MEMORANDUM

QUESTION 1 – DEFINITIONS AND TERMINOLOGY

1.1 Dip – Is the angle of which the stratum or planar feature is inclined from the horizontal, the unit is in degrees.

(2)

1.2 Rock Strength – Is the maximum stress or loading force that the rock material can resist without failing, the unit is pascal (pa)

(2)

1.3 Force – Is an action that tries to change the state or direction of movement of an object, the unit is Newton (N)

(2)

1.4 Rockburst – Is a seismic event (violent release of energy) that results in damage to the underground excavation/working place, the unit is Richter.

(2)

1.5 Induced stress – is the additional stress acting on a rockmass due to nearby mining, the unit is pascal (pa).

(2)

1.6 Closure – Is the sum of elastic and in-elastic movement of the cross sectional area of a stope, the unit normally measured mm/m.

(2)

1.7 Principal stress – Is the major stress acting perpendicular (90 degrees) to a plane without any shear stresses, the unit is measured in pascal.(pa)

(2)

1.8 K-Ratio – Is the ratio between the Horizontal and the vertical stress, dimensionless.

(2)

1.9 Deformation – Is when an object or body is prevented from moving, the applied force (load), will cause the deformation or change in shape or size of the body, the unit is measured as mm/m.

(2)

1.10 Support resistance – Is the amount of force a support unit exerts per rock face area, normally measured in Newton (N)

(2)

Total (20)

QUESTION 2 – STOPE SUPPORT CALCULATIONS

2.1 SR = 200 kN / 2.0m x 2.5m
SR = 200 kN / 5.0m^2
SR = 40 kN / m^2 (3)

2.2 Support Resistance = Force (kN)/Area (m^2)
Area = 200 kN / 50 kN / m^2
Area = 4.0 m^2
Therefore can be spaced at 2.0 m on dip and 2.0m on strike.
(3)

2.3 Support Resistance = Force (KN)/Area (m^2)
Area = 200 kN / 200 kN / m^2
Area = 1.0 m^2
Therefore can be spaced at 1.0 m on dip and 1.0m on strike.
(3)

2.4 Support Resistance = 420 kN / 4.0 m^2
Support resistance = 105 kN / m^2
(3)

2.5 Support Resistance = 420 kN / 4.0 m^2

Support resistance = 105 kN / m^2, therefore SR is not sufficient, require 200 kN / m^2 .

Area = Force / SR

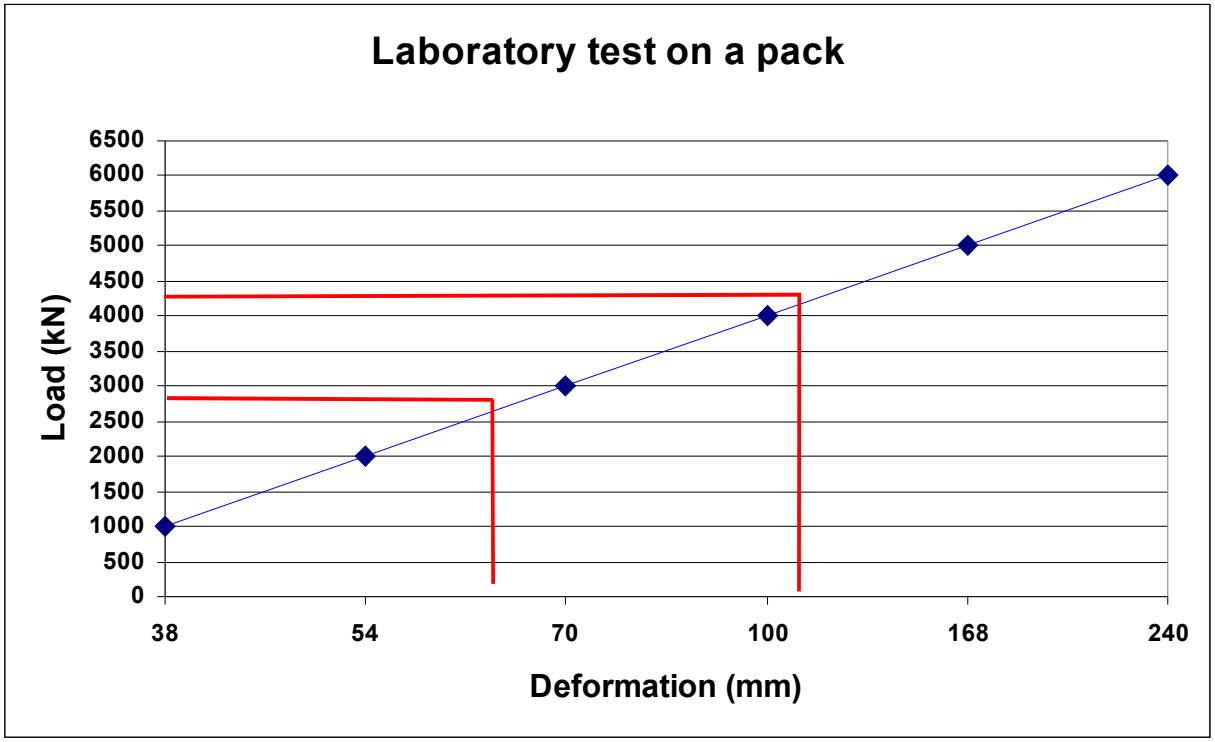
= 420 KN / 200 kN / m^2

= 2.1 m^2

= 1.449 m apart on dip and strike. (3)

2.3 Draw a load/deformation graph for the given pack. Then calculate the load at 10.0m^2 and 16.0m^2 and plot these values on the graph.

- 10.0m height x 10.0m^2 x 2700kg/m^3 x 9.81m/s^2 = **2648.7 kN,** plot onto graph and read off deformation approximately 65mm.
- 10.0m height x 16.0m^2 x 2700kg/m^3 x 9.81m/s^2 = **4237.9 kN,** plot onto graph and read off deformation approximately 110mm. (5)



Total (20)

QUESTION 3 – DEVELOPEMENT SUPPORT CALCULATIONS

3.1 Virgin stress = density x gravity x depth below surface

Virgin stress = 2700 kg/m^3 x 9.81 m/s^2 x 2500 m BS

Virgin stress = 66 217 500 Pa

Virgin stress = 66.2 MPa

(2)

3.2 a) Geometry, size and shape

b) Depth below surface

c) % Extraction, induced stress increases with increase of mining

d) Middling between the excavation and reef (4)

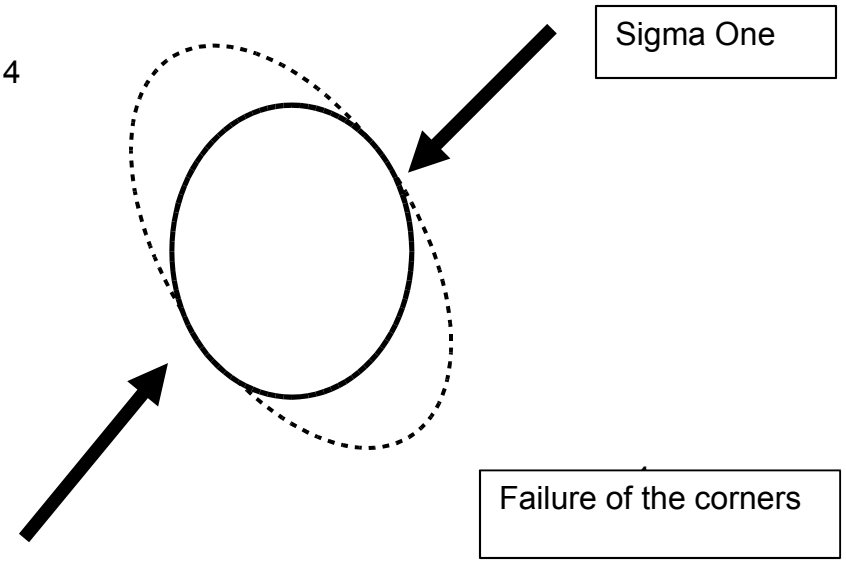
3.3 Field stress = 3 x Virgin stress

Filed stress = 3 x 66.2 MPa

Field stress = 198.6 MPa

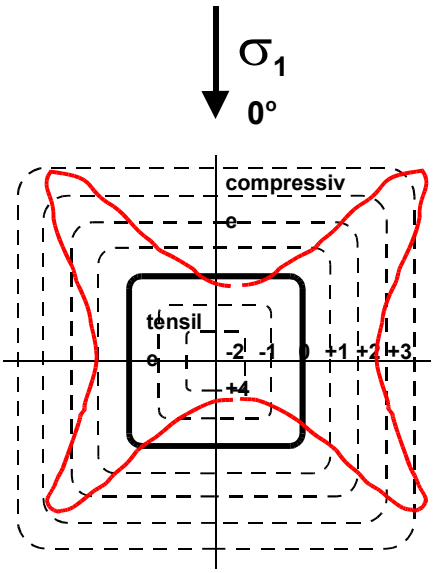
(2)

3.4



(2)

3.5



3.6 a) Hanging wall: 2.7m x 15m = 40.5 m^2

2 x long sidewalls; 2 x (2.5m x 15m) = 75 m^2

Backwall: 2.7m x 2.5m = 6.75 m^2

Total Area to be meshed and laced 122.25 m^2 (3)

b) Total cost will be:

(R55-00 +R85-00) X 122.25 m^2 = R17 115-00 (3)

c) Number of rolls = Total area/area of 1 roll including overlap

= 122.25 m^2 / (2.4-0.2) x 15

= 3.7 rolls

= 4 rolls (2)

(20 marks)

QUESTION 4 – Gully support and designs

4.1 a) Gully width
b) Siding width down dip of gully
c) updip siding width
d) lead from stope face to face of gully heading
e) distance siding can lag behind gully heading
f) distance from face to gully (footwall lifted gully)
g) distance from pack or elongate (updip side of gully)
h) distance from face to pack or elongate (down dip side of gully)
i) gully depth (hanging wall to footwall, or shoulder to footwall) (9)

4.2 a) Over charging of holes can lead to increased rock mass damage and Overbreak around the gully perimeter.
b) Poor drilling direction or hole marking can lead to variations in gully direction, Overbreak and variations in gully depth. (2)

4.3 a) Classified tailings
b) Dewatered tailings
c) Cemented tailings
d) Comminuted waste
e) Tailings-aggregate mixes. (4)

4.4 a) The type of timber used for pack construction. (Some types are more compressible than others)
b) The chock rise in timber packs – in general the greater the rise, the older the

timber and the stiffer the pack.

c) The timber rise in composite or sandwich packs. In general, it can be said that the smaller the rise the more brick layers in the pack and the stiffer the pack is.

d) The quality of blocking.

e) The quality of wedging.

f) The strength of the bricks used in timber/brick packs.

g) The width to height ratio; i.e. the higher the pack for a given width, the more compressible the pack.

h) The chock overlap. Should be at least half of the chock rise to prevent chocks from falling out.

i) Chock and brick alignment (to prevent point loading).

j) No chocks or bricks should be omitted from the pack.

k) The pack should be constructed perpendicular to the hanging wall and should not be blocked to the vertical position.

l) Footwall irregularities will cause point loading.

m) Hanging wall irregularities will cause point loading.

n) Incompetent hanging wall or footwall rock can result in pack instability, especially on gully sidewalls.

(5)

QUESTION 5 – THEORY

5.1 a) Barrier Pillars (Regional) – They are designed to carry the full load to surface and to control the height of the tensile zone**.** Spans should not exceed about ¼ the depth (3)

b) Non-yield (stable) pillars – They are also designed to carry the full load to surface. In very shallow mines they are used to restrict the length of the spanning hanging wall beams. Normally designed with a safety factor of 1.6 or Width to height ratio greater than 5. (3)

c) Yield pillars – Are small reef pillars designed to fail in a stable manner as the stope converges elastically. Should have width to height ratios of 2.5 to 3.0. (3)

d) Crush Pillars – Are small reef pillars designed to fail in a stable manner on the face or as close as possible to the face. Should have width to height ratios of less than 2.5. (3)

5.2 a) When a rock fall occurs with certain dimensions as result of rockburst or gravity induced fall of ground. (0.5)
When a fatal occurs as result of rockburst or fall of ground. (0.5)

b) SAMRASS 1 and SAMRASS 3 forms. (1)

c) At least 10 linear metres of a working face has been severely damaged and choked and will require re-establishment and re-supporting or be abandoned.

- At least 25 metre squared of a working area has been severely damaged and choked and will require re-establishment and re-supporting or be abandoned.
- At least 10 linear metres of gully has been restricted with rock clearly recently displaced from the hanging wall and gully sidewalls.
- At least 10 linear metres continues or 30 linear metres cumulative of access ways of tunnels or travellingway has been severely damaged and will require rehabilitation or to be abandoned.
- At least 10 square metres of roof or 5 cubic metres of rock has been displaced from the roof of the mining cavity or excavation.
- At least 10 cubic metres of rock has been freshly displaced from pillars or tunnel sidewalls. Total (20) (6)

Total 100