Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.TECH(ME)/SEM-2/MME-203A/2013

2013

DESIGN OF MATERIAL HANDLING EQUIPMENTS

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

   i) The material code of material characteristics abrasiveness is given by one letter/number from

   a) 1 to 5 b) 6 to 9

   c) *H* to *K* d) none of these.

   ii) The material code of material characteristics flowability is given by one letter/number from

   a) 1 to 5 b) 6 to 9

   c) *H* to *K* d) none of these.

iii) The material code of material characteristics lump size is given by one letter/number from

a) 1 to 5 b) 6 to 9

c) *H* to *K* d) *A* to *G*.

iv) Angle of surcharge is

a) same as angle of repose

b) dynamic angle of repose

c) 0·7 × dynamic angle of repose

d) none of these.

v) Necessary references for design of Belt conveyor is given by

a) IS 11592 b) IS 1891

c) IS 8598 d) IS 8730.

vi) The dimensions of principal components of screw conveyor is given by

a) IS 5563 b) IS 1891

c) IS 8598 d) Is 8730.

vii) Mechanical advantage of wheel and differential axle is

a) $R/(r_1 - r_2)$ b) $2R/(r_1 - r_2)$

c) $R/2(r_1 - r_2)$ d) $R/(r_1 + r_2)$.

viii) 6 × 19 construction of a rope means

a) 6 strands, 19 wires

b) 19 strands, 6 wires

c) 6 strands rope of 19 mm diameter

d) none of these.

ix) According to the load capacity the medium duty (Class-II) bridge cranes have the capacity

a) 0 - 5 tones b) 5 - 20 tones

c) 20 - 50 tons d) less than 1 ton.

x) Ratchet gearing is used for

a) breaking purpose

b) slowing down the lowering speed of the load

c) holding the load by preventing backward rolling of the load

d) all of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Explain the dynamic phenomenon in Chain Conveyor.

3. Show that the capacity of conveying of a troughed Belt Conveyor is $B^2V\gamma[576\tan(0\cdot35\phi)+432\tan\lambda]$ tph with the symbols having their usual meaning assuming length of each carrying idler is 0·4 B and the width of material cone is 0·8 B, λ is the troughing angle.

4. Determine the rope, drum and pulley diameter for a pulley system of a 5 tonne EOT crane with 4 falls.

   Take rope factor = 0·105; Drum factor = 2·4 and Pulley factor = 2·7. Consider 6 ×19 rope with breaking loads are given as below :

Rope dia (mm)	Breaking load (kN)	Duty type	Minimum Factor of safety
9	49	I	4·5 - 5
11	66	II	5·5
13	86	III	6
16	134	IV	6·5 - 7
17	164		

5. Show a schematic diagram of Weston Pulley block and deduce the expression of mechanical advantage and velocity ratio. 2 + 3

6. With proper labelling draw the schematic diagram of the electricity operated Hoisting Gear.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. Calculate the kW rating and maximum pull of a belt conveyor of capacity = 350 tph, weight of belt = 11·9 kg/m run, weight of each idler = 6·07 kg and weight of each bottom roller is 15·16 kg, horizontal length of conveyor = 800 m and slope is 1 in 9·2, belt speed is 1·6 m/s, length correction factor is 1·11, drive factor = 1·19 for 420 degree angle of wrap with two drums, length of skirt board is 10 m. Sketch the drive.

8. Draw a neat sketch of a centrifugal discharge bucket elevator and show its different constructional parts. What are the other types of bucket elevators ?

9. What is the effect of lump size on the screw diameter ? Determine the capacity and hence power requirement of a screw conveyor.

10. a) How do you specify a bridge crane ? 3

    b) For gain in force pulley system with the rope running off a fixed pulley show that resultant efficiency of the pulley system $\eta_\tau = (\varepsilon^z - 1)/(\varepsilon^z . z)(\varepsilon - 1)$ and the pulling force (effort) is given by $P = Q.\varepsilon^z.(\varepsilon - 1)/(\varepsilon^z - 1)$.

    Where ε = pulley factor of resistance, z = number of pulleys and Q = load to be lifted. 6 + 6

11. a) With a neat sketch explain the working of a Head operator Winch. 7

b) In an epicyclic gear hoist the number of teeth of the sun gear is 14 and the two planet gears has 25 teeth each. Diameter of the hand operated chain pulley is 600 mm and drum diameter is 300 mm. Take 4 falls for the pulley system and overall efficiency of transmission 80% determine —

i) Number of teeth of the internal gear. Module of all gears is same.

ii) Gear transmission ratio.

iii) Maximum effort required to lift 6 tones load with 10% overload. 2 + 2 + 4

12. a) With a neat sketch show the various parts of the long travel traveling gear for the EOT crane. 5

b) Calculate the tractive resistance and motor power for long travel of the EOT crane with the following data :

Load handled is 15 tonnes; Span = 5 m,

Minimum distance of load from the gantry rail = 1·5 m.

Number of wheels = 4;

Material of wheels — medium hardness steel,

Trolley weight = 1·5 tones,

Effective width of the rail = 75 mm,

Diameter of wheel bearing = 110 mm,

Coefficient of friction in bearing μ = 0·1,

Rolling friction e = 0·5 mm,

Flange friction β = 2,

Transmission efficiency = 85%,

Travel speed = 1 m/sec,

Time to attain the rated speed by the motor = 5 sec.

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