KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

Department of Systems Engineering

Final Exam

Summer 2015-2016 (153)

ISE 307 Engineering Economic Analysis

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

ID: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Section \_\_\_\_\_\_SN: \_\_\_

31stAugust2016

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| --- | --- | --- |
| Question | Points | Marks |
| Q1 | 10 |  |
| Q2 | 10 |  |
| Q3 | 15 |  |
| TOTAL | 35 |  |

**Q1. (10 Marks)**

A U.S. company buys an asset at a cost of (I) = $700,000, with salvage value (S) =$0. The useful life of the asset is 7 years.

1. Compute the annual depreciation allowances and the resulting book values by using the DDB method with switching to the SL method. Show that the book value at the end of 7 years will be zero. (4 points)
2. Assume that the asset will be sold after 3 years at a price of $750,000 and that it would be classified as 7-year MACRS property. Calculate ordinary gains, capital gains, and net proceeds from sale if the ordinary gains and capital gains are taxed at 40% and 35%, respectively. (4 points)
3. If the company estimated its taxable income for the first year to be $18,000,000, find the marginal and average tax rates in the first year using the U.S. Corporate Tax Schedule given below. (2 points)

|  |  |  |
| --- | --- | --- |
| **Taxable income** | **Tax rate** | **Tax computation** |
| 0- $15,000,000  $15,000,000 - $18,333,333  $18,333,333 and Up | 34.33%  38%  35% | $5,150,000 + 0.38 (D)  $6,416,666 + 0.35 (D) |

**Q2. (10 Marks)**

A Computerized Machining Center (CMC) has been proposed for small tool manufacturing company. If the new system, which costs $250,000, is installed, it will generate annual revenues of $185,000 and will require $20,000 in annual labor, $12,000 in annual material expenses and another $8,000 in annual overhead (power and utility) expenses. The CMC would be classified as a 7-year MACRS property. The company expects to dispose out the facility at the end of year 3 and will be sold for $100,000. Assume a tax rate of 35%.

1. Develop the project’s cash flow over its project life by filling up the following Table.
2. Determine the net present worth (NPW) at the company’s MARR of 15%? Is this project acceptable?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| INCOME  STATEMENT | 0 | 1 | 2 | 3 |
| Revenues: |  |  |  |  |
| Expenses: |  |  |  |  |
| Labor |  |  |  |  |
| Material |  |  |  |  |
| Overhead |  |  |  |  |
| Depreciation |  |  |  |  |
| Taxable Income |  |  |  |  |
| Net Income |  |  |  |  |
| CASH FLOW STATEMENT |  |  |  |  |
| Net Income |  |  |  |  |
| Depreciation |  |  |  |  |
| Investment |  |  |  |  |
| Salvage Val. |  |  |  |  |
| Gain (loss) tax |  |  |  |  |
| NET CASH FLOW |  |  |  |  |

Please show your detailed calculations of the following elements:

Total depreciation: ………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

Book Value: ………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

Gain (or loss): ………………………………………………………………………………………………………

………………………………………………………………………………………………………

………………………………………………………………………………………………………

Gain tax (or credit): ………………………………………………………………………………………………………

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**Q3. (15 Marks)**

1. **(9 Marks)**

Higgins Machine Tools, Inc. is currently manufacturing one of its products on a hydraulic stamping press machine. The machine has a current operating and maintenance cost of $50,000, and this cost is expected to increase by $5,000 each year. The machine has a remaining useful life of five years and could be sold on the open market now for $100,000. Its market value declines at a rate of 17%. A new machine would cost $200,000, and its operating and maintenance cost is expected to be $33,000 each year. The new machine has an expected service life of five years and its market values reduces at a rate of 20%.

The required MARR is 15%. The firm does not expect a significant improvement in the machine's technology to occur, and it needs the service of either machine for an indefinite period of time.

1. Fill the following tables for the defender & the challenger.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Defender** | | |  | **Challenger** | | |
| **n** | **Market Value** | **O&M Cost** |  | **n** | **Market Value** | **O&M Cost** |
| 0 | $100,000 |  |  | 0 | $200,000 |  |
| 1 |  | $50,000 |  | 1 |  | $33,000 |
| 2 |  |  |  | 2 |  |  |
| 3 |  |  |  | 3 |  |  |
| 4 |  |  |  | 4 |  |  |
| 5 |  |  |  | 5 |  |  |

1. Find the economic service life for the defender and its cost.
2. Find the economic service life for the challenger and its cost.
3. **(6 Marks)**

The following data for a defender and a challenger in the tables given below show the market value, operation and maintenance cost (O&M Cost), capital recovery cost (CR), annual operation cost (AOC) and annual equivalent cost (AEC). Assuming 15% MARR and that the service of either machine is needed for an indefinite period of time:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Defender** | | | | | |
| **n** | **Market Value** | **O&M Cost** | **CR(15%)** | **AOC(15%)** | **AEC(15%)** |
| **0** | $200,000 |  |  |  |  |
| **1** | $160,000 | $100,000 | $70,000 | 100000 | $170,000 |
| **2** | $128,000 | $111,000 | $63,488 | 105116.3 | $168,605 |
| **3** | $102,400 | $122,000 | $58,107 | 109978.4 | $168,085 |
| **4** | $81,920 | $133,000 | $53,647 | 114588.8 | $168,236 |
| **5** | $65,536 | $144,000 | $49,943 | 118951 | $168,894 |
| **6** | $52,429 | $155,000 | $46,858 | 123069.1 | $169,927 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Challenger** | | | | | |
| **n** | **Market Value** | **O&M Cost** | **CR(15%)** | **AOC(15%)** | **AEC(15%)** |
| **0** | $450,000 |  |  |  |  |
| **1** | $337,500 | $60,000 | $180,000 | $60,000 | $240,000 |
| **2** | $253,125 | $60,000 | $159,070 | $60,000 | $219,070 |
| **3** | $189,844 | $60,000 | $142,419 | $60,000 | $202,419 |
| **4** | $142,383 | $60,000 | $129,105 | $60,000 | $189,105 |
| **5** | $106,787 | $60,000 | $118,404 | $60,000 | $178,404 |
| **6** | $80,090 | $60,000 | $109,757 | $60,000 | $169,757 |

1. Find the economic service life for the defender and the challenger and their cost.
2. Using marginal analysis, determine when the defender should be replaced by the challenger.

**Note: Show all details of your solution and show all results rounded to the nearest integer. If a problem can be solved by a series, you are required to solve it as a series, otherwise you will be penalized.**