

- Question No. 1 is compulsory.
- Attempt any three questions from the remaining.
- Assumption made should be clearly stated.
- Design Data Book by PSG, Mahadevan, Kale & Khandare are permitted to use.



Q.1 Answer any four

- (a) State the importance of Ray Diagram in the design of multi-speed gear box. 5
- (b) Describe the significance of the pulleys for a gain in force and pulleys for a gain in speed. 5
- (c) State the importance of the take up arrangements in the belt conveyor system, also explain the gravity take up unit with neat sketch. 5
- (d) Draw a flow chart for the morphology of design and explain each phase. 5
- (e) Describe the terms NPSH required and NPSH available associated with centrifugal pump design. 5

Q.2 It is required to design a 2 X 3 multi-speed gear box for a lathe machine operation with following specification.

$$N_{\min} = 120 \text{ rpm}, N_{\text{motor}} = 1500 \text{ rpm}, \text{ GP ratio} = 1.41$$

- a) Write structural formulae and draw structural diagrams. 5
- b) Draw ray diagram and speed chart. 5
- c) Find the number of teeth of each gear. 5
- d) Draw the deviation chart. 5

Q.3 A single cylinder, two stroke, and water cooled diesel engine is required to develop 20KW at a speed of 1500rpm. Assume the compression ratio as 12.

- a) Find the standard bore and length of a cylinder. 4
- b) Estimate the cylinder liner thickness also check for pressure and thermal criteria. 4
- c) Estimate the cylinder head dimensions and water jacket thickness. 4
- d) Select suitable size and number of bolts for the cylinder head. 4
- e) Estimate the crown thickness of the piston. 4

Q.4 For the specification of an EOT Crane ,

Application - Class II

Load to be Lifted - 15 tonne

Hoisting speed - 5 m/min

Maximum Lift - 6 m

- a) Design a 6 X 37 type of rope and find its life in months. 5
- b) Select suitable standard sheave and design axle. 5
- c) Select suitable hook and check at critical cross section. 8
- d) Select standard thrust bearing for the hook. 2
- Q.5 (a) Derive an expression for the breaking strength of 6 X 7 type of rope used in hoisting application. 5
- (b) Belt conveyor system is to be designed for the following specifications: 15
- Material conveyed up : Coal
- Capacity : 200 TPH
- Horizontal distance : 30m
- Vertical distance : 5m
- Troughing angle : 20 degree
- i. Estimate the width of the belt based on capacity.
- ii. Estimate the motor power.
- iii. Find the number of ply in the belt cross section.
- Q.6 (a) State the causes and remedies for the vibration and noise in centrifugal pump. 5
- (b) Illustrate the working of the external gear pump with neat sketches. 5
- (c) A Gear Pump required to deliver 25LPM of SAE20 oil at a pressure of 25 bar. 10
- Efficiency of the gear pump is 80%.
- i. Select suitable standard motor.
- ii. Design gear and check for bending failure.