## **GUJARAT TECHNOLOGICAL UNIVERSITY** ME - SEMESTER- III • EXAMINATION – SUMMER 2015

Date: 02/05/2015 Subject Code: 730804 **Subject Name: Design of Material Handling Equipments** 2:30 pm to 5:00 pm **Total Marks: 70** Time: **Instructions:** 1. Attempt all questions. 2. Make suitable assumptions wherever necessary. 3. Figures to the right indicate full marks. (a) List out important components commonly used in material handling Q.1 07 equipments and explain design of single hook in detail with neat sketches. (b) With the help of neat sketch, explain the plow discharge and traveling 07 tripper method used in belt conveyors. Q.2 (a) Enlist and explain the principles in selecting a material handling equipment. 07 (b) Mention clearly, important properties and characteristics required to be 07 considered, which are used to classify bulk materials. -Bulk load can be treated as unit loadø justify. OR (b) Discuss major considerations in the design of containers. 07 Q.3 (a) The 6 X 19 wire rope is used to lift the cage of vertical mine hoist 200 m 07deep. The weight of cage is 375 kg and it has to lift 1000 kg of ore at a speed of 1.5 m/s which is to be attained in 1 second. Assume factor of safety to be 5 and take following data: (*d* is diameter of wire rope) — Breaking strength of rope =  $510 d^2 N$ — Mass of rope per meter length =  $0.0036 d^2$  kg — Diameter of sleeve = 80 d— Area of wire rope =  $0.38 d^2 \text{ mm}^2$ — *E* for wire =  $0.8 \times 10^5 \text{ N/mm}^2$ . (b) Select the rope, pulleys and drum required for an electric overhead 07 travelling crane with a lifting magnet for medium service duty. — Lifting capacity = 5000 kg — Lifting height = 8 m— Weight of lifting magnet = 2,000 kg— Weight of lifting tackle = 120 kg — Number of rope part = 4— Efficiency of pulley system=0.94. OR Q.3 (a) Design the travelling mechanism of monorail crane with regard to *bearing* 07 reactions, wheel loads, and resistance to motion. (b) Explain the following: Angle of repose, Angle of surcharge, Flowability, 07 Cushion Idlers, Skims, Carcass, Snub pulley. Q.4 (a) Explain the design procedure of bucket elevator. 07

(b) Select a wire rope for a travelling crane with a lifting capacity 10 ton 07 assuming the rope life equal to 12 month. The load is suspended on four rope parts. Medium service duty.

- Q.4 (a) Derive the equation for speed at which the load is lifted for hand power 07 hoisting mechanism.
  - (b) Determine the required power ratings of the motors of an EOT to be used 07 in the manufacturing shop of a plant, having a lifting capacity of 10 T and to be operated at a span of 20 m. Assume suitable linear velocity of the load. Take trolley traverse speed as 45 m/min, crane travelling speed as 100

m/min. Also assume, the total moment of gyration of motor and coupling together to be equal to  $2 \text{ kg-m}^2$ .

- Q.5 (a) Explain the need of dust control system in belt conveyor? Explain dust 07 suppression equipment and dust extraction system used in belt conveyor.
  - (b) A block and tackle has six sheaves on each block. The wire rope diameter 07 is 22 mm. Assuming factor of safety to be 6 and ultimate strength of rope as 130 MPa, find, (i) Capacity of tackle, and (ii) Hoist efficiency. Derive the equation you use.

## OR

A horizontal belt conveyor is used in transporting a mineral ore. The 14 maximum capacity of the conveyor is 70 tph, at a belt speed of 2 m/sec. The mineral ore material has a density of 800 kg/m<sup>3</sup>. A three-ply belt is used for the conveyor and the surcharge factor for the belt is to be taken as 0.08. Assume the mass of each idler as 7.8 kg. Use the following additional data for the design of conveyor.

Friction factor for idlers = 0.025Snub factor for both snub pulleys = 0.02Snub factor for both drive and tail pulleys = 0.06Material velocity along the path of belt = 0.5 m/secAngle of lap on drive pulley =  $190^{\circ}$ Coefficient of friction between belt and drive pulley = 0.4Ultimate tensile strength per unit width of ply = 30 N/mm Drive Efficiency = 80 %Motor speed = 1440 RPM Carrying Idler pitch = 0.75 mApproximate return idler pitch =  $2 \times \text{carrying idler pitch}$ Center-to-center distance between drive and tail pulley = 100.5 mCenter-to-center distance between end snub pulleys on return side = 99 m Pulley diameter = 125x No. of ply Circumferential velocity of the rotary brush cleaner = 2 m/sec Cleaning factor =  $5 \times Cleaning \ velocity$ B is belt width in m, Cleaning force  $= 5g \times B$ Unloading resistance =  $3.5 \text{ m}_{M} \text{ x g x B}$ where,  $m_M$  is the mass of the material/ unit length (i.e. kg/m) Standard pulley diameters: 315, 400, 500 630, 800, 1000 mm. Standard motor ratings: 5, 5.5, 7.5, 10, 11, 12.5, 15, 20, 22, 25 kW. 400 500 650 Belt width, B (mm) 800 1000  $M_{\rm B}$  (kg/m) 5 6.5 9 12 16

Draw a schematic diagram and determine:

- 1. A standard belt width;
- 2. Standard diameter pulley, width of pulley;
- 3. Number of carrying- and return-side idler pulleys;
- 4. A standard electric motor to run this conveyor.