2013

MATERIAL HANDLING

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 any *ten* of the following :

$$10 \times 1 = 10$$

i) Material bulk density

a) is higher than its density

b) is lower than its density

c) is equal to its density

d) none of these.

ii) For a free flowing bulk material, angle of repose

a) is greater than angle of surcharge

b) is less than angle of surcharge

c) is equal to angle of surcharge

d) none of these.

iii) For a belt conveyor "take up" is used to

a) take away material at any desired location

b) adjust belt tension

c) remove metallic pieces from the material being

conveyed

d) none of these.

iv) In a belt conveyor

a) all impact rolls have drives

b) any carrying rolls have drives

c) only return rolls have drives

d) none of the impact, carrying or return rolls have

drives

v) In a gravity roller conveyor, the rollers rotates because

a) they are all power rollers

b) the unit loads in contact is more on them due to

gravity

c) whole conveyor using the roller slides due to

gravity

d) none of these.

vi) In a chain conveyor variation in chain speed will

a) more when number of drive sprocket teeth will be

high

b) more when number of drive sprocket teeth will be

low

c) independent of the number of drive sprocket teeth

d) none of these.

vii) In a corrugated apron conveyor

a) Material conveyed suffer less corrosion

b) Aprons are formed to have overlaps at the end to

form continuous bed or trough

c) Gap between aprons along chain line is more

compared to flat spaced conveyor

d) None of these.

viii) In a screw conveyor

a) Both conveying and blending of material is possible

b) Small metallic screws are conveyed

c) Screw physically moves along with material in the

direction of material movement

d) None of these.

ix) In centrifugal discharge bucket elevator, bucket pitch is

a) smaller compared to that in a continuous

discharge bucket elevator

b) same as that in continuous discharge bucket

elevator except that material is discharged

centrifugally

c) higher compared to that of continuous discharge

bucket elevator

d) bucket pitch has no effect on type of bucket

elevator

x) In a positive discharge bucket elevator, buckets are

connected to

a) a belt as pulling element

b) a pair of chains as pulling element

c) either belt or chain

d) none of these.

xi) In positive pressure pneumatic conveying system

a) suction pipes or nozzles with air blower for suction

will be required for the movement of the material

b) air compressor with drive motor will be required for

the movement of the material from a feeder

c) both (a) and (b)

d) none of these.

xii) Inclined faces of a hopper, bin or bunker will depend on

a) only angle of repose of material, to be stored

b) friction angle of material vis-a-vis liner material

c) both (a) and (b)

d) none of these.

xiii) In a belt conveyor, skirt boards are provided at

a) discharge end at head pulley

b) tail pulley at receiving point of material

c) all along length of conveyor to cover the material

d) none of these.

xiv) Rated capacity of an FLT is 2T with load centre 500 mm

from heel. Distance between heel and nearest wheel is

400 mm. The maximum load that can be carried which

has CG at 200 mm from the heel is

a) 4 T b) 3 T

c) 2.5 T d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. Draw a simple sketch of slide gate and name the parts. 5

3. Draw a simple sketch of horizontal belt conveyor with screw

take up naming main parts. 5

4. Draw a simple sketch of belt bucket elevator and name main

parts. 5

5. Draw a simple sketch of a horizontal screw conveyor showing

main parts. 5

6. Name any five principles of material handling. 5

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) What are the basic differences between centrifugal

discharge and continuous discharge bucket elevators ?

b) When do you use a positive discharge bucket elevator ?

c) Calculate the bucket capacity in litres for a continuous

discharge type belt bucket elevator handling coal at

20 tph when belt speed is 0.8 m/s bucket spacing is

320 mm. Consider filling factor as 0.6, reserve capacity

for design purpose as 15%. Bulk density of coal may be

assumed as 725 kg/m3.

Also select the fabricated bucket from the table below :

Length (mm)	Projection (mm)	Depth (mm)	Capacity (Litres)	Steel bracket mass (kg) For sheet thickness (mm)		
				2.6	3.15	5.0
250	150	195	3.65	3.5	4.5	
250	180	310	6.7	4.5	5.5	———
310	180	310	8.3	5.5	7.0	—— 10.5

$5 + 3 + 7$

8. What is a Wharf crane ? What are the different types

available ? Draw a simple sketch of a Wharf crane and

explain its working principle with level luffing mechanism,

where the jib head pulley traverses in a circular path.

$2 + 3 + 5 + 5$

9. A horizontal screw conveyor with diameter and pitch 600 mm

each has length 7.4 meters to convey cement with bulk

density 1.2 t/m3. Assume tube (shaft) diameter as 114mm

and filling as 30%.

i) Calculate screw speed of rotation in rpm.

ii) What is the minimum power required at the screw

shaft.

iii) What are the OD and ID of the annular disc from which

a screw flight can be made of one pitch length. $5 + 7 + 3$

10. A 3 roll troughing belt conveyor with snub drive having wrap

angle 210° and belt width 500 mm has horizontal centre

distance 45 metres, lift 12 metres, belt spped 1.5 m/s,

normal capacity 60 tph, handling free flowing material with

bulk density 0.86 t/m3.

Neglecting skirt board friction and wrap resistance at pulleys,

find minimum drive HP required at drive pulley shaft at a

discharge end.

Assume 5 number impact idlers of 450 mm pitch, normal

carrying idler at 1000 mm pitch and return idlers at

3000 mm pitch, weight of rotating parts of an impact idler, a

carrying idler and a return idler 6.5 kg, 4.8 kg and 10 kg

respectively, belt weight per metre length 8 kg, belt cleaning

resistance at discharge pulley end and at V cleaner on return

belt 53 kg/m width of belt for each location. 15

11. a) What is the basic difference between belt conveyor and

a belt feeder ? How do you control the feed rate of a belt

feeder ?

b) For a belt conveyor with a sunb drive and angle of wrap

210°, coefficient of friction between belt and rubber

lagged drive pulley at discharge end is 0.4. The

maximum belt tension calculated at the discharge

pulley is 900 kg. If belt speed is 1.3 m/s, calculate

maximum power required at the drive shaft.

If drive efficiency is 90% and minimum reserved power

is of 15% is to be provided in the drive, what should be

the minimum power required for the drive motor ?

5 + 10