Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

ME Semester –III Examination Dec. - 2011

Subject code: 730904 **Date: 08/12/2011**
Subject Name: Design of Material Handling Equipments
Time: 10.30 am – 01.00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Arrange the following material handling equipments in logical sequence based on the order of usage(flow of material) in actual conveying system: **07**

1)Wagon tippler 2) Apron feeder 3) Belt conveyor
4) Stacker Reclaimer 5) Wagon Marshal 6) Hopper

Also briefly explain the function of each of the above mentioned equipments.

(b) Explain the function performed by Carcass and Cover of the belt. Also enlist any four types of textile fabric belt. **07**

Q.2 **(a)** Explain the importance of the following with respect to the material handling system: **07**

1) Bulk density of material
2) Surcharge angle

(b) What are the different means for storing the bulk material? Explain any three of them. **07**

OR

(b) What do you mean by protective packaging? Explain how can one achieve protective packaging? **07**

Q.3 **(a)** A wire rope hoist which is hand operated is to raise 250 kg of load. The rope is being wound on a drum of 30 cm diameter. The force on the operating lever is limited to 20 kg. The effective length of the lever is 35 cm. Determine the number of ropes leading to the hook block, the efficiency of the hoist and factor of safety of the hoist, assuming that it is reefed with 15mm – 6 x 37 wire rope. Assume hoisting block with 5 sheaves and constant C=1.076. **07**

(b) Explain with the help of neat sketch the dust extraction system and its importance in belt conveyor. **07**

OR

Q.3 **(a)** Design & suggest the suitable size of 6 x 19 SWR to be used with a drum hoist so that it can lift a load of 7500 kg from the depth of 140 meter. There is a starting slack of 3 meters. Assume that the weight per meter length of the rope may be taken as $0.35d^2$ kg where d is the diameter of rope in cm. Modulus of elasticity of the rope is 0.84×10^6 kg/cm^2. Breaking load of 6 x 19 rope is $5100d^2$. Assume factor of safety as 5. **07**

(b) "Belt conveyor is used for wide range of capacity and has tremendous amount of adaptability to the path of travel". Justify the statement. **07**

Q.4 **(a)** Explain how the pulley design is depended upon the belt design. Also explain why the crowning is not preferable on pulley face width. **07**

(b) An incline conveyor has to convey the material over distance of 2.5 km and a height of 500 meter. It handles an ore having the density of 1.5 ton/m^3.If the belt speed is 120 m/min, then determine the standard width of four ply belt so that the material can be conveyed at the rate of 3 ton/hr. For incline belt use flowability factor of 2.65×10^{-4} for conveyor inclination 15 degree or less and use flowability factor of 2.50×10^{-4} for 16-25 degree. Also determine the diameter and width of drive pulley & gear reduction ratio for motor, if motor speed is 1440 rpm. Assume the material for ply of belt has a material factor $K_1 = 2.5$ & belt tension & arc of contact factor, K_2 as 80.Assume suitable side margin and use standard pulley diameter. **07**

OR

Q.4 **(a)** What are the important requirements of idler? Explain the functions performed by the idler in the belt conveyor. **07**

(b) A horizontal belt conveyor is used for transporting a material having mass density of 800 kg/m^3.Surcharge factor for the flat drive is 0.08. Determine belt width, if material is to be conveyed at the rate of 36 ton/hr. Assume belt speed as 1.75 m/s. **07**
What is the effect of increasing the belt speed above the optimal value in belt conveyor?

Q.5 **(a)** A horizontal conveyor is used in transporting ore.The detail of conveyor is given below. The maximum capacity of conveyor is 250 tph, at the belt speed of 2 m/s. Mineral ore has density of 800 kg/m^3. A 3 ply belt is used for conveyor & the surcharge factor for the belt can be taken as 0.08. Mass of each idler can be assumed as 20 kg. **07**

Assume the following data for the conveyor.
Friction factor for idlers = 0.025
Snub factor for both the snub pulley = 0.02
Snub factor for drive and tail pulley = 0.06
Material velocity along path of blet = 1 m/s
Circumferential velocity of the rotary brush cleaner, V_{clean} = 2 m/s
Cleaning factor = 5 V_{clean}
Cleaning force = K_{clean} gB
Unloading resistance = 3.5 m_ggB
Angle of wrap = 210 deg

Coefficient of friction between belt & drive pulley = 0.4
Ultimate tensile strength per unit width of ply = 70 N/mm
Drive efficiency = 93 %
Motor speed = 1440 rpm
Carrying idler pitch = 1.5 m, L_C = 298.5 m, Z_c = 199
Return idler pitch = 2.99 m, L_R = 296.01 m, Z_R = 99
Standard motor rating = 5,5.5,7.5,10,11,12.5,15,20
Conveyor contains plow discharge and rotary belt cleaner.

Belt width, mm	400	500	650	800	1000
M_B (kg/m)	5	6.5	9	12	16

Determine:
1) Standard electric motor to run this conveyor
2) Standard pulley diameter.

L_1(conveyor length-head to tail centre-centre distance) = 300 m
L_2(snub pulleys centre-centre distance) = 299 m.

(b) What is the function of the bucket elevator in bulk material handling system? What are the different types of bucket elevators? Explain all of them **07**

OR

Q.5 **(a)** Design a crane hook for a 3 ton crane. The hook is to be of swiveling type & of triangular section. Assume μ = 5 and permissible stress for the hook material is 500 kg/cm^2. **07**

(b) Explain the importance of feeder in belt conveyor. Explain the constructional features & working of different types of vibrating feeders. **07**

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