Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-III Regular Examination January 2011

Subject code: 730804

Subject Name: Design of Material Handling Equipments

Date: 10 /01 /2011 **Time: 02.30 pm – 05.00 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) Explain the general characteristics of hoisting machines and list the specifications of hoisting machines. **07**

Q.2 **(a)** Explain the design procedure of Belt conveyor. **07**

(b) Explain the methods of loading and discharging of conveyors. **07**

OR

(b) An inclined conveyor handles an ore having a density of 1.5 t/m^3. The material has to be conveyed over a distance of 2 kms and a height of 450m. If the belt speed is to be 120 m/min, then determine the standard width of the four ply belt so that the material can be conveyed at a rate of 3 tonnes/hr. For the inclined belt use the following data for the flowability factor. **07**

Conveyor Inclination	10^0 - 15^0	16^0 - 20^0	21^0 - 25^0	26^0 - 30^0	31^0 - 35^0
Flowability Factor, C_1	2.65×10^{-4}	2.5×10^{-4}	2.35×10^{-4}	2.20×10^{-4}	2.05×10^{-4}

Standard belts widths are: 300, 400, 500, 600, 650, 750, 800, 900, 1000, 1200, 1400, 1600, 1800, 2000, 2200, 2400 mm.

Also determine the diameter and width of the drive pulley and the gear reduction ratio for the motor, if the motor speed is 1440 rpm. Assume the material for the ply of the belt has a material factor $k_1 = 2.5$ and the belt tension and arc of contact factor, $k_2 = 80$. The effective width b (in meters), of the material carried by the belt safely is given by the following equation:

$$b = 0.9B - 0.05 \text{ where } B = \text{Belt Width, m.}$$

Q.3 **(a)** How does the flexibility of a wire influence its design? How can the flexibility of a wire rope be increased? **07**

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

OR

Q.3 **(a)** Why lifting magnets are used in material handling equipments? Explain electric lifting magnet with neat sketch. **07**

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

Lifting capacity = 5,000 kg
Lifting height = 8 m
Weight of lifting magnet = 2,000 kg
Number of rope part = 4

Q.4	**(a)**	Explain monorail cranes with neat sketch and derive equation for bearing reaction, wheel load and resistance to motion.	**07**
	(b)	Determine the braking torques for hoisting and travelling mechanisms of an electric overhead crane. Lifting capacity = 5,000 kg, span = 14 m, load lifting(or lowering) speed=10 m/min, trolley traverse speed = 45 m/min, crane travelling speed=100 m/min, power supply-three-phase, 380 V, duty medium (DF=25%).	**07**

OR

Q.4	**(a)**	Explain the design procedure of rotary JIB crane with a rope-driven trolley.	**07**
	(b)	Derive the equation for speed at which the load is lifted for hand power hoisting mechanism.	**07**
Q.5	**(a)**	Explain the design procedure of bucket elevator.	**07**
	(b)	Suggest suitable material for crane hooks and justify them. Why trapezoidal cross-section is preferred for the hook.	**07**

OR

Q.5		Design bucket elevator used for sand for below given data. Mass flow rate of belt conveyor = 7.5 kg/sec., Density of sand = 1500 kg/m^3, Capacity of mass flow rate = 27 tonnes/hr., Lifting vertical height = 10 m.	**14**

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