Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – III • EXAMINATION – SUMMER • 2013

Subject code: 730804 **Date: 15-05-2013**

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 PSG design data book is permissible**

Q.1 **(a)** Explain the factors to be consider for selection of material handling equipments **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**

Q.2 **(a)** Discuss in detail "Elements of the shoe brake" **07**

(b) Explain Zhitkov's method for finding the endurance of the steel wire rope **07**

OR

(b) Select by the rope, pulleys and drum required for an electric overhead travelling crane with a lifting magnet for Medium service duty. **07**

Lifting capacity = 5000 kg
Lifting height = 8 m
Weight of lifting magnet = 2,000 kg
Weight of lifting tackle = 120kg
Number of rope part = 4
Efficiency of pulley system=0.94

Q.3 **(a)** Explain luffing mechanism with sketch for changing the crane outreach. **07**

(b) Design a lowering brake for crane with a lifting capacity of 3 tons and lifting height of 27 m. The size of the brake wheel should be assign in conformity with permissible heating under the following unfavorable condition. **07**

Mean weight of load being lowered equal to 2/3 of full load.
Mean height of lowering, equal to raising, is 3/4 of the full height of raising.
Full load = 2000kg,
full height =20m
Number of switching-in operation per hour = 40
Switch-in period for hoisting mechanism (DF) = 40%
Efficiency of the hoisting mechanism = 0.85
Lowering speed equal to lifting speed = 66 m/min
Power of the hoisting mechanism motor = 52hp
Motor rpm = 570

OR

Q.3 **(a)** Derive the amount of heat liberate per hour during braking. **07**

(b) Design travelling mechanism for cantilever and monorail crane. **07**

Q.4 **(a)** Explain Following term **07**

(I) Angle of repose (II) Angle of surcharge
(III) Flowability (IV) Cushion Idlers
(V) Skims (VI) Carcass
(VII) Snub pulley

(b) Determine the required power rating of the motors of an electric over head travelling crane for assembly shop of an engineering plant. **07**

Lifting capacity = 5,000 kg,
Span = 14 m,
Load lifting(or lowering) speed=10m/min,
Trolley traverse speed = 45 m/min,
Crane travelling speed=100 m/min,
Power supply-three-phase, 380 V,
Duty medium (DF=25%).

OR

Q.4 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/m3. 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. **14**

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 = 5
B is belt width in m, Cleaning force = 5g x B
Unloading resistance = 3.5 m_M x g x B
where, m_M is the mass of the material/ unit length (i.e. kg/m)
Angle of lap on drive pulley = 210^0
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 = 2 x carrying idler pitch
Pulley diameter = 125x No. of ply
Allowable sag of the belt = 3 % of pitch

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.

Belt width (in mm):	400	500	650	800	1000
belt mass (m_B in kg/m)	5	6.5	9	12	16

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

Q.5 **(a)** Explain the design procedure of bucket elevator. **07**

(b) Explain detail classification of material handling Equipment. **07**

OR

Q.5 **(a)** Discuss with neat sketch types of bucket elevator. **07**

(b) Sketch the mechanical system used for longitudinal travel of the crane and explain its working **07**

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