Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER III (OLD) – • EXAMINATION – SUMMER 2016

Subject Code: 730904 **Date: 05/05/2016**

Subject Name: Design of Material Handling Equipments

Time:10:30 am to 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 permitted in examination.
5. Draw neat sketch to justify your answer where necessary.

Q.1 **(a)** Explain the different of stresses induced in steel wire ropes. Also explain the wire ropes selection in detail. **07**

(b) 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 diameters and 6 feet length
3. Edible oil pouch storage plastic crates -10 pouch pack of 1 litres per crates

Q.2 **(a)** Differentiate between hoisting and conveying equipments. List and explain the criterion for selection of material handling equipment for a particular application. **07**

(b) A horizontal belt conveyor is used in conveying a coal in thermal power station. The capacity of the conveyor is 300 t.p.h , 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 = 92 % material factor for plies = 2
width of material storage on belt = (0.9B – 0.05) m
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.

Standard data / values:
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.

OR

(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 t.p.h., 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

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

(b) Design a forged steel hook with modified triangular/trapezoidal cross-section for useful load lifting capacity of the crane as 50 kN .The weight of the hook with grabbing tongs is 10 kN. The permissible stress for hook material is 230 MPa. **07**

OR

Q.3 **(a)** State and explain the basic principles used for designing materials handling equipments in detail. **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

Q.4 **(a)** Explain the chain conveyor with a neat sketch. State and explain its advantages and disadvantages compared to belt conveyor. Also states its applications. **07**

(b) Explain the economics of material handling equipments with justification. **07**

OR

Q.4 **(a)** Define and explain storage space utilization. Also explain it in relation with different types of materials handling equipments. **07**

(b) Design the E.O.T. crane main girder (double girder box type) from the following specifications: **07**
Useful load to be lifted = 250 kN Weight of hook = 5 kN
Weight of crab = 6.5 kN Span = 10 m
Height of lift = 4 m Hoisting speed = 1.5 m/min
Cross traverse speed = 10 m/min
For box type cross section, height to width ratio = 2.5
Steel plate thickness = 10 mm
Design bending stress foe steel plate = 100 MPa
Permissible deflection = span / 1000

Q.5 **(a)** Explain the Safety devices of elevators. **07**

(b) Explain the dust extraction system used in belt conveyor in detail. **07**

OR

Q.5 **(a)** Explain the factors to be considered for selection of factor of safety for different types of material handling equipment? **07**

(b) Discuss the design procedure for bucket elevator. **07**

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