Paper / Subject Code: 42871 / Design of Mechanical Systems

1T01437 - B.E.(Mechanical) Engineering)(SEM-VII)(Choice Base Credit Grading System) ((R-20) (C Scheme) / 42871 - Design of Mechanical Systems

QP CODE: 10015911   DATE: 08/12/2022

(3 Hours)   **Maximum Marks: 80**

N.B. 1) **Question No. 1 is compulsory**
2) Solve **Any Three** from remaining **Five** questions.
3) Use of standard data book like PSG, Mahadevan and Kale Khandare
   is permitted
4) Assume suitable data if necessary, giving justification

Q1   Answer any **Four** from the following
  a) Explain lays in wire rope with construction of wire rope.   **5**
  b) Explain Design Methodology and Optimum Design   **5**
  c) State the significance of specific speed and NPSH in the design of a   **5**
      centrifugal pump?
  d) Explain why an I – section with $Ixx \leq 4 Iyy$ is selected for connecting **5**
      rods of an I.C. Engine?
  e) Write assumptions made by Lewis and derive Lewis beam strength   **5**
      equation

Q2   The following specification refers to an EOT crane.   **20**
      Application - Class II
       load to be lifted - 100 KN
       Hoisting Speed - 8 m/min
       Maximum lift -10 m
      Velocity of cross travel - 20 m/min.
      Velocity of long travel - 30 m/min.
  a. Select a standard hook, material and design stresses induced at the most
      critical section.
  b. Select suitable type and size of the wire rope for an expected life of 12
      months.
  c. Design the pulley axle and select suitable bearing.
  d. Design the rope drum.

Q3   A centrifugal pump directly coupled to a motor is required to deliver 100 m^3/hour   **20**
      of water at 25^0C against a total head of 50 m.
  a. Select the type of motor speed and determine the power.
  b. Determine the impeller diameter, inlet and outlet vane angles and no. of
      vanes.
  c. Design the impeller shaft.
  d. Design the shape of the volute casing.
  e. Decide diameters of the suction and delivery pipes.

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Q4   A 20° troughing belt conveyer has following specifications.   **20**
      Material to be conveyed = Lime stone, Maximum lump size = 125mm.
      Capacity = 300 TPH, Inclination = 12^0, Center distance = 50 m.
    a) Determine width, number plies and thickness of belt.
    b) Select proper motor for conveyor
    c) Design the drive pulley along with its shaft
    d) Design the troughing idler for the belt.

Q5   A pair of straight bevel gear is used to transmit 25 kW power from output shaft   **20**
      of gear box to agitator shaft. The two axes are inclined at 85^0. The agitator shaft
      rotates at 15 rpm and reduction ratio is 4:1.
    a) Selecting suitable material for bevel pinion and gear, find module, face
       width, pitch circle diameter and outside diameter of two gears to satisfy
       strength and wear criteria.
    b) Give constructional detail of both gears.
    c) Draw sketch of the two gears in assembled condition with leading
       dimensions.

Q6a) A four stroke single cylinder water cooled diesel engine develops 7.5 kW brake   **15**
      power when operating at 1000rpm.
    a) Determine the size of engine (bore and stroke)
    b) Design wet liner and cylinder.
    c) Design piston with pin and piston rings

Q6b) Illustrate the working of external gear pump with neat sketches.   **05**

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