THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF MINING ENGINEERING

Third Year (BEMN3) Mining Engineering

MN331 – ENGINEERING GEOLOGY AND MAPPING

Date: Monday 22nd June 2020

Venue: MN001

Time: 8:20 AM

Time Allowed: 3 Hours

INFORMATION FOR CANDIDATES:

1. You have ten minutes to read this question paper. You are not allowed to start during this period.

2. There are Three Sections to this Exam:
   Section A – Multiple Choice Questions (30)
   Section B – Short Answers Questions (4)
   Section C – Long Answer Questions (4)

3. Marking Scheme:
   Section A: 30marks
   Section B: 30marks
   Section C: 40marks

4. All answers must be written on the answer sheet provided. No other written material will be accepted.

5. Write your NAME and STUDENT NUMBER clearly on the ANSWER BOOK. DO THIS NOW.

6. You MUST NOT LEAVE the room in the first hour.

7. All MOBILE PHONES, AUDIO PLAYERS, MP3, ETC...MUST BE SWITCHED OFF.

SECTION A Multiple choice. Each question has a value of 1mark

1. What is a rock mass?
   (A) large body of mineral aggregates used in engineering works
   (B) a large volume of rock in which engineering work is to be carried out
   (C) a large block of rock that can be excavated by machines
   (D) mass of one cubic meter of rock
   (E) a volume of rock under consideration

2. Rock fabric is described by:
   (A) Size
   (B) Shape
   (C) Interrelationship between mineral grains
   (D) Orientation of grains, pore, voids, crystals and structures
   (E) All of the above

3. Joints can be healed through
   (A) leaching
   (B) dissolution
   (C) cementation
   (D) precipitation
   (E) infillings

4. Slope failure is a natural process, however the rate of failure can be affected by:
   (A) Climate change
   (B) Vegetation
   (C) Human activity
   (D) Only (A) and (C)
   (E) All of the above

5. The study of the upper most layer of the earth s crust formed of soil is called;
   (A) Petrology
   (B) Agronomy
   (C) Pathology
   (D) Podology
   (E) None of the above

6. A fault with dominant dip slip displacement is called:
   (A) Wrench fault
   (B) Normal fault
   (C) Strike slip fault
   (D) Dip slip fault
   (E) Both (B) and (D)

7. Slope failure is a natural process, however, human action can:
   (A) Stop the failure from happening
   (B) Increase the rate of failure
   (C) Decrease rate of failure
   (D) All the above
   (E) Only (B) and (C)

8. A transfer fault is a:
   (A) High angle reverse fault
   (B) Low angle normal fault
   (C) Low angle reverse fault
   (D) dip slip thrust fault
   (E) None of the above

9. Dip direction is always:
   (A) Parallel to strike
   (B) Horizontal to dip angle
   (C) Perpendicular to strike
   (D) Right angle to dip angle
   (E) Only (C) and (D)

10. Polished surface of fault plane are called:
   (A) Groves
   (B) Gouge
   (C) Pug
   (D) Slicken slides
   (E) None of the above

11. A fault that dips less than 45 degrees is sometimes called:
   (A) Thrust fault
   (B) Dip slip fault
   (C) Low angle fault
   (D) Dextral fault
   (E) Reverse fault

12. Which of the following is **not** an engineering property of a rock?
   (A) Porosity
   (B) Viscosity
   (C) Density
   (D) Permeability
   (E) Specific gravity

13. Which of the following is **not** direcily related to tectonic process?
   (A) Subduction
   (B) Uplift
   (C) Unconformities
   (D) Trench
   (E) Obduction

14. Which of the following reduce slope stability:
    (A) Water
    (B) Cohesion
    (C) Friction angle
    (D) Rock bolts
    (E) None of the above

15. A shear zone :
    (A) Has isotropic and anisotropic mineral deformation
    (B) Stretching and bending of the rock
    (C) Is deep equivalent of fault
    (D) Contains micro-folds
    (E) All of the above

16. What is a detachment fault?
    (A) Special thrust fault
    (B) A reverse fault
    (C) Part of Horst and Graben system
    (D) A normal low angle fault
    (E) A normal strike slip fault

17. Soil study for agronomical purposes is based on?
    (A) Bacteriology and mechanics
    (B) Chemistry and Bacteriology
    (C) Physics and Bacteriology
    (D) All the above
    (E) Only B and C

18. What method of analysis is used to calculate non circular failure in cohesive soil?
    (A) Darcy's method
    (B) Fellenius's method
    (C) Janbu's method
    (D) Bishops method
    (E) Only (B) and (D)

19. Shear zone is a deep level equivalent of:
    (A) Fracture
    (B) Joints
    (C) Faults
    (D) Folds
    (E) None of the above

20. During dewatering frictional resistant is reduced between caisson and surrounding ground?
    (A) Adding weight
    (B) Pumping in bentonite clay slurry solution
    (C) jetting in cohesion soil
    (D) all the above

(E) only A and B

21. Piezometer tubes are installed in to the ground to measure?
    (A) Level of subsidence
    (B) Soil creep
    (C) Water level
    (D) All the above
    (E) None of the above

22. Which activity below is not a remedial action for a failing slope?
    (A) Grassing on the toe
    (B) Loading the crest height
    (C) Toe stripping
    (D) All of the above
    (E) None of the above

23. A pull apart basin develops when two plates are under which principle stress?
    (A) Compressional stress
    (B) Extensional stress
    (C) Shear stress
    (D) All the above
    (E) Only (A) and (B)

24. Horst and graben is formed when principle stress acting on the plate is:
    (A) Compressional
    (B) Transitional
    (C) Extensional
    (D) Shear
    (E) Transformation

25. In which of the following deformation strain is **not** measurable:
    (A) Elastic deformation
    (B) Ductile deformation
    (C) Brittle deformation
    (D) All the above
    (E) Only B and C

26. The character of discontinuities can be described in terms of:
    (A) Spacing
    (B) Roughness
    (C) Type of filling
    (D) All the above
    (E) Only (A) and (B)

27. Which one of the following is a mass movement?
    (A) Debris avalanches
    (B) Lahars
    (C) Snow avalanches
    (D) All of the above

(E) A and C only

28. A strike slip fault is also called:
    (A) Reverse Fault
    (B) Normal Fault
    (C) Transform Fault
    (D) Thrust Fault
    (E) None of the above
29. A dip slip fault is also called:
    (A) Normal Fault
    (B) Reverse Fault
    (C) Thrust fault
    (D) Transform fault
    (E) None of the above

30. A thrust fault is also called:
    (A) Reverse fault
    (B) Normal fault
    (C) Transform fault
    (D) Listric fault
    (E) None of the above

SECTION B SHORT ANSWERS. The marks for each question are indicated.

1. List the four main strains developed in rock deformation. (4 marks)

2. Name the 3 types of fold orientations. (3marks)

3. List the 8 remedial measures for a failing slope. (8marks)

4. Define the words listed below; (5 x 3 = 15marks)
    (a) Plastic structure
    (b) Ductile deformation
    (c) Brittle deformation
    (d) Site Investigation
    (e) Factor of safety

SECTION C LONG ANSWERS. The marks for each question are indicated.

Question 1. Draw the basic geometry of fold and label all parts correctly including stress directions? (10mks)

Question 2. During deformation, rocks go through different deformation stages from the time stress is applied to them.

(a) Draw a schematic Stress-Strain Relationship graph and labeled correctly the 3 deformation zone along the curve. Also plot onto the curve the 3 strains as listed; fracture, fold and shear. (6marks)

(b) List the three deformation zones and describe the stress-strain relation for each of these zones. (9marks)

Question 3. Draw a figure to illustrate forces acting on a block on a horizontal surface with additional force from the side. On the figure label the following; N, R, T, W, angle of internal friction (6 marks)

Question 4. Draw a figure to illustrate forces acting on a block on an incline surface. On the figure label the following; N, R, T, W, angle of internal friction & volume components (9 marks)

END OF EXAM