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

N.B.: 1) **Question No. 1** is **compulsory.**
  2) Attempt **any three** questions out of remaining **five** questions.
  3) Use of design data book such as PSG, Mahadevan is allowed.
  4) Assume suitable data if required.

Q1 Answer **any four** from the following.
  a) Explain force analysis for Helical Gear drive.   **(5)**
  b) Explain the difference between Rolling Contact and sliding contact bearing.   **(5)**
  c) Compare between flat and V belts.   **(5)**
  d) What do you understand by coefficient of fluctuation of speed and   **(5)**
     coefficient of fluctuation of energy in flywheel?
  e) What do you understand by self-energizing and self-locking brake.   **(5)**

Q2 Design a pair of helical gears required to transmit 10 kW power from an   **(20)**
    electric motor running at 1440 rpm to a machine shaft running at 500 rpm.
    Design should be based on strength and wear. Work out constructional details
    also.

Q3 A cam operates a radial, translator roller follower having following particulars: **(20)**
    Rise of 24 mm in an angle of 90^0 of cam rotation by cycloidal motion, dwell for
    30^0 returns in 60^0 by SHM and remaining dwell to complete cycle. Speed of
    rotation 800 rpm, maximum pressure angle 20^0, mass of follower is 1.3 kg,
    minimum spring force 20 % of maximum inertia force and external resistance
    500 N during rise and 50 N during return.
    Design the cam and roller follower along with its pin.

Q4 a) Design a pair of spur gears required to transmit 12 kW power from a pinion   **(10)**
       shaft rotating at 300 rpm with a reduction ratio of 1.5.
    b) The radial load on a 180^0 hydrodynamically lubricated journal bearing is   **(10)**
       12 kN. Journal speed is 860 rpm. The bearing pressure is limited to
       1.5 N/mm^2. Select suitable fit and find bearing dimensions, oil flow rate,
       coefficient of friction, friction power loss and rise in temperature of oil.

Q5 a) Design a multi-plate clutch to transmit 8.5 kW power at 960 rpm. The plates   **(10)**
       run in oil and coefficient of friction is 0.05. Axial intensity of pressure is not
       to exceed 0.18 N/mm^2.
    b) Design open flat belt drive for a compressor running at 820 rpm, which is   **(10)**
       driven by a 22 kW motor running at 1440 rpm. Space is available for a
       center distance of 3 m.

44124   **Page 1 of 2**

Q6 a) A single row deep groove ball bearing is subjected to a radial force of 9 kN **(10)** and a thrust force of 3 kN. The shaft rotates at 1150 rpm. The expected life of bearing is 15000 hrs. The minimum acceptable diameter of the shaft is 65 mm. Select suitable bearing for this application**.**

b) A chain drive is to be used to transmit 8 kW power from an electric motor **(10)** running at 1000 rpm to a machine running at 500 rpm. The service conditions involve light shock. Select a standard roller chain, specify the correct center distance between the axes of sprockets and determine actual factor of safety for selected chain.

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