



Name:

Enrolment No:

**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**  
**End Semester Examination, December 2021**

**Course: Fermentation technology**

**Program: M.Sc. Microbiology**

**Course Code: HSMB8002**

**Instructions:**

**Semester: III**

**Duration: 03 hrs.**

**Max. Marks: 100**

	<b>SECTION A</b> <b>(Type the answers in test box)</b>	<b>(20Q x1.5M= 30 Marks)</b>	<b>CO</b>
	<b>MCQs or Fill in the blanks</b>		
Q1	What is fermentation in bioprocess technology?	<b>1.5</b>	<b>CO1</b>
Q2	The fermentation carried by yeast is called _____	<b>1.5</b>	<b>CO1</b>
Q3	Considering the fermentation at the industrial level, the microorganism <i>Bacillus</i> is used to form _____	<b>1.5</b>	<b>CO1</b>
Q4	The common example of a fermented beverage product is _____	<b>1.5</b>	<b>CO1</b>
Q5	The applications of fermentation include A. cereal products B. dairy products C. beverage products D. all of above	<b>1.5</b>	<b>CO2</b>
Q6	Which of the following is the raw material for lactic acid and SCP production? a) Fruit juices b) Beet molasses c) Cheese Whey d) Hydrocarbons	<b>1.5</b>	<b>CO2</b>
Q7	A fed-batch process is a (a) Closed system (b) Continuous system (c) Intermittently fed system (d) Biphasic system	<b>1.5</b>	<b>CO2</b>
Q8	The fermenter vessel has to pass through several tests before entering the market. Those vessels which pass the tests is given a certificate by the	<b>1.5</b>	<b>CO2</b>

	<p>insurance companies which then allow the vessel to be operated in the laboratory or factory.</p> <p>(a) True (b) False</p>		
Q9	<p>Which of the following does not influence filtration?</p> <p>a) Temperature b) Density c) Viscosity d) pH</p>	1.5	CO3
Q10	<p>Which of the following process is used to separate insoluble particles from liquids?</p> <p>a) Filtration b) Extraction c) Drying d) Sieving</p>	1.5	CO3
Q11	<p>What led to the development of Walhof-type fermenter?</p> <p>a) Yeast growth b) Bacterial growth c) Viral growth d) Fungi growth</p>	1.5	CO3
Q12	<p>The continuous cultures are not widely used in industry because</p> <p>a) they are not suited for the production of secondary metabolites b) contamination or mutation can have a disastrous effect on the operation c) the government will not approve the licensing of pharmaceuticals produced in continuous cultures d) all of the above</p>	1.5	CO3
Q13	<p>Who defined Tower Fermenter?</p> <p>a) Cohee b) Steffen c) Ebner d) Greenshields</p>	1.5	CO4
Q14	<p>Which of the following is the disadvantage of cylindro-conical vessels in brewing?</p> <p>a) Time-consuming b) Fermentation and conditioning can be carried out in the same vessel c) Reduction in maturing time d) Yeast separation is good</p>	1.5	CO4

Q15	Which of the following is not the type of airlift fermenter? a) Concentric Draft loop b) Tower loop c) ICI deep shaft d) High pressure	1.5	CO4
Q16	Which of the following is not a criterion for the choice of the recovery process? a) Location of the product b) Price of the product c) Use of the product d) Source of organism	1.5	CO4
Q17	Which of the following is not a stage of product recovery? a) Removal of solids b) Isolation of organism c) Purification and concentration d) Cell disruption	1.5	CO5
Q18	Which of the following is used to pack columns in adsorption chromatography? a) Carbon b) Silica gel c) Potassium hydroxide d) Aluminium oxide	1.5	CO5
Q19	Which of the following is not a scale-up process? a) Laboratory to pilot-scale b) Pilot-scale to industrial-scale c) Industrial to pilot-scale d) Laboratory to industrial-scale	1.5	CO5
Q20	What do you mean by 'scale-down'? a) Decreasing the scale of fermentation b) Increasing the scale of fermentation c) Decreasing the rate of agitation d) Increasing the rate of fermentation	1.5	CO5
	<b>SECTION B</b> <b>(Scan and upload)</b>	<b>(4Qx5M=20</b> <b>Marks)</b>	<b>CO</b>
	<b>Short Answer Type Question (5 marks each)</b>		
Q1	What are the requirements for fermentation industry? Explain how a biochemical process differs from a chemical process	5	CO1

Q2	Medium formulation is an essential stage in the design of successful laboratory experiments, pilot plant development and manufacturing process. Discuss the statement.	5	CO2
Q3	List various factors that may influence the microbial growth and activities in a continuous bioreactor.	5	CO3
Q4	Give a brief account of inoculation of a plant fermenter from spore suspension vessel	5	CO4
<b>SECTION C (Scan and upload)</b>		<b>(2Qx15M=30 Marks)</b>	<b>CO</b>
Q1	<p>Assume <i>Aspergillus niger</i> is being used to produce citric acid. After performing fermentation in flask culture, 21 g/l of citric acid was obtained. However, after running the same experiment but in a fed-batch fermentor, a titer of 55 g/l of citric acid was obtained.</p> <p>Based on the above observation, answer the following:</p> <ol style="list-style-type: none"> <li>Differentiate between batch fermentation, fed-batch fermentation and continuous feed fermentation</li> <li>What are the reasons behind the increase in the titer of citric acid after employing a fed-batch fermentor compared to flask culture?</li> <li>Do you expect further increase in the titer of citric acid with continuous feed fermentation</li> </ol>	<b>15 (5 marks each)</b>	<b>CO3</b>
Q2	<p>A flow diagram is shown in the picture for bacterial fermentation product of pyruvate and end products are italicized. Pyruvate is formed by catabolism of glucose is metabolized by different pathways, which are</p>	<b>15 (9 + 6) marks</b>	<b>CO4</b>

	<p>characteristic of particular organism. Based on your understanding of various biochemical pathways, answer the following:</p> <p>a) Label the microbial taxa catalyzing the reactions A, B, C, D, E, F, G, H, I.</p> <p>b) Why is it beneficial for pyruvate to be reduced via fermentation when oxygen is not available?</p>		
	<p><b>SECTION- D</b> <b>(Scan and upload)</b></p>	<p><b>(2Qx10M=20</b> <b>Marks)</b></p>	<p><b>CO</b></p>
	<p><b>Long Answer type Question</b></p>		
Q1	<p>What are antibiotics? With the help of a neat flowsheet diagram, explain the large-scale production of penicillin</p>	<p><b>10</b></p>	<p><b>CO5</b></p>
Q2	<p>(a) What is Single Cell Protein (SCP)? List common microbes as SCP producers. (5)</p> <p>(b) List five applications of SCP (5)</p> <p style="text-align: center;">OR</p> <p>(c) With the help of a neat and labelled diagram, explain various steps involved in SCP production</p>	<p><b>10</b></p>	<p><b>CO5</b></p>