Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – III • EXAMINATION – WINTER 2012

Subject code: 730804 **Date: 26/12/2012**

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)** Define material handling clearly. Explain the classification of material handling equipments and discuss the factors affecting selection of it. **07**

(b) State and explain the different principles used for designing the material handling equipments in detail. **07**

Q.2 **(a)** Suggest the suitable packaging, storage and material handling equipments for the following items/materials with neat sketches: (Any TWO) **07**

1. Steel sheets - 8 feet x 4 feet size, 2.5/5 T weight packet
2. Steel bars (circular) - different dia. 6 feet length
3. Milk bag crates

(b) How will you select the factor of safety for various material handling equipments. Explain in detail. **07**

OR

(b) List the important components commonly used in material handling equipments and explain design of single hook in detail with neat sketches. **07**

Q.3 **(a)** Explain the different safety devices used in various material handling equipments. **07**

(b) Design a steel wire rope - 6 x 19 for a lift from the following given data: **07**

No. of ropes = 2 Lift travel = 40 m

Maximum load on the rope including the load of cabin = 17 kN

Maximum speed of 5 m/sec reached in 10 m travel

Weight of rope = $3.83d^2$ N/m Area of rope = 0.38 m^2

Diameter of wire = 0.063d Factor of safety = 8

Sheave diameter = 40 d Modulus of elasticity of rope = 84000 N/mm^2

Tensile strength of 6 x 19 rope =$38.5d^2$ N/m^2

OR

Q.3 **(a)** Explain the design of main girder (box type) of an E.O.T. crane in detail with neat sketches. **07**

(b) Design a steel wire rope - 6 x 37 for a mine hoist considering 10 % of service load from the following given data: **07**

No. of falls = 6 Lift travel = 40 m

Maximum lifting capacity = 30 kN Acceleration of hoist =1m/sec^2

Weight of rope = $3.83d^2$ N/m Effective area of rope = 0.38 m^2

Diameter of wire = 0.045d Factor of safety = 5

Minimum Sheave diameter = 30 d Breaking load =$470d^2$

Modulus of elasticity of rope = 80000 N/mm^2 C = 1.05 for wire rope

Q.4 **(a)** Draw a neat sketch of chain conveyor and label the main parts in it. State its advantages and disadvantages compared to other conveyors. **07**

(b) An inclined belt conveyor at an angle of 15^0 to the horizontal is used in transporting a mineral ore. The capacity of the conveyor is 500 tph, at a belt speed of 2.25 m/sec. The mineral ore material has a density of 2000 kg/m^3. Use the following additional data : **07**

Length of load carrying run of belt = 200.5 m
Drive Efficiency = 91 % width of belt = 800 mm
Motor speed = 1500 RPM Factor of safety for belt = 12
Standard motor ratings : 40,50,60,75,90,100,110,125,150,175kW.
ultimate tensile strength for belt per unit length (width) per ply =125 N/m
mass of fabric ply belt per unit length = 12.5 kg/m
effective tight side belt tension on drive pulley = 71538 N
effective slack side belt tension on drive pulley = 21084 N
Find (1) power required to drive the belt conveyor (2) the power rating of standard electric motor (3) the no. of plies for fabric belt

OR

Q.4 **(a)** Explain the need of dust control system in belt conveyor? Explain dust suppression equipment and dust extraction system used in belt conveyor. **07**

(b) A horizontal belt conveyor is used in conveying a coal in thermal power station. The capacity of the conveyor is 300 tph, at a belt speed of 2 m/sec. The material has a density of 800 kg/m^3. Use the following additional data : **07**

Material conveying horizontal length = 260 m
Surcharge factor for polyamide belt = 0.0725
belt tension and arc of contact factor for belt = 80
number of plies for polyamide belt = 3 Motor speed = 1440 RPM
Drive Efficiency = 93 % material factor for plies = 2
width of material storage on belt = (0.9B – 0.05) m
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 (mB in kg/m)** of 5, 6.5, 9, 12 and 15.5 respectively.
Ultimate tensile strength for belt per unit length (width) per ply =60 N/m
Effective tight side belt tension on drive pulley = 8279 N
Effective slack side belt tension on drive pulley = 1911 N
Find (1) standard belt width (2) reduction ratio of gear reducer (3) power required to drive the belt conveyor (4) the power rating of standard electric motor (5) the available factor of safety

Q.5 **(a)** Draw a neat sketch of Gantry crane and label the main parts in it. State its advantages and disadvantages over E.O.T. crane and hoists. **07**

(b) Design the of main girder of an E.O.T. crane (double girder type) from the following given data: **07**

Load to be lifted = 250 kN Weight of hook = 4 kN
Weight of crab = 6.5 kN Span L = 13.7 m
Height of lift = 5.5 m Hoisting speed = 1.5 m/min
Cross traverse speed = 10 m/min
Hollow rectangular cross section with height to width ratio = 2.5
Steel plate thickness = 10 mm
Permissible bending stress = 100 MPa Permissible deflection = L/750

OR

Q.5 **(a)** Explain the stability analysis of movable crane used in railway yard for loading and unloading of goods / wagons with neat sketch. **07**

(b) Design a two rope hoisting drum driven by a worm gear reducer at 25 r.p.m. from the following given data: **07**

Lifting capacity = 10 kN Hoisting speed = 42 m/min
Lifting height = 20 m diameter of each rope = 15 mm
The distance between grooves of the two ropes = 115 mm
Drum material FG260 with $[\sigma_{bending}] = 140$ MPa and $[\sigma_{shear}] = 50$ MPa
Maximum acceleration of the elevator = 1.2 m/ sec^2

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