1(a) Define unit cell and space lattice. Calculate the packing efficiency for the SCC, BCC and FCC systems.

1(b) The atomic weight and atomic radius of sodium is 23 and 185 pm, respectively and it has BCC structure. Calculate its density.

OR

4(b)' Explain the different types of defects in the crystals and write their influence on the properties of crystalline solids.

2(a) What are cast irons? How are they classified? Give the composition, properties and uses of white cast iron.

2(b) What are plain carbon steels? How are they classified? Give the properties and uses of different types of low carbon steels.

OR

2(b)' Give the general composition, properties and uses of ferritic and martensitic stainless steels.

3 Draw the phase equilibrium diagram of Fe-C system. Describe the solid phases and invariant reactions in the Fe-C phase diagram.

OR

3' Discuss the followings:

(a) Heat treating temperatures for carbon steel.

(b) Annealing
4(a) Explain the principle of transmission electron microscopy (TEM). List the components of TEM and describe the process of imaging by TEM.  

4(b) Write the principle involved in thermogravimetric analysis (TGA). Explain the curve obtained during TGA studies by taking suitable example.

OR

4(b) Differentiate between differential thermal analysis (DTA) and differential scanning calorimetry (DSC). What informations can be obtained from DSC curve?

5(a) Explain five properties of wood that makes it suitable as building material.

5(b) What are composites? Explain various constituents of composites with suitable examples.

6(a) Define semiconductors. Differentiate between intrinsic and extrinsic semiconductors with suitable examples.

6(b) What is cement? Name the different ingredients and write their functions.

OR

6(b) What are abrasives? Write the properties and applications of artificial abrasives.
1(a) In MLT θ system (T being time and θ temperature), what is the dimension of thermal conductivity? [1.5]

1(b) Heat transfer by combustion of wood in open air is analysed by three different cases: case 1, case 2 and case 3, as shown in fig 1. Identify the major mode of heat transfer in each case. [1.5]

![Fig1: Heat generation by burning of wood](image)

I(c) In flow across tube banks, how does the heat transfer coefficient vary with the row number in the flow direction? How does it vary with in the transverse direction for a given row number? [0.2]

I(d) The wall of the house in a new state are to be constructed using a ‘cavity wall’ design. This comprises an inner layer of brick (k= 0.5 W/m K and 120 mm thick), an air gap and an outer layer of brick (k= 0.3 W/m K and 120 mm thick). At the design condition the inside room temperature is 20 °C, the outside air temperature is -10 °C; the heat transfer coefficients on inside, outside and in the air gap are; 10, 40 and 6 W/m²K respectively. Calculate the heat flux through the wall. [0.5]

1(e) Show that the overall heat transfer coefficient for a concentric tube heat exchanger is given by the relation:

\[ U_o = \left[ \frac{r_o}{h} \ln \left( \frac{r_o}{r_i} \right) + \frac{r_o}{h_i} r_i + \frac{1}{h_o} \right]^{-1} \] [0.5]
1(e') Air at atmospheric pressure and 20°C is flowing with a velocity of 8 m/s over a 1.5 m x 6 m flat plate whose temperature is 80°C. Determine the rate of heat transfer from the plate if air is flowing parallel to 1.5 m long side.

The properties of air is given in table 1.

<table>
<thead>
<tr>
<th>T (K)</th>
<th>ρ (kg/m³)</th>
<th>c_p (J/kg-K)</th>
<th>μ (kg/m-s)</th>
<th>v (m²/s)</th>
<th>k (W/m-K)</th>
<th>α (m²/s)</th>
<th>Pr</th>
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<tr>
<td>100</td>
<td>3.605</td>
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<td>0.711 x 10⁻⁵</td>
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<td>0.02544</td>
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<tr>
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<td>0.02623</td>
<td>2.213</td>
<td>0.713</td>
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<tr>
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<td>0.02888</td>
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<td>0.707</td>
</tr>
</tbody>
</table>

2(a) Draw a typical pool boiling curve and level various regimes on it.

2(b) Explain Leidenfrost phenomenon in boiling.

2(c) Show various regimes in film condensation on a vertical plate. Will the heat flux be higher at the top or at the bottom of the plate and Why?

2(d) The condenser of a steam power plant operates at a pressure of 7.38 kPa. Steam at this pressure condenses on the outer surface of horizontal pipes through which cooling water circulates. The outer diameter of the pipe is 3 cm, and the outer surface of the pipes are maintained at 30°C. Determine

i. The rate of heat transferred to the cooling water per unit length of pipe.

ii. The rate of condensation of steam per unit length of a horizontal pipe.

Given that:

- Saturation Temperature at 7.38 kPa, \( T_s = 40 \) °C
- Density of water (Liquid phase), \( \rho_l = 994 \) kg/m³
- Density of water (vapour phase), \( \rho_v = 0.05 \) kg/m³
- Specific heat of water, \( c_{pl} = 4178 \) J/kg°C
- Thermal conductivity of water, \( k_l = 4178 \) W/mK
- Viscosity of water, \( \mu_l = 0.720 \times 10^{-3} \) kg/m.s
- Latent heat, \( h_{fg} = 2407 \times 10^{-3} \) J/kg

Contd.....3.
2(d) Water is to be boiled at atmospheric pressure in a mechanically polished stainless steel pan placed on the top of a heating unit. The inner surface of the bottom of the pan is maintained at 108 °C. If the diameter of the bottom of the pan is 30 cm, determine:
   a) The rate of heat transfer to the water
   b) The rate of evaporation of water
   c) Apply Rohsenow relation for boiling which is as follows:

   \[ q \text{ (nucleate)} = \mu_i h_f \left[ \frac{g(\rho_i - \rho_v)}{\sigma} \right]^{1/2} \left[ \frac{C_{pl}(T_v - T_{sat})}{C_f h_f \rho_f \mu_f} \right] \]

   Where, \( C_{st} = 0.0130 \) and \( n = 1.0 \)
   The properties of water at this condition could be taken as given below:
   \[ \rho_i = 957.9 \text{ kg/m}^3 \quad h_f = 2257.0 \times 10^3 \text{ J/kg} \]
   \[ \rho_v = 0.6 \text{ kg/m}^3 \quad \mu_v = 0.282 \times 10^{-3} \text{ kg/m} \cdot \text{s} \]
   \[ Pr_i = 1.75 \quad C_{pl} = 4217 \text{ W/kg} \cdot \text{°C} \]
   \[ \sigma = 0.0589 \text{ N/m} \]

3(a) Draw temperature profile for 1-2 shell and tube heat exchanger.

3(b) What are advantages and limitations of U tube heat exchanger over fixed tube type?

3(c) What is meant by fouling in a heat exchanger? Write the types and economic penalties of fouling.

3(d) A 2-4 shell and tube heat exchanger is used to heat glycerine from 20 °C to 50 °C by hot water which enters the thin walled 2 cm diameter tube at 80 °C and leaves at 40 °C. The total effective length of the tubes in the exchanger is 60 m. The convective heat transfer coefficient is 25 W/(m²K) on the glycerine side and 160 W/(m²K) on water side. Determine the rate of heat transfer in the exchanger:
   a) before fouling
   b) After fouling, with a fouling factor of 0.0006 m²°C/W, occurs on the outer surface of the tube

![Diagram of heat exchanger]

\[ C = \frac{t_2 - t_1}{t_2 - t_1} \]

Two-shell passes and 4, 8, 12, etc. (any multiple of 4), tube passes

\[ Contd.....4. \]
3(d') Show that the effectiveness of a 1-1 shell and tube heat exchanger for parallel flow is given by

\[ e_{\text{parallel flow}} = \frac{1 - \exp\left(-\frac{U A_s}{C_c} \left(1 + \frac{C_{c_i}}{C_{h_i}}\right)\right)}{\left(1 + \frac{C_c}{C_{h_i}}\right) \frac{C_{\text{min}}}{C_c}} \]

4(a) Write a short note on scraped surface heat exchangers.

4(b) How does the vortex formation in an agitated vessel affect the heat transfer rate?

4(c) What is Wein's displacement law? At what wavelength does a body at 2000 K emit maximum radiation?

4(d') A thin Aluminium sheet with an emissivity of 0.1 on both sides is placed between two very large parallel plates that are maintained at uniform temperatures \( T_1 = 800 \) K and \( T_2 = 500 \) K and have emissivities \( \varepsilon_1 = 0.2 \) and \( \varepsilon_2 = 0.7 \) respectively. Determine the net rate of radiation heat transfer between the two plates per unit surface area of the plates and compare the result to that without the shield.

OR

4(d') Consider the 5-m x 5-m x 5-m cubical furnace shown in fig. 2 whose surfaces closely approximate black surfaces. The base, top and side surfaces of the surface are maintained at uniform temperatures of 800 K, 1500 K and 500 K respectively. Determine

a) The net rate of radiation heat transfer between the base and the side surfaces.

b) The net rate of radiation heat transfer between the base and the top surfaces.

c) The net rate of radiation heat transfer from the base surfaces.

Fig 2: Radiant heat transfer from cube

View factor \( F_{1-2} = 0.2 \).
Answer all the questions. Start each question and its part thereof from fresh page. Notations used have their usual meaning unless otherwise specified. Use of psychrometric chart and graph paper is allowed.

1(a) State the penetration theory of mass transfer along with the assumptions. Also write down the expression for the liquid phase mass transfer coefficient $\kappa$ according to this theory. 

1(b) A test tube, 0.015 m in diameter and 0.12 m long, has 0.0004 kg camphor in it. How long will it take for the camphor to disappear? The pressure is 1 atm and the temperature is 20 °C. The sublimation pressure of camphor at this temperature is 97.5 mmHg, and the diffusivity of camphor at given temperature and pressure is $5.64 \times 10^{-6}$ m$^2$/s. Molecular weight of camphor is 152.03 kg/kmol.

OR

1'(a) Define the terms mass average velocity and molar average velocity. Show that the two velocities are same if the molecular weights of all species in the mixture are equal.

1'(b) A stream of nitrogen containing 7.5 mol% benzene vapor is scrubbed with a nonvolatile absorption oil in a tower at 35 °C and 1.2 bar total pressure. The gas phase mass transfer coefficient is estimated to be $k_g = 9.8 \times 10^{-4}$ kmol/m$^2$·s·bar. The mole fraction of benzene as gas-liquid interface is $y_i = 0.01$. Calculate the mass transfer coefficients $k_y$ and $k_e$. Also calculate the mass transfer flux.

2(a) The number of transfer units for absorption of three gases $A$, $B$, and $C$ in water are 10, 4, and 15 respectively. The inlet and exit concentrations (mole fraction) of the...
gas-phase and of the liquid-phase have the same values in all the cases. For which system is the average driving force for mass transfer maximum? Give detail explanation of your answer.

2(b) It is required to absorb 95% of the acetone from a mixture with nitrogen containing 1.5 mol% of acetone in a counter-current tray tower. The total gas input is 30 kmol/h and the water enters the tower at a rate of 90 kmol/h. The tower operates at 300 K and 1 atm. The equilibrium relation is \( y = 2.53x \). Determine the number of ideal trays necessary for this separation using Kremser analytical method.

OR

2 (b') Sulfur dioxide is to be scrubbed from an air stream in a small packed tower by contacting with an organic amine. The feed gas contains 3% \( \text{SO}_2 \) by volume, and 95% of it is to be absorbed. The total gas rate is 150 m\(^3\)/h at 20 °C and 1.1 bar absolute pressure. The liquid enters the column at a rate of 1.40 kmol/h. Given: the overall mass transfer coefficient, \( K_c = 3.2 \times 10^{-4} \text{ kmol/m}^2\cdot\text{s} \cdot \Delta p \text{ (bar)} \); the effective gas-liquid contact area = 105 m\(^2\) per m\(^3\) of packed volume; slope \( \Delta f \) of the equilibrium line, \( m = 0.17 \). Determine the overall gas-phase mass transfer units and the packed height if the column is 0.3 m in diameter.

3(a) Define the terms relative saturation and percentage saturation related to humidification operation and obtain a relationship between them. Show that the relative saturation is always greater than the percentage saturation except for the extreme conditions of dry gas (0% humidity) and saturated gas (100% humidity).

3(b) A cooling tower is to be designed to cool water from 45 °C to 30 °C by counter-current contact with air of dry-bulb temperature 30 °C and wet-bulb temperature of 25 °C. The water rate is 5500 kg/h·m\(^2\) and the air rate is 1.25 times the minimum. Determine the tower height if the overall mass transfer coefficient is \( K_y \cdot a = 2500 \text{ kg/h·m}^2 \).

OR

3(b') A horizontal spray chamber with recirculated water is to be used for the adiabatic humidification and cooling of air. The active part of the chamber is 1.5 m long. The
coefficient of heat transfer is $h = 18.6$ W/m-K. An amount of 200 cc/min of air at 65 °C, $y' = 0.017$ kg water/kg dry air, is to be blown through the spray. Determine the temperature of the exit air. For air water system, humid heat in J/kg DA is:

$$C_s = 1005 + 1884y'$$

4(a) In a laboratory drying test of a granular, hygroscopic wet solid, it took 8.5 h to dry the solid from 28% to 2% moisture with solid loading of 20 kg/m². Given $X_i = 0.1$, $X^* = 0.005$, and the falling rate of drying being linear in moisture content (all moistures are on dry basis), calculate the time required for drying the material from 25% to 1.5% moisture under similar drying conditions. What are the highest and the lowest drying rate?

4(b) A Swenson-Walker crystallizer is to produce 800 kg/h of FeSO₄·7H₂O crystals. The saturated solution enters the crystallizer at 49 °C and the slurry leaves at 27 °C. Cooling water enters in the jacket of the crystallizer at 25 °C and leaves at 21 °C. The overall heat transfer coefficient has been estimated to be 203.5 W/m²-K. There are 1.3 m² of cooling surface per meter of crystallizer length. Estimate the cooling water required in kg/h. given: Saturated solution FeSO₄ at 49 °C and 27 °C contain 140 and 74 parts of FeSO₄·7H₂O per 100 parts of excess water, respectively. The average specific heat of the initial solution 2.90 kJ/kg·K, and the heat of crystallization is 66.15 kJ/kg. Molecular weights of FeSO₄ and H₂O are 151.91 and 18.02 kg/kmol respectively.
Maximum Marks: 60
Credits: 04
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.  Question  M.M.
1(a)  Explain in brief the pre-treatment steps given to crude oil before sending it to Distillation Unit.  [05]
1(b)  Explain with the help of neat sketch, the process of Atmospheric and vacuum distillation of crude oil with reference to product pattern and steam economy.  [10]

OR

1(b') Discuss in detail the Delayed Coking Process with special reference to process flowsheet, feedstocks, operating variables and advantages of this process over conventional coking process.  [10]

2(a)  Discuss the technological aspects of FCC with reference to the reactor design.  [7]
2(b)  Explain with the help of reactions the significance of reforming process in a refinery. Explain the effect of following process variables on the yield and quality of reformate. (i) Reactor Temperature, (ii) Reactor Pressure and (iii) Water Content.  [8]

OR

2(c)  Describe with the help of reactions and process flowsheet [desulfurization of Naphtha. Explain the effect of process variables and catalyst used, also discuss the effect of feedstock on hydrogen consumption in the process.  [10]

3(a)  Explain the significance of isomerization in petroleum industry. What are the feedstocks and catalyst used in Butamer Isomerization process and Penex process?  [3]

Contd.....2.
3(b) Describe with the help of reactions UOP catalytic polymerization process with reference to the effect of temperature and olefinic content of feed on product pattern.

3(c) Explain with the help of a process flowsheet H₂SO₄ alkylation process with reference to process variables as temperature and acid strength. What are the impurities present in alkylation feed streams and how they affect the alkylation process?

4(a) What are the desirable properties of Lubricating oils and mention the role and importance of each processing step employed for the production of Lube Oil Base Stock (LOBS).

4(b) Describe with the help of a suitable process flowsheet propane deasphalting process. Explain the effect of temperature and solvent to feed ratio on the yield and quality of deasphalted oil.

OR

4(a) Mention the main process steps involved in wax deoiling operation.

4(b) Explain the Wax sweating Principles. Describe the wax Sweating process for Slack wax.

4(c) Which solvent is satisfactorily used as deoiling solvent for waxes? What are the limitations of this solvent and how these limitations can be overcome.
2015-16
B.TECH. (AUTUMN SEMESTER) EXAMINATION
(PETROCHEMICAL ENGINEERING)
REFINERY ENGINEERING CALCULATIONS
PK-331
Credits: 04

Maximum Marks: 60
Duration: Three Hours.

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning

Q No 1
(a) Discuss the status of Indian refinery industry with reference to global refinery industry.  5.0

OR

(a') What is the significance of atmospheric and vacuum distillation unit in any typical refinery configuration?  5.0

(b) Compare the various distillation curves with the help of neat sketch  5.0

(c) Calculate the following average boiling point of the TBP curve given in figure 1  5.0

- Volume average boiling point
- Molal average boiling point
- Mean average boiling point

Q No 2
(a) Why refluxes is required in atmospheric distillation column? How it can be incorporated?  5.0

OR

(a') What do you understand about overflash? Why it is necessary in atmospheric distillation column?

Contd.....2.
(b) Light Distillate (Range = 20 - 30 vol % of crude oil) is desired as side stream product from atmospheric distillation column. Four tray steam stripper is used to remove lighter fractions associated with Light Distillate. Find out the outlet temperature of Light Distillate from stripper. The conditions is given below;

Steam rate = 10 lb/bbl of stripped product@500 °F
SF = 0.235 ADU feed = 100,000 BPD

Enthalpy of steam (assume for all temperature)= 1050 btu/lb
Draw tray temperature of Light Distillate = 450 °F

Take initial temperature guess, ΔT = 30 °F for stripper

Q No 3
(a) Discuss the vacuum distillate products with reference to metal content and carbon residue. 5.0

(b) Discuss the fuel type vacuum operation with neat sketch. 5.0

OR

(a') Discuss the various residue mode of vacuum distillation column.

(b') Write down energy balance expression for fuel type operation with neat sketch.

(c) In a vacuum distillation, feed is charged at flash zone at a temperature of 775 °F. If the total distillate products leaving flash zone are 1150 mol/hr which is 65 volume % of vacuum feed, then find whether column will operate under dry or wet condition. Required data is given as;

Hydrocarbon decomposition gas = 40 mol/hr
Hydrocarbon decomposition vapor = 35 mol/hr
Air leakage = 2.0 mol/hr
Tower top minimum pressure = 10 mm Hg
Tower internal assembly = 03 Chimney + 03 Grid section

Q No 4
(a) Why extended surface is needed in convection section? 5.0

Contd.....3.
(b) Discuss vertical cylindrical furnace with neat sketch.

OR

(b') Why draft is required in furnaces. Explain the types of draft used in furnaces with neat sketch.

(c) A petroleum stock at a rate of 1300 bbl/hr of specific gravity 0.863 is passed through a train of heat exchangers and is allowed to enter directly the radiant section of box type heater at 250°C. The heater is designed to burn 3200 kg per hour of refinery off gases as fuel. The net heating value of fuel is $4.7 \times 10^4 \text{ KJ/kg}$. The radiant section contains 190 sq. meters of projected area of one row of tubes (10.5 cm OD, 12 m long and spaced at 2 OD). Find the outlet temperature of the petroleum stock.

Given data
- $\alpha=0.88$, Air fuel ratio=20
- Average Specific heat of stock= 2.268 $\text{ KJ/Kg}^\circ\text{C}$
Figure 1 TBP. API data of Crude oil
**Figure 3 Mean Average Boiling Point**

**Figure 4 Molal Average Boiling Point**
Figure 5 Reduced Crude vacuum region phase behavior
2015-16
B.TECH. (AUTUMN SEMESTER) EXAMINATION
(PETROCHEMICAL ENGINEERING)
REFINERY ENGINEERING CALCULATIONS
PK-413N
Credits: 04

Maximum Marks: 60
Duration: Three Hours.

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning

Q No 1
(a) What do you understand by crude assay? Why it is required in designing of crude distillation column? 5.0

OR

(a') Explain the important distillation curves. How are they useful in column design? 5.0

(b) What types of average boiling points are used for petroleum fractions? Discuss with its importance. 5.0

(c) What do you understand by retrograde phenomena? Explain with the help of neat sketch. 5.0

Q No 2
(a) Describe following terminology with the help of neat sketch. 5.0
- TBP cut volume
- TBP cut point
- TBP overlap

(b) What do you understand by flash zone in atmospheric tower. If 52 vol% of atmospheric tower feed is desired as a distillate product (ΣD) and 2.0 vol% of feed is maintained as overflash then what will the amount of feed that is required to vaporize at flash zone. Strip out percentage can be taken as 23%. 10.0

Contd.....2.
(b') Find out the Gap for the D1-D2 & D2-D3. Also Calculate the critical Gap of the above fractions, keeping other parameters constant. Range is given for TBP data of figure 1:

<table>
<thead>
<tr>
<th>Separation Di-Di+1</th>
<th>No of trays (N)</th>
<th>Reflux (R)</th>
<th>Cut Range, Di+1 (Vol%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D4-D5</td>
<td>8</td>
<td>4</td>
<td>0-8</td>
</tr>
<tr>
<td>D3-D4</td>
<td>8</td>
<td>3</td>
<td>8-12</td>
</tr>
<tr>
<td>D2-D3</td>
<td>6</td>
<td>1</td>
<td>12-30</td>
</tr>
<tr>
<td>D1-D2</td>
<td>6</td>
<td>7</td>
<td>30-45</td>
</tr>
<tr>
<td>W-D1</td>
<td>3</td>
<td>-</td>
<td>45-51</td>
</tr>
</tbody>
</table>

Conversion of TBP into ASTM is given as:

\[ \text{ASTM}_{T50} = 1.05 \times \text{TBP}_{T50} \]

Q No 3

(a) What are the operational differences between vacuum distillation column and atmospheric distillation column?

5.0

(b) Discuss the distillates produced from vacuum tower also mention their applications.

OR

(b') Explain the economic consideration for vacuum distillation column

5.0

(c) Explain how vacuum distillation column will operate under dry mode?

5.0

Q No 4

(a) Describe the different sections and their functions of the furnaces.

5.0

(b) Why extended surface is needed in convection section of tube still heaters?

5.0

OR

(b') Discuss the importance of burner and its working in the furnaces

(c) Discuss any two of the following parameters for designing of radiant section of furnace

- Heat Duty
- Air Fuel ratio
- Tube spacing
- Cross over temperature

5.0

Contd....3.
Figure 1 TBP. API data of Crude oil
Figure 2 Fractionation between adjacent side stream products
Answer all the questions.
Assume suitable data if missing.

1. a. Differentiate between luxuries and necessities.  
   03

   b. What is a price demand supply relationship? Explain how the addition of supply for a given demand will establish a new and lower price.  
   03

   c. An engineer has two bids for an elevator to be installed in a new building. The details of the bids for the elevators are as follows:

<table>
<thead>
<tr>
<th>Bids</th>
<th>Initial cost (Rs.)</th>
<th>Service life (years)</th>
<th>Annual operations &amp; maintenance cost (Rs.)</th>
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</thead>
<tbody>
<tr>
<td>Alpha Elevator Inc.</td>
<td>4,50,000</td>
<td>15</td>
<td>27,000</td>
</tr>
<tr>
<td>Beta Elevator Inc.</td>
<td>5,40,000</td>
<td>15</td>
<td>28,500</td>
</tr>
</tbody>
</table>

   Determine which bid should be accepted, based on the present worth method of comparison assuming 15% interest rate.

   OR

   1'. c'. A cement plant plans to open a new rock pit. Two plans have been devised for movement of raw material from quarry to the plant. Plan A requires the purchase of an earth mover and the construction of an unloading pad. Plan B calls for construction of a conveyer system from the quarry to the plant. The expected costs are as follows:

<table>
<thead>
<tr>
<th>PLAN A</th>
<th>PLAN B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mover</td>
<td>Pad</td>
</tr>
<tr>
<td>Purchase Price ($)</td>
<td>45000</td>
</tr>
<tr>
<td>Annual Operating Cost ($)</td>
<td>6000</td>
</tr>
<tr>
<td>Salvage Value ($)</td>
<td>5000</td>
</tr>
<tr>
<td>Life (Years)</td>
<td>4</td>
</tr>
</tbody>
</table>

   Which plan should be selected for an interest rate of 15% per year?

2. a. Differentiate between book value and market value. How does depreciation affect a company’s cash flow?

Given the data below, find the depreciation and book value in year 3, using a double declining balance method:

| First cost: | Rs. 400,000 |
| Salvage Value: | Rs. 75,000 |
| Life:      | 5 years    |

   OR

   Contd....2.
What are the various criteria for performing a cost benefit analysis? Five interdependent proposals are under consideration for a particular project. The present worth of capital requirement and benefits for each proposal are as follows:

<table>
<thead>
<tr>
<th>Alternative</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>PW of Capital (Rs.)</td>
<td>80,000</td>
<td>50,000</td>
<td>72,000</td>
<td>43,000</td>
<td>81,000</td>
</tr>
<tr>
<td>PW of Benefits (Rs)</td>
<td>70,000</td>
<td>55,000</td>
<td>76,000</td>
<td>52,000</td>
<td>84,000</td>
</tr>
</tbody>
</table>

Develop an incremental B/C ratio analysis and select the appropriate alternative.

Define the terms economic life and useful life of an asset.
Two years ago, a machine was purchased at a cost of Rs. 2,00,000 to be useful for eight years. Its salvage value at the end of its life is Rs. 25,000. The annual maintenance cost is Rs. 25,000. The present market value of the existing machine is Rs. 1,20,000. A new machine, with a service life of 6 years, is now available at Rs. 1,50,000. Its annual maintenance cost is Rs. 14,000. The salvage value of the new machine is Rs. 20,000. Using an interest rate of 12%, find whether it is worth replacing the present machine with the new machine.

Discuss the social responsibilities of an organisation. What are the arguments for and against social responsibility of organisations?

What are the advantages of group decision making. Differentiate between Delphi and Nominal group decision making techniques.

What do you understand by organizational planning? Differentiate among tactical and operational plans.

Describe the five alternatives to job specialization. What is the advantage of each, as compared to specialization?

How is leadership different from management? Give suitable example to distinguish between them.

What are various levels of control system in an organization? Explain the four fundamental steps of any control process.

Describe the four basic levels of international business activity. Do you think any organization will achieve the fourth level? Why or why not?

Describe the processes of human resource planning, recruiting and selection.

What do you understand by marketing mix or 4P's of marketing?

Explain the difference between macroeconomics and microeconomics in the context of financial management.