ; (C) Filter paper, 0.28 μ ; (D) Nitrocellulose, 0.28 μ

Q19: What is the limiting nutrient for growing most of the bacteria?

(A) Glucose; (B) Sucrose; (C) Glycerol; (D) All

Q20: The rate of cell growth is mentioned by the equation: $r_x = \mu x$. What is the unit of volumetric rate of biomass production?

(A) kg/m/s; (B) kg/m³/s; (C) kg m/s; (D) kg/m³/s³

Q21: What is the alternate name of Fed Batch Process?

Q22: The degree of reduction of S is

(A) 5; (B) 4; (C) 6; (D) 9

Q23: The difference between entrapment and encapsulation:

(A) Presence of a membrane; (B) Agar agar powder; (C) mass transport limitation; (D) active site modification

Q24: The mass transfer and heat transfer are maximum in STBR:

(A) True (B) False

Q25: There is no difference between kinetic behavior of immobilized cells and free cells?

(A) True; (B) False

Q26: The phase subsequent to the exponential phase where secondary metabolites are synthesized is referred to as:

- (A) Idiophase
- (B) Late exponential phase
- (C) Stationary phase
- (D) All of the above

Q27: The volume of fermentation broth in batch mode of reaction is constant:

(A) True; (B) False

Q28: A suitable production medium must contain -----, and -----for maximum yield.

Q29: The productivity of the process of antibiotic synthesis depends on:

(A) Sugar Concentration; (B) Inoculum (C) pH and temperature; (D) Time

Q30: You are growing cell biomass in shake flask. Which yield coefficient is more significant as per your assumption?

PART B (20 Marks)

Q1 (a): Analyze the different steps of microbial growth in batch mode of culturing? [3]

Q1 (b): Define the role of Monod constant on specific growth? [2]

Q2: Design a fermentation process where high concentration of S and P inhibits the production process? [3]

Q3 (a): Calculate the stoichiometry of the given equation? [2]



Q3 (b): Explain the mechanism of thermal death kinetic? [2]

Q4: Find out the elemental balance in the mentioned reaction? [3]



Q5 (a): Comments on the different types of reactors employed for immobilized systems. [3]

Q5 (b): Investigate the salient features of bubble column reactor? [2]