Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–V (NEW) EXAMINATION – WINTER 2020

Subject Code:3150502 Date:01/02/2021

Subject Name:Mechanical Operations

Time:10:30 AM TO 12:30 PM Total Marks: 56

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			Marks
Q.1	**(a)**	Define (1) Mesh number (2) Angle of nip (3) Work index	**03**
	(b)	Write a short note on Screen analysis.	**04**
	(c)	Describe various laws for size reduction and write principle of comminution.	**07**
Q.2	**(a)**	What is power number and its significance?	**03**
	(b)	What the use is of filter aid and filter media?	**04**
	(c)	Give classification of various size reduction equipments.	**07**
Q.3	**(a)**	Define sphericity. Prove that sphericity of sphere is unity.	**03**
	(b)	What rotational speed in RPM would you recommend for a ball mill of 1200 mm in diameter charged with 75mm balls?	**04**
	(c)	Describe open circuit & closed circuit operation with neat sketch.	**07**
Q.4	**(a)**	Calculate the power required to crush 150 tonnes per hour of limestone if 80% of the feed passes 50mm screen and 80% of the product passes a 3.125mm screen? Work index of limestone = 12.74.	**03**
	(b)	Explain sink and float method.	**04**
	(c)	With the help of a neat sketch explain the construction and working of a toothed roller crusher and write the important equations for roll crusher.	**07**
Q.5	**(a)**	What are the various equipments used for storage of solids? Discuss any one.	**03**
	(b)	With neat diagram explain about grizzlies.	**04**
	(c)	With the help of neat sketch explain different types of impellers for agitation of liquids along with application.	**07**
Q.6	**(a)**	Discuss the different criteria's for selection of conveyers.	**03**
	(b)	Explain: "For efficient grinding, ball mills must be operated at a speed less than the critical speed."	**04**
	(c)	With neat sketch, explain pneumatic conveying system with advantages and disadvantages.	**07**
Q.7	**(a)**	Explain minimum fluidization velocity.	**03**
	(b)	Describe batch sedimentation process with a neat sketch in details.	**04**
	(c)	Explain construction and working of continuous rotary vacuum filter.	**07**
Q.8	**(a)**	Discuss applications of fluidization in chemical industry.	**03**
	(b)	Write short note on batch centrifuge.	**04**

(c) With neat diagram explain construction and working of plate and frame filter press also state its advantages and limitations. **07**

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2021

Subject Code:3150502 Date:27/12/2021

Subject Name:Mechanical Operations

Time:02:30 PM TO 05:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Define (1) Mesh number (2) Angle of nip (3) Work index	**03**
	(b)	What the use is of filter aid and filter media?	**04**
	(c)	Describe open circuit & closed circuit operation with neat sketch.	**07**
Q.2	**(a)**	What is power number and its significance?	**03**
	(b)	Write a short note on Screen analysis.	**04**
	(c)	Give classification of various size reduction equipments.	**07**
		OR	
	(c)	With the help of neat sketch explain different types of impellers for agitation of liquids along with application.	**07**
Q.3	**(a)**	Define sphericity. Prove that sphericity of sphere is unity.	**03**
	(b)	Determine minimum fluidization velocity.	**04**
	(c)	Describe various laws for size reduction and write principle of comminution.	**07**
		OR	
Q.3	**(a)**	Calculate the power required to crush 150 tonnes per hour of limestone if 80% of the feed passes 50mm screen and 80% of the product passes a 3.125mm screen? Work index of limestone = 12.74.	**03**
	(b)	Differentiate between particulate fluidization and bubbling fluidization.	**04**
	(c)	What are the various methods for prevention of swirling in an agitated vessel?	**07**
Q.4	**(a)**	Give significance of Power no, Reynolds no and Froude no for mixing of liquids.	**03**
	(b)	Discuss factors affecting performance of cyclone.	**04**
	(c)	Explain principle of ultrafiltration, types of membrane and membrane modules used for it.	**07**
		OR	
Q.4	**(a)**	Discuss the different criteria's for selection of conveyers.	**03**
	(b)	Write short note on storage of solids.	**04**
	(c)	With neat sketch, explain pneumatic conveying system with advantages and disadvantages.	**07**
Q.5	**(a)**	Differentiate between clarifier and classifiers	**03**
	(b)	Classify the Filtration equipments with examples in each category.	**04**

	(c)	With neat diagram explain construction and working of plate and frame filter press also state its advantages and limitations.	**07**

OR

Q.5	**(a)**	Define: electrostatic separation.	**03**
	(b)	Write short note on batch centrifuge.	**04**
	(c)	Explain construction and working of continuous rotary vacuum filter.	**07**

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – SUMMER 2021

Subject Code:3150502 Date:15/09/2021

Subject Name:Mechanical Operations

Time:10:30 AM TO 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Define sphericity and calculate sphericity of the cube.	**03**
	(b)	Define volume surface mean diameter, volume mean diameter, mass mean diameter and arithmetic mean diameter.	**04**
	(c)	Develop the equation for the calculation of effectiveness of the screen.	**07**
Q.2	**(a)**	Give the difference between ideal screen and actual screen.	**03**
	(b)	Write short note on various screening equipment.	**04**
	(c)	A sludge filtered in a washing plate and frame press is of such a nature that the filtration equation is $V^2 = K\ t$, where V is the volume of the filtrate obtained in time t, when the pressure is constant 30 cubic meter of filtrate is produced in 10 hrs. (a) 3 cubic meter of wash water is forced through the cake at the end of the filtration. What is the washing time? (b) If the filtering surface of the press is doubled, all other conditions remaining constant, how long it take to produce 30 cubic meter of filtrate?	**07**
		OR	
	(c)	Write principle of comminution. Explain various laws of size reduction in detail.	**07**
Q.3	**(a)**	Define: (i) angle of nip (ii) mixing index. and (iii) angle of repose	**03**
	(b)	Write short note on storage in bin and silos.	**04**
	(c)	Describe open circuit and closed circuit operation with neat sketch.	**07**
		OR	
Q.3	**(a)**	Discuss various mechanism of filtration in brief.	**03**
	(b)	Differentiate clarifier and classifier.	**04**
	(c)	Discuss the condition of the fluidization with sketch and show the relation of pressure drop and bed height versus superficial velocity.	**07**
Q.4	**(a)**	Discuss the different criteria's for selection of conveyors.	**03**
	(b)	Write short note on equipment used for cohesive solid mixing.	**04**
	(c)	Describe the pneumatic conveying system with sketch.	**07**
		OR	
Q.4	**(a)**	Define filter aid and write use of it in filtration.	**03**

	(b)	Describe differential settling method.	**04**
	(c)	Explain the construction and working of cyclone separator in detail.	**07**
Q.5	**(a)**	Write short notes on slurry transport.	**03**
	(b)	Write short note on muller mixer.	**04**
	(c)	A roller crusher has rolls of 150 cm in diameter and 75 cm face width. The crushing roll surfaces are 1.25 cm apart at the narrowest point. The angle of nip 30°. The roll crusher operates at a speed of 150 rpm. They are used to crush a rock of specific gravity of 2.35. Calculate the maximum permissible size of feed and the maximum actual capacity in metric tons per hour, if the actual capacity is 20 % of the theoretical.	**07**

OR

Q.5	**(a)**	What is power number and its significance?	**03**
	(b)	Define agitation and mixing. Enlist different types of flow pattern induced in an Agitated vessel contains liquid.	**04**
	(c)	Which methods are used to prevent swirling and vortex formation in an agitated tank?	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V(NEW) EXAMINATION – SUMMER 2022

Subject Code:3150502 Date:09/06/2022

Subject Name:Mechanical Operations

Time:02:30 PM TO 05:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Define (1) Screen capacity (2) Ideal screen (3) No of particles in mixture	**03**
	(b)	Define Sphericity. Prove that Sphericity of sphere is unity.	**04**
	(c)	Describe various laws for size reduction and write principle of Comminution.	**07**
Q.2	**(a)**	A certain set of rolls of 1000mm diameter by 375mm width of face. They are set so that the crushing surfaces are 12 mm apart at the narrowest point. The angle of nip is 30 °. What is the maximum permissible size of feed?	**03**
	(b)	Differentiate differential and cumulative analysis.	**04**
	(c)	A material is crushed in a jaw crusher and the average size of the particle is reduced from 5 cm to 1.3 cm with consumption of energy at the rate of 37 Watt.hr/ton. What will be the consumption of energy necessary to crush the same material of average size 8 cm to an average size 3 cm? The mechanical efficiency remains same. (a) Using Rittinger's law; (b) using Kick's law	**07**
		OR	
	(c)	Explain the construction and working of Grizzlies with the help of a neat sketch.	**07**
Q.3	**(a)**	Explain principle of filtration.	**03**
	(b)	Derive the mathematical expression for constant rate filtration.	**04**
	(c)	Explain in detail the working of batch sedimentation with application.	**07**
		OR	
Q.3	**(a)**	Discuss Sink and float method	**03**
	(b)	Explain construction and working of the Dorr thickener.	**04**
	(c)	Explain construction and working of filter press.	**07**
Q.4	**(a)**	Write down purpose of agitation	**03**
	(b)	Define power number and write down its significance.	**04**
	(c)	Discuss scale up of agitation vessel	**07**
		OR	
Q.4	**(a)**	Define mixing index and its significance.	**03**
	(b)	Discuss paddles agitator.	**04**
	(c)	Explain double arm kneading mixture in detail with neat sketch.	**07**
Q.5	**(a)**	Discuss the different criteria’s for selection of conveyers.	**03**
	(b)	Explain in detail the belt conveyer.	**04**

	(c)	List different types of industrial conveyers and explain any one in detail.	**07**
		OR	
Q.5	**(a)**	Enlist the industrial applications of batch and continuous fluidization.	**03**
	(b)	Discuss minimum fluidization velocity and pressure drop in fluidized bed with neat sketch.	**04**
	(c)	Explain in detail: Types of fluidization.	**07**

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