

PART D: GATE PROBLEMS

CHAPTER 8
GATE PROBLEMS (2004-2012)

2004

Q. 83-84 are based on the data supplied in the paragraph below

Fixed capital investment for a chemical plant is Rs. 40 million with an estimated useful life of 6 years and a salvage of Rs. 4 million. The rate of interest is 15%. Tax is 25% of the annual taxable income. In the first year of operation, the income from sales is Rs. 20 million and manufacturing expenses are Rs. 5 million. The plant depreciates on a straight line basis.

83. The rate of return on investment is given by

- (A) 50 (B) 37.5
(C) 32 (D) 20

84. The net present value (NPV) in million Rs. At the start and at the end of the first year of operation is respectively given by

- (A) zero and -28.9 (B) -40 and -28.9
(C) -40 and 12.75 (D) zero and 12.75

2005

28. For a solid processing plant, the delivered equipment cost is Rs. 10 lakhs. Using Lang multiplication method, the total capital investment, in lakhs of rupees, is

- (A) 46 (B) 57
(C) 100 (D) 200

29. The cost of a drum dryer is Rs. 10 lakhs. The cost of a drum dryer with double the surface area in lakhs of rupees is

- (A) 2×10 (B) $3^{0.6} \times 10$
(C) $5^{0.6} \times 10$ (D) $2^{0.6} \times 10$

30. The cost of a distillation column in the year 2000 is x rupees. What is the cost of the column in rupees in the year 2010 given the cost indices for the years 2000 and 2010 are 480 and 520 respectively?

- (A) $(520/480)^2 x$ (B) $(480/520) x$
(C) $(520/480) x$ (D) $(520/480)^{0.6} x$

72. The original value of an equipment is Rs. 10000/-. The salvage value is Rs. 500/- at the end of its useful life period of 5 years. What is the asset value in rupees after two years by textbook declining balance method?

- (A) 3025/- (B) 4010/-
(C) 5020/- (D) 6050/-

73. The depreciable fixed cost is Rs. 100 lakhs. The average profit per year is Rs. 15 lakhs. The average depreciation cost per year is Rs. 10 lakhs. What is the payout period in years, if there is no interest charge?

- (A) 8 (B) 4
(C) 10 (D) 20

2006

60. In a desalination plant, an evaporator of area 200 m² was purchased in 1996 at a cost of \$3,00,000. In 2002, another evaporator of area 50 m² was added. What was the cost of the second evaporator (in \$)? Assume that the cost of evaporators scales as (capacity)^{0.54}. The Marshall and Swift index was 1048.5 in 1996 and 1116.9 in 2002.

- (A) 1,30,500 (B) 1,39,100
(C) 1,41,900 (D) 1,51,200

62. Due to a 20% drop in the product selling price, the pay-back period of a new plant increased to 1.5 times that estimated initially, the production cost and the production rate remaining unchanged. If the production cost is C_p and the new selling price is C_s , then C_p/C_s is

- (A) 0.2 (B) 0.4
(C) 0.5 (D) 0.6

63. Obtain the optimal diameter of a cylindrical storage vessel of volume V . The curved shell costs C_s (in $\$/m^2$), and the flat top and bottom plates cost C_p (in $\$/m^2$)

$$(A) D = \frac{C_s}{C_p} \left[\frac{4V}{\pi} \right]^{\frac{1}{3}}$$

$$(B) D = \left[\frac{8VC_s}{\pi C_p} \right]^{\frac{1}{3}}$$

$$(C) D = \left[\frac{VC_s}{C_p} \right]^{\frac{1}{3}}$$

$$(D) D = \left[\frac{4VC_s}{\pi C_p} \right]^{\frac{1}{3}}$$

64. A sale contract signed by a chemical manufacturer is expected to generate a net cash flow of \$ 2,50,000 per year at the end of each year for a period of three years. The applicable discount rate (interest rate) is 10%. The net present worth of the total cash flow is \$.

(A) 7,50,000

(B) 6,83,750

(C) 6,21,500

(D) 3,32,750

2007

65. A pump has an installed cost of Rs. 40,000 and a 10-year estimated life. The salvage value of the pump is zero at the end of 10 years. The pump value (in rupees) after depreciation by the double declining balance method, at the end of 6 years is

(A) 4295

(B) 10486

(C) 21257

(D) 37600

2008

18. For the case of single lump-sum capital expenditure of Rs. 10 crores which generates a constant annual cash flow of Rs. 2 crores in each subsequent year, the payback period (in years), if the scrap value of the capital outlay is zero is

(A) 10

(B) 20

(C) 1

(D) 5

19. The relation between capital rate of return ratio (CRR), net present value (NPV) and maximum cumulative expenditure (MCE) is

(A) $CRR = \frac{NPV}{MCE}$

(B) $CRR = \frac{MCE}{NPV}$

(C) $CRR = NPV \times MCE$

(D) $CRR = \frac{MCE}{NPV+MCE}$

66. A reactor has been installed at a cost of Rs. 50,000 and is expected to have a working life of 10 years with a scrap value of Rs. 10,000. The capitalized cost (in Rs.) of the reactor based on an annual compound interest rate of 5% is

(A) 1,13,600

(B) 42,000

(C) 52,500

(D) 10,500

2009

18. The total fixed cost of a chemical plant is Rs. 10.0 lakhs; the internal rate of return is 15% and the annual operating cost is Rs. 2.0 lakhs. The annualized cost of the plant (in lakhs of Rs.) is

(A) 1.8

(B) 2.6

(C) 3.5

(D) 4.3

45. A column costs Rs. 5.0 lakhs and has a useful life of 10 years. Using the double declining balance depreciation method, the book value of the unit at the end of five years (in lakhs of Rs.) is

(A) 1.21

(B) 1.31

(C) 1.64

(D) 2.05

2010

45. A reactor needs to be lined with a corrosion resistant lining. One type of lining cost Rs.5 lakhs and is expected to last for 2 years. Another type of lining lasts for 3 years. If both choices have to be equally economical, with the effective interest rate being 18%, compounded annually, the price one should pay for the second type of lining is

(A) Rs. 6.1 lakhs

(B) Rs. 6.5 lakhs

(C) Rs. 6.9 lakhs

(D) Rs. 7.6 lakhs

Common Data for Questions 50 and 51:

A plant produces phenol. The variable cost in rupees per tonne of phenol is related to the plant capacity P (in tonnes/day) as $45,000 + 5P$. The fixed charges are Rs. 100,000 per day. The selling price of phenol is Rs. 50,000 per tonne.

50. The optimal plant capacity (in tonnes per day) for minimum cost per tonne of phenol, is

(A) 101

(B) 141

(C) 283

(D) 422

51. The break-even capacity in tones per day, is

(A) 50

(B) 40

(C) 30

(D) 20

2011

45. A process plant has a life of 7 years and its salvage value is 30 %. For what MINIMUM fixed – percentage factor will the depreciation amount for the second year, calculated by declining balance method be EQUAL to that calculated by the straight line depreciation method?

(A) 0.1

(B) 0.113

(C) 0.527

(D) 0.887

