

N.B.: (1) Question No 1 is compulsory

(2) Attempt any three questions out of remaining five questions

(3) Assume suitable data if necessary and indicate it clearly.

(4) Figures to the right indicate full marks.

- Q.1. Solve any four questions of the following. **20**
- (a) What is Process Engineering? Explain basic functions of process engineering.
 - (b) Discuss different types of depreciation.
 - (c) Describe cash flow of industrial operation with tree diagram.
 - (d) Explain which factors are to be considered during tray selection of distillation column?
 - (e) What is P & ID? Explain its significance.
 - (f) Explain the various types of costs.
- Q.2. (a) Calculate the number of theoretical stages for an absorption column used to absorb acetone from mixture of 10 gmol/sec of air & 1 gmol/sec of acetone using water as the solvent. Recovery of acetone is 95% at temperature of 300K & column pressure of 10 bar. The vapour pressure of acetone & water is 0.337 & 0.032 bar respectively. Also determine the solvent flowrate & absorption factors for all components. **10**
- (b) What is Break Even analysis? Explain with graphical representation. Also derive the equation for break-even point **10**
- Q.3. (a) A project expected to have cash flow for the five years as follows, after all expenses & taxes. The initial fixed capital investment is Rs. 1000000 & the working capital investment is 15% of the fixed capital investment. Find the rate of return using Straight Line depreciation. Salvage value of project is zero. **10**

Time (years)	Cash flow (Rs.)
0-1	200000
1-2	270000
2-3	330000
3-4	400000
4-5	475000

- (b) Explain working & applications of Short Path Distillation Unit (SPDU) with schematic diagram. **10**
- Q.4. (a) Tray stack in distillation column has 23 number of trays and tray spacing is 0.6 m. Diameter of the tray stack is 1.06 m. Then calculate present bare module cost of this tray stack based on the following data: **10**
 $C_0 = \text{Rs. } 13860$; $L_0 = 10 \text{ ft}$; $D_0 = 2 \text{ ft}$; $\alpha = 0.97$; $\beta = 1.45$; $F_m = 0$; $F_s = 1$; $F_t = 1.8$; $MF = 1$; UF at present time = 3.12
- (b) Differentiate: (i) Batch process & Continuous process **10**
(ii) Packed column & Tray column

- Q.5 (a) For the case of a nominal annual interest rate of 20% for capital of Rs. 2000, **10**
determine:
i) Total amount accumulated after one year (365 days) with daily compounding.
ii) Total amount accumulated after 6 years with continuous compounding.
iii) The effective annual interest rate if compounding is continuous.
- (b) Find out the power required for a turbo blower as well as the discharge **10**
temperature of air from blower for the following.
Duty;
Fluid: Atmospheric air
Capacity= 1084 m³/h
Discharge pressure= 2atm
C_p/C_v for air= 1.395
Inlet temperature of air= 50^oC
Efficiency of turbo blower= 0.7
- Q.6. (a) Discuss FUG method for design of multicomponent distillation **10**
(b) A new piece of equipment costs Rs. 30000 & will have a scrap value of Rs.8000 **10**
at the end of its useful life period of 20 years & interest is compounded at 6% per
year. What is the capitalized cost of equipment?
