PNG UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF MINING ENGINEERING

2022 FIRST SEMESTER EXAMINATION

Fourth Year Mining and Mineral Process Engineering

MN 411: MINERAL ECONOMICS

DATE: TUESDAY 7TH JUNE 2022
TIME ALLOWED: THREE (3) HOURS

START: 8:20 AM

VENUE: TENT

INFORMATION FOR CANDIDATES

1. Write your **NAME** and **Student Number** clearly on the **ANSWER BOOK**. Do it **NOW**.

2. You have ten (10) minutes to read this question paper. You **SHOULD NOT** write in the answer book during this period.

3. There are **THREE PARTS**: (1) Multiple Choice Questions; (2) Discounted Cash Flow modelling and (3) Optimising models

4. Attempt to **ANSWER ALL THE QUESTONS IN PARTS 1 &2. IN PART 3; YOU ARE AT LIBERTY TO ANSWER ONE OF THE TWO QUESTIONS**

5. Marks as indicated and is out of 100 Marks

6. **NO** other materials are allowed in the exam room. This includes Mobile Phones, MPs and other devices

PART 1: MULTIPLE CHOICES (40 Marks) [2 Marks each]

1. **Which <u>two</u> factors are the important risk factors that control the financial viability of a mining project?**

a) plant capacity, operating costs
b) operating costs and market price
c) price and exchange rate
d) operating cost and inflation rate

2. **Discount rate measures the:**

a) interest on borrowed money
b) average riskiness of allocating financial capital to a project
c) higher the risk, higher the discount rate and vice versa
d) a cost of capital that affects time value of money
e) a and b are correct
f) b and c are correct

3. **Weighted average cost of capital (WACC) combines the underlying risks of:**

a) equity and debt capital
b) equity and debt capital and tax rate
c) mineral market return, equity and debt capital and tax rate
d) all of the above

4. **A major role of financial capital depreciation is:**

a) to measure the wear and tear on physical equipment
b) to measure the capital payback period
c) to enhance the recovery of the capital cost used to develop a mine
d) to make a mining project profitable

5. **What is the WDV in the 7th year if a capital cost of $10 million is depreciated using Straight line method over a 10 year mine life?**

a) $10 million
b) $5 million
c) $3 million
d) $2.5 million

6. **What is the annual repayment if you borrow K100,000 from BSP to start a business at 10% interest rate if the loan term is 10 years**

a) K12,341 per year
b) K13,250 per year
c) K15,355 per year
d) K16,275 per year

7. **Which is the most correct statement?**

a) present value (PV) = net cash flow/inflation
b) present value (PV) = net cash flow/cost of capital
c) present value (PV) = net cash flow* inflation index
d) present value (PV) = net cash flow/(1+ WACC)^period
e) present value (PV) = net cash flow/(1- WACC)^period

8. **Which is/are the most correct statement/s?**

a) net present value (NPV) = sum of cash flows
b) net present value (NPV) = sum of gross cash flows
c) net present value (NPV) = sum of net after tax cash flows
d) net present value (NPV) = sum of discounted cash flows
e) net present value (NPV) = product of discounted cash flows
f) *d* and *e*

9. **Which is the most correct statement?**

a) internal rate of return (IRR) = sum of cash flows/ (1+ WACC)^period
b) IRR = sum of NATP/(1+ WACC)^period
c) IRR = a rate used to derive sum of present values
d) IRR = a rate that causes sum of cash flows equals to zero

10. **What is <u>wrong</u> with placements of items in the <u>cash flow statement</u> below?**

Cash flow year ($M)	Year (0)	1	2	3	4	5	6
Add back depreciation		1	1	1	1	1	1
NEBT*		12.53	16.81	12.50	8.91	10.22	15.67
Capex ($M)	-20						
Salvage value							7.25
Working capex			-2.7				2.7
Taxes paid		-2.57	-3.45	-3.56	-3.7	-4.05	-1.57
Dividend paid		-1.11	-2.15	-0.98	-3.17	-2.13	-3.25

*Net earnings before tax

a) NEBT, dividend and taxes should not be in the cash flow statement
b) NEBT, working capital and salvage from sales are wrongly placed
c) NEBT, taxes paid, working capital and dividend are wrongly placed
d) NEBT and taxes paid should not be in the cash flow statement

11. A competitive market structure has the following features:

a) firms are price takers
b) competitive forces of supply and demand at the market place
c) market disturbances by civil unrests and political conflicts
d) involvement of vertically integrated firms
e) *a* and *b* are correct

12. A differentiated product is one that has undergone:

a) a major facelift of the same product without changing the price
b) an improvement in product features that come with a higher price than a standard product
c) a price review to set a high price to compete well
d) set up market dominance using deceitful means and ways

13. Profit exists when there is:

a) high competition
b) price taking opportunity exists
c) interest rate is low
d) low barriers to entry
e) high barriers to entry
f) all of the above are correct

14. A vertically integrated firm is (are) said to:

a) have advantage over market dominance through customer loyalty
b) produce cheap goods to target low income earners
c) produce raw minerals as well as the end products
d) all of the above are correct
e) *b* and *c*

15. Major role(s) of linear programing is(are) to:

a) make a graphical solution and optimise costs
b) optimise the use of resources to minimise wastage, minimise cost and maximise benefit (profit)
c) ensure optimal solutions are used to attain the desired objective.
d) formulate a linear function comprising of constraint equations
e) all of the above
f) *b* and *c*

16. The importance of a slack value is:

a) it represents units of materials (resources) being left over or a shortage it affect the production target.
b) it represents resource constraints with unbounded regions within a feasible region
c) it represents the cost is higher than the profit
d) it represents a constraint curve is parallel to the objective function

17. The main function of the queuing model is (are):

a) optimise productivity by managing time
b) optimise productivity by ensuring the service rate is higher than arrival rate
c) optimise productivity by managing servicing and waiting times to ensure low waiting time to avoid productivity losses and equipment idleness
d) optimise cost because time is money
e) *b* and *c* are correct

18. Managing the truck-shovel relationship ensures:

a) daily production target is met
b) costs must be reduced
c) the desired average cycle time of trucks is maintained
d) there must be no shortage of truck or shovel in the production system
e) all of the above are correct

19. A young engineer finds a shovel operator having frequent smoking sessions:

a) is a sign of optimised productivity
b) is a sign of service rate is higher than the arrival rate
c) is a sign of productivity losses and equipment idleness
d) is a sign of not enough shovels in the production system
e) is a sign of not enough trucks in the system
f) *b, c* and e are correct

20. Inventory model deals with the issue (s) of:

a) optimising costs of supplies
b) optimising costs of supplies and sufficient quantity of materials must be in stock to continue production before the arrival of new stock on time
c) optimising costs of supplies and avoid shortages of materials that may affect production or a single activity
d) all the above are correct
e) *b,* and *c* are correct

PART 2: DCF MODELING

[40 Marks]

A medium scale gold mine has a 5-year mine life. The capital cost is $10 million per year for the 5 years. It will generate about $8.5 million/year for 5 years at an operating cost of $3.5 million/year. The working capital is $2 million and a salvage value of $5 million will be realised from the sale of assets in year 5. WACC is 10%, inflation is 3%, income tax is 25% and royalty rate is 2%.

1. Construct a nominal DCF model **(20 Marks)**
2. Derive the NPV, IRR, DPBP and KE. **(10 Marks)**
3. What is the market value of this project? **(5 Marks)**
4. Write a concise summary of this project **(5 Marks)**

Note: use straight line depreciation method

PART 3: OPTIMISING MODELS [20 Marks]

Question 1: [20 Marks]

A medium scale surface mine has 2 shovels and 10 haul trucks in operation. The arrival rate is Poisson distributed at a rate of 4 trucks per hour and service rate is 5 trucks per hour. Analyse the operating system using a suitable queue model to investigate the efficiency of the production system. Note that the management does not accept trucks waiting on the line for more than 15 minutes.

Question 2: [20 Marks]

A man engaged in the SME sector produces handcrafts: mainly baskets and sun-hats. She makes an average of K40 per basket and K20 per hat. He secures a lucrative contract to supply 30 handcrafts (both baskets and huts) (*which is fixed, or cannot supply more than that*). To meet the demand, he contracts a local man who supplies him with 80 meters of bush-*canta* vines (atleast). Each basket requires 2 meters of material (*canta*) and each hat requires 8 meters of material (*canta*). The man notices that he can produce not more than 20 baskets per month.

1. Formulate the linear programming model
2. Make a graphical solution to the problem
3. Compute the total profit
4. Compute the slack for each of the constraint equation
5. Make a conclusion and a specific mention of the slack