

Name:

Enrolment No:



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Analytical Methods in Geosciences

Semester: VI

Program: B. Tech GSE

Course Code: GSEG 315

No of Pages 3

Instructions:

Time 03 hrs.

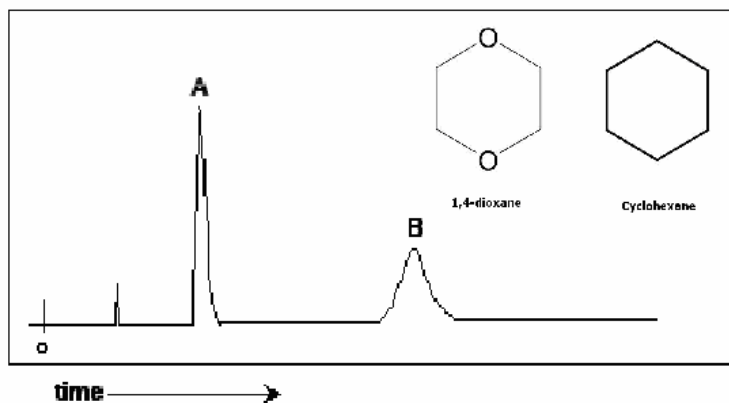
Max. Marks: 100

SECTION A [5X4 marks=20]

S. No.		Marks	CO
Q 1	Define “capacity factor” and “separation factor” of chromatography.	4	CO1
Q 2	Explain how you will classify the performance of the column based on the capacity factors.	4	CO1
Q 3	Define ‘crystal’ and ‘interfacial angle’.	4	CO4
Q 4	If a 125×4.6 mm column and a flow rate of 1 mL min^{-1} . Calculate the estimated dead time.	4	CO2
Q 5	The sample composed of three compounds, A, B & C with different polarities. The sample is loaded onto a C18 column and eluted with 30% methanol/water mp. After eluting with 10 mL of solvent and collecting 1 mL fractions, compounds A and B are found to be in the 3 rd and 6 th fractions, respectively. Explain which compound is more polar, A or B.	4	CO3

SECTION B [4x10=40marks]

Q 6 Use the following gas chromatogram of a mixture of dioxane and cyclohexane eluted on a non-polar column to answer the following two questions.



- (a) Interpret what is the identity of the substance labeled peak A.
(b) The area measured for peak A is 2 cm^2 and the area measured for peak B is 3

	cm ² . Assuming that the detector response is the same for both substances, calculate the mol% of A in the mixture.		
Q 7	(a) Discuss about the surface analyzing techniques and their application in geosciences. (b) Analyze the uses and principle of micro beam analysis	4+6=10	CO5
Q 8	(a) Design flowchart for spectroanalytical procedure for determining chemical elements in geological samples. (b) Using suitable examples, explain how atomic absorption spectroscopy is important in petroleum exploration?	5+5=10	CO4
Q 9	(a) How the crystal symmetry is relevant in XRD analysis? (b) Illustrate the various criteria of symmetry.	5+5=10	CO5
	OR		
	(a) Discuss about the 'parameters' of a crystal face. (b) Analyze how the crystallographic notation done by "Index System Miller".	5+5=10	CO5

SECTION-C [2x20=40marks]

Q 10	<p>Given the following chromatogram and a column length of 20 cm:</p> <p style="text-align: right;">$\alpha = \frac{t'_{R(B)}}{t'_{R(A)}}$</p>	5+10+5=20	CO5
	<p>Calculate:</p> <ol style="list-style-type: none"> Capacity factor for solutes A and B Number of theoretical plates for solutes A and B Plate height for solutes A and B Separation factor Discuss how will you classify the performance of the column based on the capacity factors. 		

Q 11	<p>(a) Illustrate the application and limitations of XRD technique.</p> <p>(b) When an x ray powder pattern of crystalline copper is obtained using x ray from copper target, the wavelength of K line is 4.05pm, reflections are found to be at: 21.65; 25.21; 37.06. Calculate: (i) type of cubic crystal; (ii) length of side of unit cell; (iii) radius of copper atom.</p>	5+15= 20	CO6
	(OR)		
	<p>(a) Discuss miller indices and it's important in XRD study.</p> <p>(b) Image plate X-ray detectors usually stand perpendicular to the primary beam that passes through the middle of the circular (340 mm diameter) active area of the detector. Calculate the maximum resolution that can be reached with a distance of 45 mm between crystal and detector</p> <p style="margin-left: 40px;">ii. with CuKα radiation, $\lambda = 1.5418 \text{ \AA}$ and</p> <p style="margin-left: 40px;">iii. with MoKα, $\lambda = 0.7107 \text{ \AA}$</p>	5+15= 20	CO6

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SECTION A [5X4marks=20]

S. No.		Marks	CO
Q 1	Describe about surface analyzing techniques and their uses in Geosciences	4	CO1
Q 2	Explain the application of micro beam analysis.	4	CO1
Q 3	Discuss about miller indices and its importance in XRD study	4	CO4
Q 4	List the applications of UV spectroscopy technique in geosciences.	4	CO2
Q 5	Define the terms: (i) capacity factor & (ii) Dead time	4	CO1

SECTION B [4x10=40marks]

Q 6	Elaborate the basic principle of X- ray diffraction technique.	10	CO4
Q 7	When an x ray powder pattern of crystalline copper is obtained using x ray from copper target, the wavelength of K line is 4.05pm, reflections are found to be at: 25.21 & 37.06. Calculate: (i) type of cubic crystal; (ii) length of side of unit cell; (iii) radius of copper atom.	10	CO4
Q 8	(a) Discuss a spectroanalytical procedure for the quantitative determination of chemical elements. (b) Elaborate the uses of atomic absorption spectroscopy in petroleum exploration.	5+5=10	CO5
Q 9	(a) Explain about symmetry of a crystal. (b) Describe the various criteria of symmetry.	5+5=10	
	OR		
	(a) Explain the 'parameters' of a crystal face. (b) Describe how is crystallographic notation done by "Index System Miller"	5+5=10	CO5

SECTION-C [2x20=40marks]

Q 10	<p>Trace element composition of kerogen from Niger Delta are given below. Interpret the types of kerogen and depositional environment of the source rock. Justify your answer.</p> <table border="1" data-bbox="279 422 1214 575"> <thead> <tr> <th>sample</th> <th>V</th> <th>Cr</th> <th>Co</th> <th>Ni</th> <th>Mn</th> <th>Fe</th> <th>Cu</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>277</td> <td>33.3</td> <td>24</td> <td>114</td> <td>243</td> <td>5212</td> <td>56</td> </tr> <tr> <td>2</td> <td>134</td> <td>21</td> <td>19</td> <td>61</td> <td>179</td> <td>4489</td> <td>51</td> </tr> <tr> <td>3</td> <td>97</td> <td>17.55</td> <td>12</td> <td>49</td> <td>157</td> <td>3309</td> <td>44</td> </tr> </tbody> </table>	sample	V	Cr	Co	Ni	Mn	Fe	Cu	1	277	33.3	24	114	243	5212	56	2	134	21	19	61	179	4489	51	3	97	17.55	12	49	157	3309	44	5+10+5 =20	CO5
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Q 11	<p>(a) Explain the acquisition, processing and interpretation processes of computed tomography.</p> <p>(b) Clarify the uses of X ray computed tomography and micro computed tomography in petroleum exploration?</p>	5+10+5 =20	CO6																																
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<p>You are given a sample composed of three compounds, A-C with different polarities. The sample is loaded onto a C18 column and eluted with 30% methanol/water mp. After eluting with 10 mL of solvent and collecting 1 mL fractions, compounds A and B are found to be in the 3rd and 6th fractions, respectively. Explain which compound is more polar, A or B? Justify your answer.</p>			CO6																																