



PNG UNIVERSITY OF TECHNOLOGY
DEPARTMENT OF MINING ENGINEERING

2021 FIRST SEMESTER EXAMINATION

Fourth Year Mining and Mineral Process Engineering

MN 411: MINERAL ECONOMICS

DATE: TUESDAY 8th JUNE 2021
TIME ALLOWED: THREE (3) HOURS
START: 8:20 PM

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) Time Value of Money Applications; and (3) Discounted Cash Flow Modelling
4. Attempt to **ANSWER ALL THE QUESTIONS**
5. Marks as indicated
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 are the major economic risks that affect the value of a mining project?
 - a) interest rate, plant capacity, operating costs and market price
 - b) operating costs, market price, tax rate, foreign exchange and interest rates
 - c) operating and capital costs, price and exchange rate
 - d) operating and capital costs, price, inflation and interest rate

2. Discount rate vs MARR are identified as:
 - a) an interest rate on borrowed money and an internal rate of return
 - b) an interest rate charged on money and risk premium of a project
 - c) a risk premium of a project and investor's expected minimum return on investment
 - d) both are same but have the same meaning and their uses

3. Which is the real value if BSP declares a nominal profit of K230 million in 2020 financial year. The inflation rate is 6%?
 - a) K200.16 million
 - b) K216.98 million
 - c) K210.16 million
 - d) K230.98 million

4. What is the WACC if risk-free interest (R_f) = 4%; industry return (R_m) = 6%, industry beta = 1.5%, capital financing is 50% equity, 50% debt; effective tax rate is 30% and debt interest rate is 20%.
 - a) 7%
 - b) 8.25%
 - c) 12%
 - d) 10.50%
 - e) 11.05%

5. What is the written down value in year 4 if a capital cost of \$10 million is depreciated using the DDB method using $\frac{1}{2}$ year 150% depreciation over 5 year period?
 - a) \$4.165 million
 - b) \$5.95 million

- c) \$1.25 million
- d) \$2.916 million

6. Gold and copper prices are expected to rise because:

- a) operating costs, tax rate and foreign exchange rates
- b) competitive forces of supply and demand at the market place
- c) market disturbances by civil unrests and political conflicts and COVID-19 disturbing supply
- d) closure of the Porgera mine and PNG's exchange rate depreciation
- a) *b* and *c* are correct

7. Vertically integrated firms are the ones that:

- a) control the supply chain; from producing raw materials to producing the end products
- b) control the supply chain through locking-in the supplier through contract sales
- c) control supply, control price and therefore, become a monopoly producer
- d) control supply, control price and therefore switching to another supplier is difficult

8. Which statement(s) is/are correct about time value of money?

- a) value of money increases with time
- b) value of money decreases with time
- c) a consumer will use more money for few goods in future
- d) a consumer will use more money for less goods in future
- e) all of the above
- f) *b* and *d* are correct

9. Which statement(s) is/are correct constructing a DCF model?

- a) operation costs and gross revenue are inflated in a real DCF model
- b) operation costs and gross revenues are deflated in a real DCF model
- c) interest rate on debt capital is expensed before corporate income tax
- d) depreciation expense caters for recovery of the risk-less capital cost
- e) all of the above
- g) *c* and *d* are correct

10 Which statement(s) is/are correct?

- a) accounting profit & loss statement and DCF model are same
- b) accounting profit & loss statement and the net after tax profit (NATP) in a DCF model are same
- c) accounting cash flow statement and add back depreciation, including financing activities, including asset disposals (salvage value) are same
- d) all of the above
- e) *b* and *c*

11 Which statement/s is/are correct in a nominal DCF model?

- a) working capital is expensed in year 1 and recovered in final year by compounding it
- b) working capital is expensed in year 1 and the same value is recovered in the final year
- c) salvage value is compounded in the final year
- d) salvage value is realised in the final year as a constant value
- e) all of the above
- f) *a* and *d*
- g) *a* and *c*

12 Which statement/s is/are correct for a nominal DCF model?

- 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

13) Which is/are the most correct statement/s?

- a) net present value (NPV) = sum of cash flows + capital cost
- b) net present value (NPV) = sum of gross cash flows + capital cost
- c) net present value (NPV) = sum of net after tax cash flows + capital cost
- d) net present value (NPV) = sum of discounted cash flows + capital cost
- e) net present value (NPV) = product of discounted cash flows + capital cost

14) Which is the most correct statement about internal rate of return?

- a) $IRR = \text{sum of cash flows} / (1 + WACC)^{\text{period}}$
- b) $IRR = \text{sum of NATP} / (1 + WACC)^{\text{period}}$
- c) IRR = discounting the net CFs at a rate that gives sum of PVs=capital cost
- d) IRR = a rate that causes the sum of cash flows equals to zero
- e) d and c are same and thus both are correct

15) Which is the most correct statement?

- a) discounted payback period is a period which equals the cumulative sum of NATP
- b) discounted payback period is a period which equals to cumulative sum of net CFs
- c) discounted payback period is a period which cumulative net CFs equal to zero
- d) discounted payback period is a period which cumulative PVs equal to zero

16) Identify what is wrong with the nominal DCF model below

	Year (0)	1	2	3	4	5	6
Gross revenue (\$M)	-40	12	16	12	8	10	15
Royalty		0.9091	0.827	0.751	0.683	0.621	0.565
Operating cost		-11.39	-13.90	-9.39	-6.09	-6.35	-8.85
Interest deductions		-.61	-.71	-.32	0.77	.12	.97
Net CF Before Tax		2.33	5.11	7.11	6.44	4.2	5.11

- a) Gross revenue and royalty are wrong with depreciation missing
- b) Operating cost is misplaced with interest deductions
- c) Net CF before tax is in the wrong position
- d) All the parameters in the model are correct

17) What is the payback period given the net cash flow given below?

	Year (0)	1	2	3	4	5	6
Net Cash flow (\$M)	-40	12.53	16.81	12.50	8.91	10.22	15.67
Discount factor (10%)		0.9091	0.827	0.751	0.683	0.621	0.565
Present value (PV)		11.39	13.90	9.39	6.09	6.35	8.85
Cumulative PV	-40	-28.61	-14.71	-5.32	0.77	7.12	15.97

- a) 4.50 years
- b) 3.87 years
- c) 3.5 years
- d) 3.35 years

18) Which is statement below satisfied the correct financial condition for viability of a project?

- a) if NPV >0, longer DPBP and lower KE
- b) if NPV >0, IRR < WACC and higher KE
- c) if NPV <0, IRR > WACC, longer DPBP and higher KE
- d) if NPV >0, IRR > WACC, shorter DPBP and higher KE

19) What things are wrongly placed in the cash flow section of a nominal DCF model below?

Net Cash flow (\$M)	Year (0)	1	2	3	4	5	6
Net After tax Income (NATI)		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

- a) NATI and dividend should not be in the cash flow statement
- b) Working capital, and salvage from sales are wrongly placed
- c) NATI, working capital and dividend are wrongly placed
- d) Taxes paid, depreciation add back being misplaced, with salvage and working capital treated incorrectly

20) The main purpose of a DCF model is to:

- a) Become an expert accountant to satisfy the accounting rules
- b) Use historical financial statements to analyse the viability of a project
- c) Use future cash flows to analyse the financial viability of a project
- d) Use future cash flows to determine the portfolio of investment options to invest in a most attractive project since capital available is scarce
- e) a and b are correct
- f) c and d are correct

PART 2: APPLICATIONS OF TIME VALUE OF MONEY [20 Marks]

1. A small mining project developed at the capital cost of \$10 million is projected to generate \$2 million profit in years 1 to 10. Calculate the NPV of the above project if the discount rate is 10%. [10 Marks]
2. What is the capital cost of the Wafi-Golfu copper-gold project now if its capital cost was US\$2.7 billion in 2016 is revised in the April Quarter of 2021. US CIPs are as follows: April 2016 (233.436); April 2021 (261.237). Please comment on what is the cause of the increase in the capex. The real escalation rate is 3%. [10 Marks]

PART 3: DCF MODELING [30 Marks]

A medium scale gold mine has a 5-year mine life. The capital cost is \$50 million per year for the 5 years. It will generate about \$20 million/year at an operating cost of \$10 million/year. The working capital is \$5 million and a salvage value of \$5 million will be realised from the sale of assets in year 4. WACC is 10%, inflation is 3%, income tax is 25% and royalty rate is 2%. Apply the straight-line depreciation method. Is the mine economically viable?

1. Construct a nominal DCF model (10 Marks)
2. Derive the NPV, 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)