Ref. No. Ex/ME(M2)/PC/B/T/422/2023

B.E. MECHANICAL ENGINEERING FOURTH YEAR SECOND SEMESTER EXAMINATION-2023

MATERIAL HANDLING

Time: 3 Hours | Full Marks: 100

Assume any relevant data, if necessary. Symbols in the Question Paper carry their usual meanings. Figures in the margin indicate full marks. All Parts of any one question must be answered together.

GROUP-A

Q1. Choose the correct alternative 10×1=10

i) Fork lift truck is used for
(a) lifting and lowering (b) vertical transportation
(c) both '(a)' and '(b)' (d) none of the above

ii) Match the following

Device	Purpose
A. Overhead crane	1. horizontal transportation
B. Pumps	2. lifting and lowering
C. Chutes	3. lifting and transportation

The correct order is
(a) A-2, B-1, C-3 (b) A-1, B-2, C-3
(c) A-3, B-2, C-1 (d) A-2, B-3, C-1

iii) The following is used to transport materials having flat bottoms
(a) Belt conveyor (b) Roller conveyor
(c) Chain conveyor (d) None of the above

iv) Angle of repose of bulk material is used for determination of its
(a) mobility (b) fluidity (c) flowability (d) none of these

v) Which of the following is not a hoisting equipment with lifting gear?
(a) Cage elevators (b) Jib cranes
(c) Pulleys (d) Troughed belts

vi) What is the mass capacity of flat belt conveyor if volumetric capacity 0.55 m^3/hr? (ρ = 1500 kg/m^3)
(a) 825 tons/hr (b) 825 kg/hr (c) 2.727 tons/hr (d) 2722 kg/hr

vii) Which of the following statements is false for troughed belt conveyors?
1. Troughed belt conveyors use flexible belts
2. They contain five idlers
3. Depth of trough decreases with increasing number of idlers
4. Flexibility of belt increases as depth of trough decreases

(a) 1 and 2 (b) 2 and 3
(c) 3 and 4 (d) None of the above

[Turn over

viii) Which discharge method provides only intermediate discharge for low speed flat belt conveyor?
(a) Plow discharge (b) Tripper discharge
(c) Both (a) and (b) (d) None of the above

ix) The choice of appropriate type of pneumatic conveying system depends upon
(a) bulk density and particle size (b) flow ability
(c) abrasiveness (d) all of these

x) In a $\phi 20\times6\times19$ wire rope, number 6 indicates the
(a) diameter of the wire rope in mm (b) Number of strands in the wire rope
(c) Number of wires (d) Gauge number of the wire

GROUP-B

Answer any SIX (6) Questions

6×15=90

Q2. (a) What are the basic objectives of materials handling systems?
(b) How a material is coded? Give one example with code.
(c) Discuss advantages and disadvantages of unitization of load. 5+5+5=15

Q3. (a) What are the advantages and disadvantages of material handling? What are the functional scopes of material handling within an industry?
(b) Write down any five principles of Material Handling System. Discuss in detail.
5+10=15

Q4. (a) In a neat sketch, show the general arrangement of a belt conveyor system and label the different important parts.
(b) A horizontal belt conveyor with 3-roller troughing arrangement handles coal at the rate of 150 ton/hr at a speed of 2.5 m/sec. the side troughing idlers are set at an angle of 15^0 with respect to the axis of central idler. If the bulk weight of the material is 0.8 ton/m^3 and static angle of repose of the load is 45^0, then find out the width of the belt. Deduce the expression that you use in solving the problem with necessary assumptions.
5+10=15

Q5. (a) A Screw conveyor is to be designed to convey moulding sand at an inclination of 15^0 with the horizontal. The required capacity is 50 tones per hour, length of conveying is 25 mtr, bulk density of sand 1.50 ton/cubic mtr and is abrasive in nature, loading efficiency is 0.125, screw pitch =1.0D (where D= nominal diameter of screw), r.p.m of the screw is 50 r.p.m, inclination factor is 0.55, mass flow rate is 60 tones/hr, progress resistance coefficient is 4. Find out
(i) nominal diameter of screw in meter.
(ii) total power of screw required in Kw.

(b)Explain the typical applications of screw conveyor. Sketch different profiles used in screw conveyor. State the restrictions in screw conveyor system. 10+5=15

Q6. (a) Explain total resistance to motion take place in case of unpowered roller conveyor.
(b) Discuss the advantages and disadvantages of pneumatic conveyor? 10+5=15

Q7. (a) Explain with neat sketches, any two types of buckets used in bucket elevators and state their uses.
(b) Draw neatly the feeding and discharging arrangement of a bucket elevator. Label the diagram
(c) A bucket elevator is to be designed to handle aluminium ore of 100 tons per hour. The height of elevator is 20 m. Calculate the individual capacity of bucket in litres on the basis of the following data:
(i) bucket filling factor =0.75
(ii) material bulk density =1300 kgf/m^3.
(iii) elevator speed =0.83 m/sec
(iv) bucket spacing=0.320 m. 4+4+7=15

Q8. (a) What is pneumatic conveyor? Discuss the advantages and disadvantages of pneumatic conveyor.
(b) How pneumatic conveyor system can be classified on the basis of air pressure? Briefly describe the basic principles of operation of a positive pressure system of low pressure pneumatic conveying. If necessary, give figures to enumerate this.
4+(5+6)=15

Q9. (a) How industrial trucks are classified? Explain different parts of fork lift trucks with sketch. Briefly explain the use of fork lift trucks.
(b) What is a tractor? Explain wheel type and crawler type tractors with application areas Differentiate between tractor and trailer.
(c) The rated capacity of a FLT is 2000 kg and load centre is 450 mm. The distance between front wheels to heel of the fork is 350 mm. If a load is to be carried whose c.g. is at a distance of 550 mm from the heel of the forks, then calculate the maximum safe weight ''W'' that can be carried. 4+5+6=15

Q10. (a) Describe with neat sketch working of Electric Overhead Traveling (EOT) Crane.
(b) State the applications EOT cranes.
(c) Explain different types of jib cranes are used in warehouses and ship yards.
7+3+5=15

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