

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**ME Semester –III Examination Dec. - 2011**

**Subject code: 730804**

**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.
4. Use of design data book is permissible.

**Q.1** A horizontal belt conveyor is used in transporting a mineral ore. The maximum capacity of the conveyor is 225 tph, at a belt speed of 120 m/min. 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 20 kg. Use the following additional data for the design of conveyor.

Friction factor for idlers = 0.025

Snub factor for both snub pulleys = 0.02

Snub factor for both drive and tail pulleys = 0.06

Material velocity along the path of belt = 1 m/sec

Circumferential velocity of the rotary brush cleaner = 2 m/sec

Cleaning factor = 10

B is belt width in m, Cleaning force =  $10g \times B$

Unloading resistance =  $3.5 m_M \times g \times B$

where,  $m_M$  is the mass of the material/ unit length (i.e. kg/m)

Angle of lap on drive pulley =  $210^\circ$

Coefficient of friction between belt and drive pulley = 0.4

Ultimate tensile strength per unit width of ply = 60 N/mm

Drive Efficiency = 93 %

Motor speed = 1440 RPM

Carrying Idler pitch = 1.5 m

Approximate return idler pitch = 3 m

Pulley diameter =  $125 \times \text{No. of ply}$

Allowable sag of the belt = 3 % of pitch

Standard pulley diameters : 315, 400, 500 630, 800, 1000 mm.

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Standard motor ratings : 5, 5.5, 7.5, 10, 11, 12.5, 15, 20, 22, 25 kW.

Standard belt width (in mm) : 400 500 650 800 1000 and corresponding to belt mass ( $m_B$  in kg/m) of 5, 6.5, 9, 12 and 16 respectively.

Design a safe conveyor completely keeping in view all major components and aspects which must be taken care of.

- Q.2** (a) Enlist various application areas of Material Handling Equipments (MHEs). 07  
Giving examples of each of these, discuss significant parameters to be considered for the selection of an appropriate MHE.
- (b) Derive a relation to determine the frictional resistance at carrying and return idlers. 07

**O R**

- (b) What is the importance of material flowability? Give at least four convincing practical examples for your answer. 07
- Q.3** (a) Mention clearly, important properties and characteristics required to be considered, which are used to classify bulk materials. 07
- (b) Discuss take up arrangements used in belt conveyors. 07

**O R**

- Q.3** (a) What is meant by containerization and explain its significance. 07
- (b) Explain the methods of loading and discharging of conveyors. 07
- Q.4** (a) Explain complete design procedure for wall mounted Jib cranes. 07
- (b) For heavy duty cranes, give at least four arrangements of rope-pulley combinations. Find number of bends for each arrangement and compare them based on performance. 07

**O R**

- Q.4** (a) Suggest a suitable size of wire rope for an inclined mine shaft of length 800 m and inclination of the rails  $60^\circ$  with the horizontal. The loaded skip weighs 10,000 kg, the rope velocity is 10 m/sec, acceleration period for it is 10 sec., required factor of safety is 5, rope drum diameter 80 times the diameter of the rope, the car friction is 0.025 kg/kg of weight normal to the incline and friction of rope on guide roller is 0.05 kg/kg of weight normal to the incline. 09
- (b) Analyze double hook and the drum only, for a heavy duty crane. Derive the design equations. 05

- Q.5 (a)** Explain monorail cranes with neat sketch and derive equation for bearing reaction, wheel load and resistance to motion. **07**
- (b)** Sketch a general layout of a girder for an Electrically Operated Travelling (EOT) crane. Suggest suitable cross section and material if the load lifting capacity of the crane is 150 T. Show the stress distribution across the cross section chosen. **07**

**O R**

- Q.5 (a)** Describe the step by step procedure for the design of a bucket elevator. **07**
- (b)** Determine the required power ratings of the motors of an EOT to be used 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 kg-m<sup>2</sup>. **07**

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