Roll No.											

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST 1

Sem : Odd Sem. 2019-20 | **Date**: 30.09.2019

Course Code: PET 321 | **Time**: 11:00AM to 12:00PM

Course Name: UNIT OPERATIONS | **Max Marks**: 40

Program & Sem: B.Tech. (PET) & V DE | **Weightage**: 20%

Instructions:

i. Read the question properly and answer accordingly.

ii. Question paper consists of 3 parts.

iii. Scientific and Non-programmable calculators are permitted.

Part A (Memory Recall Questions)

Answer all the Questions. Each Question carries two marks. **(5Qx2M=10M)**

1. Characterization of a particle is done by how many factors?
(C.O.NO.1) [Knowledge]
2. How many types of mixers are there for non-cohesive solids?
(C.O.NO.1) [Knowledge]
3. What is the difference between Hinge and Sprocket?
(C.O.NO.1) [Knowledge]
4. The volume of any particle is depend on how many variables?
(C.O.NO.1) [Knowledge]
5. What is tumbling mixer and its applicable for what type of solid particles?
(C.O.NO.1) [Knowledge]

Part B (Thought Provoking Questions)

Answer both the Questions. Each Question carries ten marks. **(2Qx10M=20M)**

6. Discuss the different types of analysis that can be used for particle size distribution of a solid powder?
(C.O.NO.1) [Comprehension]

7 Describe different types of conveyors for a transportation of solid particles.
(C.O.NO.1) [Comprehension]

Part C (Problem Solving Questions)

Answer the Question. Each Question carries ten marks. (1Qx10M=10M)

8. A sample of crushed silica sand has given below in the Table 8.1 for the particle size analysis. The density of particles is 2650 kg/m^3 and the shape factors are a=0.8 and ϕ_s =0.571. For the material between 4-mesh and 28-mesh in particle size, calculate the following (i) total surface area in mm^2/gm, (ii) number of particles in each gram, (iii) volume mean diameter, (iv) volume surface mean diameter, (v) mass mean diameter for the particle mesh size between 4 and 10.

(C.O.NO.1) [Comprehension]

Table 8.1 Particle size Analysis

Mesh	Screen opening D_{pi}, mm	Mass fraction retained, x_{fi}	Average particle diameter in increment, $\bar{D}_{pi}$, mm	Cumulative fraction smaller than D_{pi}
4	4.699	0.0050	—	1.0000
6	3.327	0.0251	4.013	0.9749
8	2.362	0.1250	2.845	0.8499
10	1.65	0.3202	2.007	0.5297
14	1.166	0.2570	1.409	0.2727
20	0.833	0.1590	1.001	0.1132
28	0.589	0.0538	0.711	0.0594

SCHOOL OF ENGINEERING

Semester: Odd (2019-20)
Course Code: PET 321
Course Name: Unit Operations
Program & Sem: Petroleum Engineering & VI

Date: 30-09-2019
Time: 1 Hour
Max Marks: 40
Weightage: 20%

Date:
Time:
Max Marks:
Weightage:

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels			Thought provoking type [Marks allotted] Bloom's Levels			Problem Solving type [Marks allotted]			Total Marks
			K			C			C/A			
1	1	1	1*2	=	2							2
2	1	1	1+1	=	2							2

3	1	1	1+1	=	2							2
4	1	1	1+1	=	2							2
5	1	1	1+1	=	2							2
6	1	1				5+5	=	10				10
7	1	1				5+5	=	10				10
8	1	1							2*5	=	10	10
	Total Marks											40

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

I here certify that All the questions are set as per the above lines Deepjyoti]

Annexure- II: Format of Answer Scheme

SCHOOL OF ENGINEERING

SOLUTION

Semester: Odd (2019-20)
Course Code: PET 321
Course Name: Unit Operations
Branch & Sem: Petroleum Engineering & V

Date: 30-09-2019
Time: 1 Hour
Max Marks: 40
Weightage: 20%

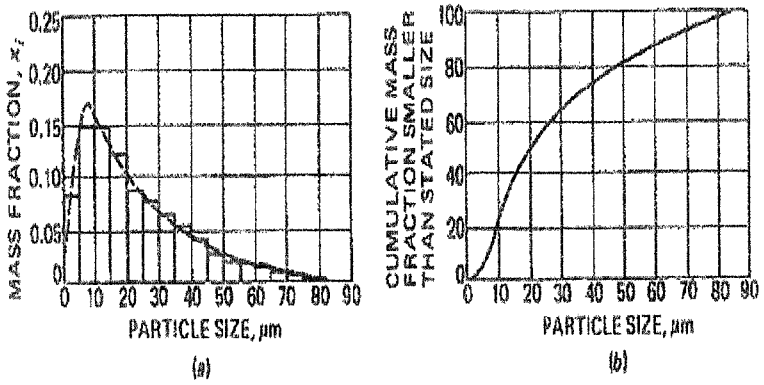
Date:
Time:
Max Marks:
Weightage:

Part A (5 x 2 = 10)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	Characterization of a particle is done by shape, size and density.	1*2=2	2
2	Two are Ribbon and Tumbling mixers.	1+1=2	2
3	Hinge is a movable joint and Sprocket is a wheel type with teeths or cogs to pass the chain over it.	1+1=2	2
4	The volume of any particle is depend on two variables – shape factor and particle diameter.	1+1=2	2
5	Tumbling mixer works on the principle of shearing & diffusive action of the surface. It consists of the metallic container which is rotated on its horizontal axis. The efficiency of a tumbling mixer highly depends on the speed of rotation. It is applicable for non-cohesive solids.	1+1=2	2

Part B (4 x 5 = 20)

Q No	Solution	Scheme of Marking	Max. Time required for each Question

6	Information from such a particle-size analysis is tabulated to show the mass or number fraction in each size increment as a function of the average particle size (or size range) in the increment. An analysis tabulated in this way is called a *differential analysis*. The results are often presented as a histogram, as shown in Fig. 28.1*a*, with a continuous curve like the dashed line used to approximate the distribution. A second way to present the information is through a *cumulative analysis* obtained by adding, consecutively, the individual increments, starting with that containing the smallest particles, and tabulating or plotting the cumulative  **FIGURE** Particle-size distribution for powder: (*a*) differential analysis; (*b*) cumulative analysis.	5+5=10	7.5

	sums against the maximum particle diameter in the increment. Figure is a cumulative-analysis plot of the distribution shown in Fig. 28.1*a*. In a cumulative analysis the data may appropriately be represented by a continuous curve. Calculations of average particle size, specific surface area, or particle population of a mixture may be based on either a differential or a cumulative analysis. In principle, methods based on the cumulative analysis are more precise than those based on the differential analysis, since when the cumulative analysis is used, the assumption that all particles in a single fraction are equal in size is not needed. The accuracy of particle-size measurements, however, is rarely great enough to warrant the use of the cumulative analysis, and calculations are nearly always based on the differential analysis.		
7	**Belt conveyor**: A conveyor belt is the carrying medium of a belt conveyor system (often shortened to belt conveyor). A belt conveyor system consists of two or more pulleys (sometimes referred to as drums), with an endless loop of carrying medium—the conveyor belt—that rotates about them. One or both of the pulleys are powered, moving the belt and the material on the belt forward. The powered pulley is called the drive pulley while the unpowered pulley is called the idler pulley. There are two main industrial classes of belt conveyors; Those in general material handling such as those moving boxes along inside a factory and bulk material handling such as those used to transport large volumes of resources and agricultural materials, such as grain, salt, coal, ore, sand, overburden and more. **A screw conveyor** or auger conveyor is a mechanism that uses a rotating helical screw blade, called a "flighting", usually within a tube, to move liquid or granular materials. They are used in many bulk handling industries. Screw conveyors in modern industry are often used horizontally or at a slight incline as an efficient way to move semi-solid materials, including food waste, wood chips, aggregates, cereal grains, animal feed, boiler ash, meat and bone meal, municipal solid waste, and many others. An important type of conveyor for transporting material in the form of finely divided solids or pasty solids is the screw conveyor. This apparatus consists essentially of a spiral blade revolving around an axis in the bottom of a U-shaped trough.	2*5=10	7.5

	The screw element is called a flight and may be sectional, helicoid, or special. The sectional conveyor is made up of short sections, each of which is stamped as a disc, cut along one radius ,and then given the proper twist to develop the spiral. Each disc provides for one full turn of the conveyor, and the various turns are riveted together. The helicoids flight however is made from a single long ribbon that is twisted and warped into a spiral shape and then welded to the central shaft. **Apron Conveyor** is a type of conveyor made from individual apron plates that are linked together with hinges on its underside, thus creating a looped carrying surface where materials can be placed. It plays a vital part in several industries by being used to move different materials from one location to another. The apron conveyor is used to deliver a large number of materials across several phases of production and is particularly useful for transport of huge and heavy materials. **A bucket elevator**, also called a grain leg, is a mechanism for hauling flowable bulk materials (most often grain or fertilizer) vertically. It consists of: Buckets to contain the material; A belt to carry the buckets and transmit the pull; Means to drive the belt; Accessories for loading the buckets or picking up the material, for receiving the discharged material, for maintaining the belt tension and for enclosing and protecting the elevator. A bucket elevator can elevate a variety of bulk materials from light to heavy and from fine to large lumps. A centrifugal discharge elevator may be vertical or inclined. **Pneumatic conveying:-** The method extensively used for the conveying of light and bulky materials is the pneumatic conveyor. In this system the material is transferred in suspension in a stream of air. The household vacuum cleaner is a familiar illustration of this method. There are variety of systems, but they all involve a pump or fan for producing the stream of air, a cyclone for separating larger particles, and usually, but not necessarily, a big filter for removing the dust. In the simplest form a pump of the cycloidal type produces a moderate vacuum and its suction is connected to the conveying system. The material sucked up through a nozzle which may be fixed or movable. The stream of air with the solid in the suspension goes to a cyclone separator, of the type described, and then to the pump. Where the material carries dust that would injure the pump, that would be harmful if discharge into the air, or that is the desired product, a bag filter of the type described is placed between the separator and pump.		

Part C (1 x 10 = 10)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
8	(i) total surface area-	2*5=10	20

$$A_w = \frac{6x_1}{\Phi_s \rho_d \bar{D}_{p1}} + \frac{6x_2}{\Phi_s \rho_p \bar{D}_{p2}} + \cdots + \frac{6x_n}{\Phi_s \rho_p \bar{D}_{pn}}$$

$$= \frac{6}{\Phi_s \rho_p} \sum_{i=1}^{n} \frac{x_i}{\bar{D}_{pi}}$$

where subscripts = individual increments

x_i = mass fraction in a given increment

n = number of increments

$\bar{D}_{pi}$ = average particle diameter, taken as arithmetic average of smallest and largest particle diameters in increment

$A_w = 829.478 \text{ mm}^2/\text{gm}$

(ii) number of particles in each gram-

$$N_w = \frac{1}{a\rho_p} \sum_{i=1}^{n} \frac{x_i}{\bar{D}_{pi}^3} = \frac{1}{a\rho_p \bar{D}_V^3}$$

$N_w = 22$ particles/gm

(iii) volume mean diameter-

$$\bar{D}_V = \left[\frac{1}{\sum_{i=1}^{n} (x_i/\bar{D}_{pi}^3)} \right]^{1/3}$$

2.801 mm

(iv) volume surface mean diameter-

	$$\bar{D}_s = \frac{1}{\sum_{i=1}^{n} (x_i/\bar{D}_{pi})}$$ 4.78 mm (v) mass mean diameter- $$\bar{D}_w = \sum_{i=1}^{n} x_i \bar{D}_{pi}$$ 1.0999 mm		

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GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST - 2

Sem & AY: Odd Sem 2019-20
Course Code: PET 321
Course Name: UNIT OPERATIONS
Program & Sem: B.Tech (PET) & V (DE)

Date: 18.11.2019
Time: 11.00 AM to 12.00 PM
Max Marks: 40
Weightage: 20%

Instructions:

(i) Read the question properly and answer accordingly.

Part A (Memory Recall Questions)

Answer all the Questions. Question carries two and three marks **(6Qx2M+1Qx3M=15)**

1. Define Unsize fractions. [1*2=2] (C.O.NO.3) [Knowledge level]
2. Name any two types of screening equipment. [1+1=2] (C.O.NO.3) [Knowledge level]
3. What is Flocculation? [1*2=2] (C.O.NO.4) [Knowledge level]
4. Define "Plate and Flame press" [1*2=2] (C.O.NO.3) [Knowledge level]
5. Write the principle of "Gas Clarification". [1*2=2] (C.O.NO.3) [Knowledge level]
6. What is "Thickener"? [1*2=2] (C.O.NO.4) [Knowledge level]
7. Name any three different motions of a screen. [1+1+1=3] (C.O.NO.3) [Knowledge level]

Part B (Thought Provoking Questions)

Answer all the Questions. Each Question carries five marks. **(3Qx5M=15M)**

8. Suppose three numbers of filter mediums (A, B and C) are present, where A has solid particles just above the medium, the solid particles go inside the flow channels of B and the solid particles does not go inside the C at all. Which and why filter medium will produce clear water or clean gas and also, name of the filter medium?

[2+2+1=5] (C.O.NO.3) [Comprehension level]

9. "A process which involves separation of particles for different densities". What is the name of the process? Please explain it briefly using any method.

[1+4=5] (C.O.NO.4) [Comprehension level]

10. A pack of disks lead to a breakthrough during filtration of liquid then how the filtration and solids removal efficiency will vary? What is the process of filtration and also, what is the name of the filter?

[2+2+1=5] (C.O.NO.3) [Comprehension level]

Part C (Problem Solving Questions)

Answer the Question. Each Question carries ten marks. (1Qx10M=10M)

11. The solid particles spreads over a screen to separate effectively into required size of particles. Establish a relation for two different materials that present in the solid particles with respect to their mass flow rates to find an overall effectiveness of the screen. Also, calculate the mass flow rate ratios for overflow, underflow to feed and the overall effectiveness of the screen from Table 11.1, which passes through a 10-mesh size.

[5+5=10] (C.O.NO.3) [Comprehension level]

Table 11.1 Screen Analysis

Mesh	D_p (mm)	Feed	Overflow	Underflow
4	4.699	0	0	0
6	3.327	0.025	0.071	0
8	2.362	0.15	0.43	0
10	1.651	0.47	0.85	0.195
14	1.168	0.73	0.97	0.58
20	0.833	0.885	0.99	0.83
28	0.589	0.94	1.0	0.91
35	0.417	0.96		0.94
65	0.208	0.98		0.975
Pan		1.0		1.0

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

Semester: Odd (2019-20)
Course Code: PET 321
Course Name: Unit Operations
Program & Sem: Petroleum Engineering & V

Date: 18-11-2019
Time: 1 Hour
Max Marks: 40
Weightage: 20%

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	C	
1	3 (5%)	Unit-III: Screening and Filtration	2			2
2	3 (5%)	Unit-III: Screening and Filtration	2			2
3	4 (5%)	Unit-IV: Separations and Distillation	2			2
4	3 (5%)	Unit-III: Screening and Filtration	2			2
5	3 (5%)	Unit-III: Screening and Filtration	2			2

6	4 (5%)	Unit-IV: Separations and Distillation	2			2
7	3 (7.5%)	Unit-III: Screening and Filtration	3			3
8	3 (12.5%)	Unit-III: Screening and Filtration		5		5
9	4 (12.5%)	Unit-IV: Separations and Distillation		5		5
10	3 (12.5%)	Unit-III: Screening and Filtration		5		5
11	3 (25%)	Unit-III: Screening and Filtration			10	10
	Total Marks		15	15	10	40

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

Annexure- II: Format of Answer Scheme

GAIN MORE KNOWLEDGE REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

SOLUTION

Semester: Odd (2019-20)

Course Code: PET 321

Course Name: Unit Operations

Branch & Sem: Petroleum Engineering & V

Date: 18-11-2019

Time: 1 Hour

Max Marks: 40

Weightage: 20%

Part A (6Qx2M+1Qx3M=15)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	The particles which can pass through the screen openings or mesh are defined as Unsize fractions.	1*2=2	2
2	Gyrating and Vibrating screens	1+1=2	2
3	Flocculation refers to the process by which fine particulates are caused to clump together into a floc or bigger forms.	1*2=2	2
4	Plate and Flame press is a discontinuous pressure filter where large pressure differential apply across the filter medium or septum for rapid filtration of liquids or solids.	1*2=2	2
5	Gas clarification is done by impingement of the particles against a solid surface placed in the flowing stream.	1*2=2	2
6	Gravity separation used to convert a dilute slurry of fine particles into a clarified liquid and a concentrated suspension in a large open tanks and this process is called thickener.	1*2=2	2
7	1. Gyrations in horizontal plane 2. Gyrations in vertical plane 3. Gyrations at one end	1+1+1=3	3

Part B (3Qx5M=15)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
8	Clarifying filter which removes small amounts of solids to produce a clean gas or clear water or liquids. The solid particles are trapped inside the filter medium or flow channel. It is having pores in the filter medium that are much larger in diameter than the particles to be removed.	2+2+1=5	5
9	Devices that separate particles of differing densities are known as sorting classifiers. They use one of the two principal separation methods: sink-and-float and differential settling. Sink-and-float methods:	1+4=5	5

	A sink-and-float method uses a liquid sorting medium, the density of which is intermediate between that of the light material and that of the heavy material. Then the heavy particles settle through the medium, and the lighter ones float, and a separation is thus obtained. This method has the advantage that, in principle, the separation depends only on the difference in the densities of the two substances and is independent of the particle size. This method is also known as the heavy fluid separation.		
10	A pack of disks for a clarifying disk filter, where the filtration rate and solids removal efficiency are typically almost constant for a considerable period of operation but eventually the solids contents of the filtrate rises to an unacceptable "breakthrough" value and backwashing of the filter medium element becomes necessary. This is Liquid Clarifier and removes small amounts of solids to produce a clean gas or clear water or liquids. The solid particles are trapped inside the filter medium or flow channel. It is having pores in the filter medium that are much larger in diameter than the particles to be removed.	2+2+1=5	5

Part C (1Qx10M=10)

Q No	Solution	Scheme of Marking	Max. Time required for each Question

11	Let F, D, and B be the mass flow rates of feed, overflow, and underflow, respectively, and x_F, x_D, and x_B be the mass fractions of material A in the streams. The mass fractions of material B in the feed, overflow, and underflow are 1- x_F, 1- x_D, and 1- x_B. $F = D + B$ $Fx_F = Dx_D + Bx_B$ Elimination of B from the above equations gives $\frac{D}{F} = \frac{x_F - x_B}{x_D - x_B}$ Elimination of D gives $\frac{B}{F} = \frac{x_D - x_F}{x_D - x_B}$ 4.1.3 Screen effectiveness A common measure of screen effectiveness is the ratio of oversize material A that is actually in the overflow to the amount of A entering with the feed. These quantities are Dx_D and Fx_F respectively. Thus $E_A = \frac{Dx_D}{Fx_F}$ where E_A is the screen effectiveness based on the oversize. Similarly, an effectiveness E_B based on the undersize materials is given by $E_B = \frac{B(1 - x_B)}{F(1 - x_F)}$ A combined overall effectiveness can be defined as the product of the two individual ratios. $E = E_A E_B = \frac{(x_F - x_B)(x_D - x_F)x_D(1 - x_B)}{(x_D - x_B)^2(1 - x_F)x_F}$ (i) D/F = 0.384 (ii) B/F = 0.616 (iii) E = 0.498	5+5=10	20

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GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Semester: Odd Semester: 2019 - 20
Course Code: PET 321
Course Name: UNIT OPERATIONS
Program & Sem: B.Tech (PET) - V (DE-II)

Date: 24 December 2019
Time: 9.30 AM to 12.30 PM
Max Marks: 80
Weightage: 40%

Instructions:
(i) Read the all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and Non-programmable calculators are permitted.

Part A [Memory Recall Questions]

Answer all the sub Questions. Each sub Question carries 02 marks. (15Qx2M=30M)

1. Answer the following questions:

a. Difference between Unit Operation and Process.	(C.O.No.1) [Knowledge]
b. Define Mixing Index.	(C.O.No.1) [Knowledge]
c. Write different types of Mixers	(C.O.No.1) [Knowledge]
d. Define sphericity.	(C.O.No.1) [Knowledge]
e. Write difference between Hinge and Sprocket.	(C.O.No.2) [Knowledge]
f. What is screw conveyor?	(C.O.No.2) [Knowledge]
g. Define Pnuematic mode of conveying.	(C.O.No.2) [Knowledge]
h. State difference between Apron and Bucket elevator.	(C.O.No.2) [Knowledge]
i. What is gyration?	(C.O.No.3) [Knowledge]
j. How many types of membranes available for cross flow filtration?	(C.O.No.3) [Knowledge]
k. What is "Plate and Frame press"?	(C.O.No.3) [Knowledge]
l. Define 'doctor blade'.	(C.O.No.3) [Knowledge]
m. What is classifier?	(C.O.No.4) [Knowledge]
n. Define Flocculation	(C.O.No.4) [Knowledge]
o. What is Thickener?	(C.O.No.4) [Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each Question carries 10 marks. (2Qx10M=20M)

2. Number of plates which are in series containing filter medium, where slurry enters from one end of the plates and leaves the wet cake of solids with clean water. Name the filter and explain the mechanism of it. (C.O.No.3) [Comprehension]

3. The condensate form of the sample is collected in the liquid form, in a measuring cylindrical beaker which gives us the volume distillate collected. Provide the name and describe the procedure of this unit. (C.O.No.3) [Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. Each Question carries 15 marks. (2Qx15M=30M)

4. The two different materials which is a part of silica sand particles pass through a screen of 14-mesh and 28-mesh screens. Write the relations for the two different materials with respect to their mass flow rates and calculate the overflow, underflow to feed and an overall effectiveness of the screen for the two mesh size from Table 4.1. Also, compare the overall effectiveness of the screen for the two given mesh size. (C.O.No.3) [Comprehension]

Table 4.1 Screen Analysis

Mesh	D_p (mm)	Feed	Overflow	Underflow
4	4.699	0	0	0
6	3.327	0.025	0.071	0
8	2.362	0.15	0.43	0
10	1.651	0.47	0.85	0.195
14	1.168	0.73	0.97	0.58
20	0.833	0.885	0.99	0.83
28	0.589	0.94	1.0	0.91
35	0.417	0.96		0.94
65	0.208	0.98		0.975
Pan		1.0		1.0

5. A crude oil sample found to be of 31 °API. The initial and final boiling point are 90 °C and 180 °C. Calculate the K and C.I values to classify the crude oil based on their different composition and different fractions of hydrocarbons. Also, write the different classes of crude oil sample based on distillate volume collection. (C.O.No.4) [Comprehension]

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO (% age of CO)	Unit/Module Number/ Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	C	
1	C.O.NO. (1-4)	1 - 4	30			30
2	C.O. No. 3			10		10
3	C.O. No. 3			10		10
4	C.O. No. 3				15	15
5	C.O. No. 4				15	15
	Total Marks		30	20	30	80

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

I hereby certify that all the questions are set as per the above guidelines.

Faculty Signature:

Reviewer Commend:

Format of Answer Scheme

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

SOLUTION

Semester: Odd Sem. 2019-20
Course Code: PET 321
Course Name: UNIT OPERATIONS
Program & Sem: B.Tech (PET) & V (DE-II)

Date: 24.12.2019
Time: 9.30 AM - 12.30 PM
Max Marks: 80
Weightage: 40%

Part A (1Q x 30M = 30Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1 a.	Unit operation is a basic step in a process.	1+1=2	3 min.
b.	The effectiveness of solids blender is measured by a statistical procedure to evaluate the mixer's performance in a quantitative manner.	0.5*4=2	3 min.
c.	Ribbon and Tumbling mixers.	1*2=2	3 min.
d.	The shape of an individual particle expressed in terms of sphericity, it is independent of particle size.	1+1=2	3 min.
e.	Hinge is a movable joint and Sprocket is a wheel type with teeths or cogs to pass the chain over it.	1*2=2	3 min.
f.	An important type of conveyor for transporting material in the form of finely divided solids or pasty solids is the screw conveyor.	0.5*4=2	3 min.
g.	In this system the material is transferred in suspension in a stream of air.	1*2=2	3 min.
h.	Apron conveyors are used for the widest variety of purposes but usually for heavy loads and short runs. Bucket elevator is the deep apron conveyors as has been said develop gradually into a type known as bucket conveyors.	1+1=2	3 min.
i.	Gyration is a circular motion or a movement in a circle or spiral; a whirling motion.	1*2=2	3 min.
j.	3	1*2=2	3 min.
k.	A pressure filter which can apply a large pressure differential across the septum to give economically rapid filtration with viscous liquids or fine solids.	1+1=2	3 min.
l.	It is a blade to remove the cake of solids.	1*2=2	3 min.
m.	The device that the solids into two fractions.	1*2=2	3 min.
n.	It is a process of adding chemicals to bind the tiny particles together to form bigger one.	1*2=2	3 min.
o.	It is a device to separate the clarified liquid and solids or concentrated suspension.	1*2=2	3 min.

Part B (2Q x 10M = 20 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
2	Filter press or Discontinuous pressure filter. Discontinuous pressure filter applies large pressure differential across the filter medium or septum to give economically rapid filtration with viscous liquids or fine solids. It consists of set of plates designed to provide a series of chambers or compartments in which solids may collect. The plates are covered with filter medium such as canvas. Slurry is entered to each compartment under pressure, liquor passes thru the canvas and out a discharge pipe, leaving a wet cake of solids behind.	4+6=10	30 min.
3	ASTM Distillation Unit. • A crude oil sample of 100ml/50ml is taken in a conical flask, • ASTM distillation apparatus which consists of two units, the first unit heats the crude oil sample and the second unit is the distillator which condenses the vapour, • The sample is first taken to the first unit which heated up the sample, sample starts boiling and thereby generates vapour, • Next it goes to the distillatory apparatus through a pipe connected with a cork, the apparatus consists of cold water which leads to temperature reduction due to which it condenses, • Thus the condensate form of the sample is collected in the liquid form, in a measuring cylindrical beaker which gives us the volume distillate collected at a particular temperature, • The temperature corresponding to the initial drop collected gives us the initial boiling point, • Then the reading should be taken at a period of 2mnts interval until the final boiling point is reached. • After all these from the temperature and volume collected value, the correlation index and characterisation index of the crude oil sample can be calculated. • From the value of volume collected and temperature graphs can be prepared, showing the trends of crude oil samples.	2+8=10	30 min.

Part C (2Q x 15M = 30Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question

<table>
<tr>
<td>4</td>
<td>$\frac{D}{F} = \frac{x_F - x_B}{x_D - x_B}$
$\frac{B}{F} = 1 - \frac{D}{F}$
$E = \frac{(x_F - x_B)(x_D - x_F)x_D(1 - x_B)}{(x_D - x_B)^2(1 - x_F)x_F}$
(i) D/F = 0.384 – 14-mesh
(ii) B/F = 0.616 - 14-mesh
(iii) E = 0.498 - 14-mesh
(iv) D/F = 0.333 – 28-mesh
(v) B/F = 0.670 - 28-mesh
(vi) E = 0.355 - 28-mesh</td>
<td>3+12=15</td>
<td>37.5 min.</td>
</tr>
<tr>
<td>5</td>
<td>(K)= $\sqrt[3]{}$R+460/0.827ρ – (1)

(C.I.) = (48640/R+460) +473.7*ρ-456.8 – (2)
where, R = Average boiling temperature (degree celcius)
ρ = specific gravity of crude oil
K=643.4 ; Parrafinic.
CI= 955.759; Aromatic.
Class of crude oil can be determined from the ASTM Distillation method. Volume of distillate collected at temperature 180°C will give the class of a particular crude oil, as follows:
<table>
<tr><th>Volume of distillate collected at temperature 180°C</th><th>Class of crude oil</th></tr>
<tr><td>>24ml</td><td>A</td></tr>
<tr><td>21ml-24ml</td><td>B</td></tr>
<tr><td>16ml-21ml</td><td>C</td></tr>
<tr><td>12ml-16ml</td><td>D</td></tr>
<tr><td><12ml</td><td>E</td></tr>
</table>
</td>
<td>8+7=15</td>
<td>37.5 min.</td>
</tr>
</table>

Roll No												

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Semester: Odd Semester: 2019 - 20
Course Code: PET 321
Course Name: UNIT OPERATIONS
Program & Sem: B.Tech (PET) - V (DE-II)

Date: 24 December 2019
Time: 9.30 AM to 12.30 PM
Max Marks: 80
Weightage: 40%

Instructions:
(i) Read the all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and Non-programmable calculators are permitted.

Part A [Memory Recall Questions]

Answer all the sub Questions. Each sub Question carries 02 marks. (15Qx2M=30M)

1. Answer the following questions:

a. Difference between Unit Operation and Process.	(C.O.No.1) [Knowledge]
b. Define Mixing Index.	(C.O.No.1) [Knowledge]
c. Write different types of Mixers	(C.O.No.1) [Knowledge]
d. Define sphericity.	(C.O.No.1) [Knowledge]
e. Write difference between Hinge and Sprocket.	(C.O.No.2) [Knowledge]
f. What is screw conveyor?	(C.O.No.2) [Knowledge]
g. Define Pnuematic mode of conveying.	(C.O.No.2) [Knowledge]
h. State difference between Apron and Bucket elevator.	(C.O.No.2) [Knowledge]
i. What is gyration?	(C.O.No.3) [Knowledge]
j. How many types of membranes available for cross flow filtration?	(C.O.No.3) [Knowledge]
k. What is "Plate and Frame press"?	(C.O.No.3) [Knowledge]
l. Define 'doctor blade'.	(C.O.No.3) [Knowledge]
m. What is classifier?	(C.O.No.4) [Knowledge]
n. Define Flocculation	(C.O.No.4) [Knowledge]
o. What is Thickener?	(C.O.No.4) [Knowledge]

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO (% age of CO)	Unit/Module Number/ Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	C	
1	C.O.NO. (1-4)	1 - 4	30			30
2	C.O. No. 3			10		10
3	C.O. No. 3			10		10
4	C.O. No. 3				15	15
5	C.O. No. 4				15	15
	Total Marks		30	20	30	80

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

I hereby certify that all the questions are set as per the above guidelines.

Faculty Signature:

Reviewer Commend:

Part B (2Q x 10M = 20 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
2	Filter press or Discontinuous pressure filter. Discontinuous pressure filter applies large pressure differential across the filter medium or septum to give economically rapid filtration with viscous liquids or fine solids. It consists of set of plates designed to provide a series of chambers or compartments in which solids may collect. The plates are covered with filter medium such as canvas. Slurry is entered to each compartment under pressure, liquor passes thru the canvas and out a discharge pipe, leaving a wet cake of solids behind.	4+6=10	30 min.
3	ASTM Distillation Unit. • A crude oil sample of 100ml/50ml is taken in a conical flask, • ASTM distillation apparatus which consists of two units, the first unit heats the crude oil sample and the second unit is the distillator which condenses the vapour, • The sample is first taken to the first unit which heated up the sample, sample starts boiling and thereby generates vapour, • Next it goes to the distillatory apparatus through a pipe connected with a cork, the apparatus consists of cold water which leads to temperature reduction due to which it condenses, • Thus the condensate form of the sample is collected in the liquid form, in a measuring cylindrical beaker which gives us the volume distillate collected at a particular temperature, • The temperature corresponding to the initial drop collected gives us the initial boiling point, • Then the reading should be taken at a period of 2mnts interval until the final boiling point is reached. • After all these from the temperature and volume collected value, the correlation index and characterisation index of the crude oil sample can be calculated. • From the value of volume collected and temperature graphs can be prepared, showing the trends of crude oil samples.	2+8=10	30 min.

Part C (2Q x 15M = 30Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question