ES2202: Basic Structural Geology & Tectonics **Name:**
End-semester Exam, Full Marks: 50 **ID:**
4th May, 2019

Please provide precise and succinct answers to the questions. Please also provide sketches, wherever possible, to share your thoughts with me. Good luck!

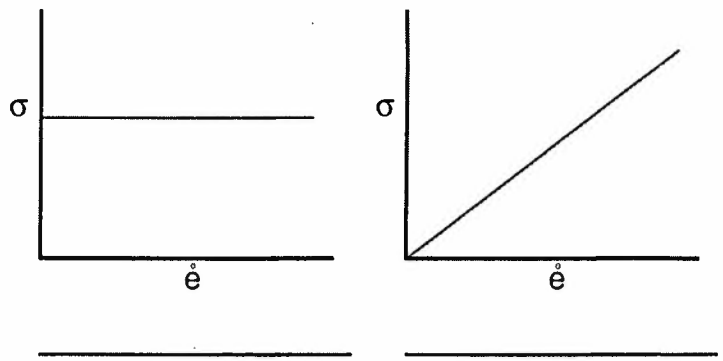
1. Please mark True /False against the following statements. Please justify your answer, providing succinct arguments. Please share your thought process with me through sketches, wherever applicable. **(15)**
(a) LULs (Lines of unchanged lengths) are the best planes to estimate the highest strain recorded in a rock.
(b) A fault plane oriented N35°/60° SE has slickenlines oriented at 60°, 020°.
(c) A rock subjected to only lithostatic pressure records the greatest differential stress.
(d) Hybrid shear fractures can not form under tensile stress.
(e) Angular relationship between the bedding and extension fractures (Joints) in an orthogonal flexure fold remain uniform from the outer arc through neutral surface through inner arc.

2. Explain, based on Anderson's theory, what kind of faults would you expect along divergent boundaries. What would be the dip of the fault if the beds are horizontal? What are the assumptions in this theory? Do you think this theory would work well for rocks deforming at depth? Please explain your answer. **(3+1+2+1)**

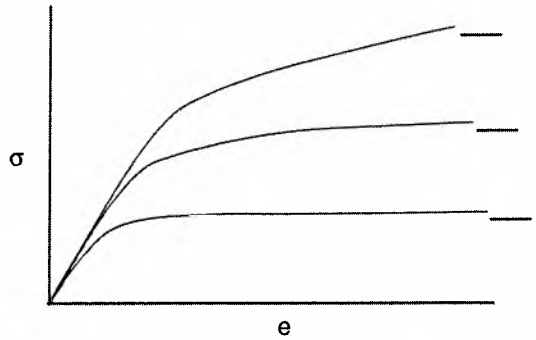
3. A sandstone has a cohesion of 17 MPa, and a coefficient of friction of 1.1. What is the shear stress (σ_s) necessary to cause sliding on a fault in the sandstone at a depth of 2.3 km (σ_n = lithospheric pressure)? The average density of the rocks above the sandstone is ρ = 2500 kg/m^3 and gravitational acceleration (g) is 9.8 m/s^2. **(4)**

4. Please explain how do slickenlines develop on shear fractures. **(3)**

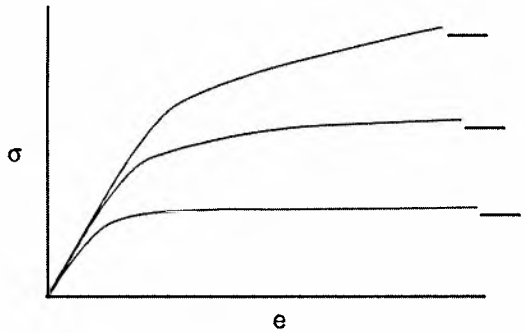
5. (a) Assume the following graphs represent the mechanical behavior of two deforming rocks. Please label the type of behavior that they demonstrate on the question paper. **(2)**



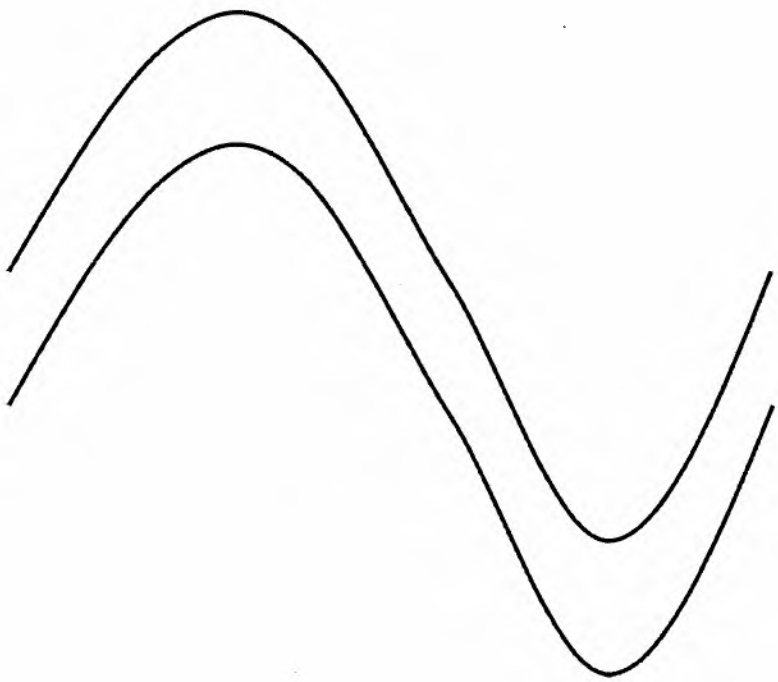
(b) Label the stress-strain behavior of the following rock with temperatures T_1, T_2, and T_3 where T_1 is the highest temperature and T_3 is the lowest temperature. **(1)**



(c) Label the stress-strain behavior of the following rock with confining pressure P_1, P_2, and P_3, where P_1 is the highest and P_3 is the lowest. (**1**)



6. Assume that you are looking at a profile-view of the following first-order fold that also develops minor/second order folds around it. Please sketch and label the minor folds that you would expect on different parts of the fold on the question paper. What is the relative wavelength of the minor fold with respect to the first-order fold? What factor controls it? Please explain, in terms of mechanics of folding, why minor folds develop their asymmetry? (**2+1+1+3**)



7. Why and from where does a mantle plume originate? Explain briefly what happens when a mantle plume reaches the base of the lithosphere? Illustrate with the help of a schematic diagram. (2+2+2)

8. What is meant by the 'Wilson cycle'? Illustrate briefly with the help of a schematic diagram. (1+3)