National Exams: May 2019

17-Pet-A1, Principles of Stratigraphy & Sedimentation

3 hours duration

NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.

2. This is a CLOSED BOOK exam.
   An approved Sharp or Casio model calculator is permitted.

3. This exam paper consists of four pages (including this cover page). There are two parts: **Part A** (Questions 1-10) conveys questions related to Sedimentology and Sedimentary Processes whereas **Part B** (questions 11-19) conveys questions related to Stratigraphy and sedimentary basin analysis.

4. Part A consists of 10 questions. Questions 1 and 2 must be answered; each one is 10 points worth (2X10 = 20 points). Answer any five of the remaining eight questions (3 to 10). Each of these questions is 6 points worth (5 X 6 = 30 points). Therefore, this Part A carries 50 points (20+30 = **50**). Do not answer more than what is required.

5. Part B consists of 9 questions. Answer any **six** of your choice. Each question weighs 6 points. Therefore, this Part B has total marks of **36** (6 X 6 = 36).

6. **The maximum attainable grade is 86/86 (50 for Part A and 36 for Part B).**

7. Most questions require an answer in essay format. Clarity and organization of the answers are important.

8. **Please note:** The first number of questions permitted to answer in each part (i.e., Part A & Part B) will be marked as they appear in the answer book. Thus, don't answer more than what you were instructed to answer.

Part A: Sedimentology and sedimentary processes

In this part, answer questions 1 and 2, and any other five questions of your choice from the remaining eight questions (i.e., 3 to 10). Questions 1 and 2 are 10 points each whereas questions 3 to 10 are 6 points each. Thus, the total mark for this Part A is 50.

Question 1: Explain the procedure of sandstone classification. Provide the different classes or types of sandstone and describe each one of them. **10 points (must be answered).**

Question 2: What is the difference between Folk's and Dunham's limestone classifications? State the different nomenclatures used by the two authors and provide the descriptions for each limestone rock type. In the case of Dunham's classification include the modification by Embry and Klovan (1972). **10 points (must be answered).**

Answer only five of the questions 3 to 10. ***Each question weighs 6 points***

Question 3: Describe morphological and sedimentological differences between alluvial fans and delta deposits. **6 points.**

Question 4: Describe turbiditic depositional system and its representative depositional model. Also explain how the depositional facies changes from proximal to distal depositional zones. **6 points**.

Questions 5: Explain the terms conglomerate, diamictite and breccias. Explain the geneses of conglomerates and breccias. **6 points.**

Question 6: The ranks of coal based on increasing fixed carbon accompanied by decreasing volatile matter are ??? (choose the correct answer from the list). **6 points.**

Peat → anthracite → lignite → subbituminous → bituminous

Anthracite → peat → lignite → bituminous → subbituminous

Peat → lignite → subbituminous → bituminous → anthracite

Peat → subbituminous → bituminous → lignite → anthracite

Question 7: Explain the difference between hemipelagic and pelagic sediments. **6 points.**

Question 8: Explain the difference between total porosity and effective porosity. What are the different types of porosities in carbonate rocks? Explain their origin, as well. **6 points.**

Question 9: Sketch and define rip currents and longshore currents. How are they generated? Also explain how they affect the sediments in the shallow marine realm. **6 points.**

Question 10: Explain how hydrolysis weathering process affects potassium feldspar minerals. Also provide the products of such kind of weathering. **6 points.**

Part B: Stratigraphy and sedimentary basin analysis:

This part consists of nine questions (11 – 19). Answer any six questions of your choice. Do not answer more than six. Each question carries 6 marks (total = 6 X 6 = 36 points)

Question 11: Explain (i) the Principle of fossil succession and (ii) application of biostratigraphy to the study of sedimentary rocks. **6 points.**

Question 12: Explain how the ratio (S/A) between rate of sediment supply (S) and rate of generation of accommodation space (A) controls parasequences types that accumulate in shallow marine realm. **6 points.**

Question 13: What is the difference between Geochronostratigraphy and geochronology? State each ones' hierarch of units and show how these units correspond to one another (i.e., geochronostratigraphic units versus geochronologic units). Table format is acceptable. **6 points.**

Question 14: Explain the term "acoustic impedance" of subsurface rocks and the relationship between acoustic impedance of subsurface rocks and the reflection of seismic waves?. **6 points.**

Question 15: Explain Walther's Law and how it is applicable to the study of sedimentary rocks. Sketch(es) with descriptions are welcome. **6 points.**

Question 16: A biostratigraphic unit may encompass _____(*choose the right answer*). **6 points.**

A) a portion of a lithostratigraphic member.
B) one complete formation.
C) two or more entire members or formations.
D) all of A, B and C.

Question 17: Explain the usefulness of wireline logs (or e-logs) for subsurface stratigraphic studies. Give an example by producing two hypothetical well-log curves from two vertical wells (through horizontally stratified sedimentary rocks of different lithologic properties) and show how they correlate with one another. **6 points.**

Question 18: Explain the importance (applications) of sedimentary basin analysis. **6 points.**

Question 19: Match the words "**a to l**" with their meaning or sedimentary significance with the listed phrases "**i to xii**". Write the letter of your choice on the dash line at the end of each phrase. **6 points.**

a) Herringbone cross-bedding, **b)** Sequence stratigraphy, **c)** paleosol, **d)** paleocurrent analysis, **e)** diachronous, **f)** regression, **g)** tongue, **h)** composite-stratotype, **i)** diastem, **j)** suite, **k)** clinoform, **l)** isopach map.

i. Sloping surfaces of prograding strata. _____
ii. Representation by contour lines that depict thickness of a given formation or rock unit. _____
iii. Sedimentary data plotted on a map to reflect the local or regional paleoslope and the direction from which sediment source (provenance area) lies. _____
iv. Boundary of a geologic unit characterized by age difference in different locations that the unit occurs. _____
v. Minor geologic time gap or stratal discontinuity shorter than the resolution of biostratigraphic dating. _____
vi. Soil horizon preserved in the stratigraphic record. _____
vii. Seaward migration of the shoreline._____
viii. Intertidal sedimentary structure. _____
ix. A lithodemic unit next higher in rank to lithodeme._____
x. study of sedimentary rocks based on their vertical stacking patterns that result from changes in accommodation space. _____
xi. A unit that wedges out beyond the boundaries of the stratigraphic unit in which it belongs to.___
xii. Combination of several reference sections (which may include a type section) required to demonstrate the range or totality of a stratigraphic unit. _____