Paper / Subject Code: 42871 / Design of Mechanical Systems

(Time: 3 Hours)   [Total 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.   (20)
   i)   What is Design Morphology? Explain Design Morphology with flow chart.
   ii) Derive Lewis equation for strength of gear tooth.
   iii) Classify the wire ropes based on twisting of wires in strands and state their specific use.
   iv) Draw a neat sketch of centrifugal pump and explain its principle of working.
   v)   Why cleaning of belt is necessary in belt conveyors? List down some usual types of belt
        cleaners.

Q2. A) Find suitable module for Helical gear pair for following specifications, using strength and wear
        considerations and check for dynamic load.   (10)

Power Transmitted	-	50KW
Input Speed	-	360RPM
Reduction Ratio	-	3
Helix Angle	-	17^0

B) A two stage gear box is used to transmit 15 KW power from an electric motor running at 1440
     RPM to a machine with overall reducing ratio of 20. For the second stage spur gear pair,
                                                                                    (10)
   i) Determine the module using bending failure.
   ii) Check the gears for dynamic load by using Buckingham's method.

Q3. A) 20° troughing belt conveyor has the following specification: (10)
        Material to be conveyed-Lime stone
        Maximum lump size-125 mm
        Capacity-300 TPH
        Inclination -11°
        Centre distance-50 m
   i) Determine the width, number of piles and the thickness of the belt.
   ii) Select standard motor for belt conveyor.

B) A CI bevel gear pair having pitch circle diameter of 80 mm and 100 mm is used for
     transmitting 3KW power at pinion speed of 1200 RPM. The tooth system is 14.5^0 involute. If
     the static strength of pinion and gear is 50 MPa. Determine i) Module ii) Face width iii)
     Surface hardness. Assume velocity factor accounts for dynamic load.   (10)

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Q4. The following specifications refer to an EOT crane. (20)
  Load to be lifted: 150 KN
  Hoisting speed: 10 m/min,
  Lift: 12m,
  Application: Class-II.
  i) Select suitable wire rope and find its life.
  ii) Select standard hook and check the induced at 3 different sections.
  iii) Design cross piece and side plate.
  iv) Select suitable motor for hoisting mechanism.

Q5.A) A gear pump required to deliver 160 LPM of SAE 30 oil at pressure of 40 bar.
    By making suitable assumption, (15)
      i) Select the suitable Standard motor.
      ii) Design the gears and Shafts by checking failures.
      iii) Design the Casing.

  B) What is the significance of NPSH in the design of centrifugal pump? (05)

Q6. A) Design following components for single cylinder, four stroke petrol engine to develop
      10 KW power at a speed of 1000 rpm by making suitable assumptions and neat sketch.
      i) Cylinder, liner and cylinder head with stud.
      ii) Piston with pin and ring.
      iii) Connecting rod with small and big end. (15)

  B) Explain the considerations made in design of connecting rod. (05)

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