Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 60551

M.E./M.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Elective

CAD/CAM

ED 4073 – MATERIAL HANDLING SYSTEMS AND DESIGN

(Common to: M.E. Computer Aided Design/M.E. Engineering Design)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Design Data Book is permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the different types of material handling equipment used in an industry?

2. Suggest the material for the following components :

   (a) Hoisting Drum (b) Hooks

   (c) Ropes (d) Brakes.

3. List the main parameters of a hoisting machine.

4. Examine a primary benefit of employing a cantilever crane in contrast to a monorail crane.

5. Propose a concise overview on application of belt conveyors and apron conveyors.

6. What are the key design features of escalators?

7. What are the importance of loading efficiency in the design of bucket elevators?

8. Examine the significance of load distribution in the design of fork lift trucks.

9. List the advantages of designing a gearbox with more than six speeds for an automotive application.

10. Outline any two design considerations that are crucial for optimizing the optimizing the performance of valve gear mechanisms.

PART B — (5 × 13 = 65 marks)

11. (a) Write short note on different of hoisting elements their major design parameters to be considered and prospective applications.

Or

(b) Design a crane hook as shown in figure 1 for a maximum load of 25 kN. The radius of inner fiber is 30 mm and outer fiber is 100 mm from line of action of load. Specify the location of neutral axis and stress induced at inner and outer fibers. Assume suitable data required on materials.

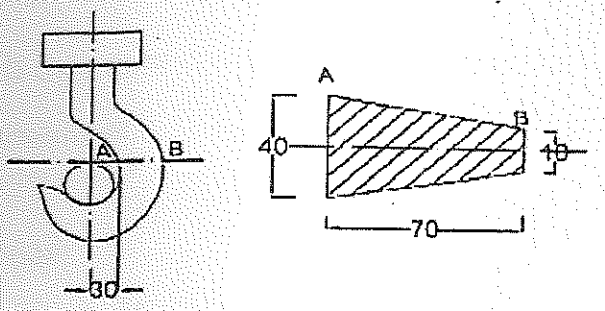

Fig. 1

12. (a) Write a note on different hoist mechanisms and types of drives with suitable schematics.

Or

(b) Explain the characteristics and design aspects of slewing and luffing mechanism of a tower crane.

13. (a) 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° with respect to the axis of the central idler. If the bulk weight of the material is 0.8 T/m^3 and static angle of repose of the load is 45°, then find out the width of the belt. Deduce the expression that you use in solving the problem with necessary assumptions.

Or

(b) A screw conveyor system is used for transporting molding sand at a inclination of 10° with the horizontal. The required capacity is 50 Ton/hr an length of conveyor is 30 m, bulk density is around 1.5 T/m^3, assume loading efficiency 0.2 and the speed of the screw shaft is 50 rpm. Find the

(i) Diameter of the screw

(ii) Power required at the screw shaft and assume resistance factor is 4.

14. (a) The data for a vertical elevator to lift foundry sand to a height of 50 m are given — as : speed of the bucket is 2 m/sec, bulk density is 1.5 Ton/m^3 loading efficiency is 80%, capacity of the each bucket is 2 litre, and space between the buckets is 400 mm. Find the capacity of the bucket elevator.

Or

(b) Write the salient features of a fork lift truck. The rated capacity of a fork lift truck is 2000 kg and load center is 450 mm. The distance between front wheels to heel of the fork is 350 mm. If a load is to be carried whose center of gravity is at a distance of 550 mm from the heel of the forks, then calculate the maximum safe weight that can be carried.

15. (a) List the important design features of an air compressor and expound the basic design of a portable air compressors with schematic.

Or

(b) What are the functional applications of power screws? Explain the design procedure for the screw jack to handle a load 'W'.

PART C — (1 × 15 = 15 marks)

16. (a) Illustrate the essential parts of an Electric Overhead Travelling (EOT) crane and label the important parts. In an EOT crane, number of falls of the rope is 6. The pay load is 70 ton, weight of the bottom block is 4% of the pay load. Frictional loss per fall is 2.5%. Taking a factor of safety of 5, calculate the design load per fall of the rope.

Or

(b) Write a note on safety devices employed in material handling systems and discuss with a neat diagrams the design of brakes used in hoisting installations with necessary equations.

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