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Reg. No. : .....

Name : .....

# Seventh Semester B.Tech. Degree Examination, November 2017
## (2013 Scheme)
## 13.705 : DESIGN OF MACHINE ELEMENTS – II (M)

Time : 3 Hours  Max. Marks : 100

***Instruction** : **Use** of approved design data book **permitted**.*

## PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. Sketch Stribeck curve indicating various lubrication regimes and discuss the significance of this curve.

2. Discuss the difference between thin and thick walled pressure vessels.

3. What is pressure angle ? What is the effect of increasing the pressure angle ?

4. Why the arms of flywheel are tapered and discuss the basis of selection of materials for flywheels ?

5. Write short notes on :
   i) Viscosity index
   ii) Module.

## PART – B

Answer **any one full** question from **each** Module. **Each** question carries **20** marks.

### Module – I

6. A 15 kW and 1200 r.p.m. motor drives a compressor at 300 r.p.m. through a pair of spur gears having 20° stub teeth. The centre distance between the shafts is 400 mm. The motor pinion is made of forged steel having an allowable static

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stress as 210 MPa, while the gear is made of cast steel having allowable static stress as 140 MPa. Assuming that the drive operates 8 to 10 hours per day under light shock conditions, find from the standpoint of strength :

a) Module

b) Face width

c) Number of teeth and pitch circle diameter of each gear.

Check the gear thus designed from the consideration of wear. The surface endurance limit may be taken as 700 MPa.

OR

7. Design a worm gear to transmit 22.5 kW at a worm speed of 1440 rpm. Velocity ratio 24:1. An efficiency of at least 85% is desired. The temperature raise should be restricted to 40°C. Determine the required cooling area.

## Module – II

8. A 360° hydrodynamic bearing operates under the following conditions :

Radial load = 60 kN;

Journal diameter = 160 mm;

Bearing length = 170 mm;

Radial clearance = 0.15 mm;

Minimum film thickness = 0.03 mm;

Viscosity of lubricant = 8 cP.

What is the minimum speed of operation for the journal to work under hydrodynamic conditions ?

OR

9. A single row deep groove ball bearing has load bearing capacities as $C_0 = 2500$ N and $C_1 = 5500$ N. Determine the expected life of the bearing if it is subjected to a load of $F_a = 1000$ N and $F_r = 1800$ N. Also determine the average life of the bearing.

## Module – III

10. Design a cast iron flywheel for a four stroke cycle engine to develop 110 kW at 150 r.p.m. The work done in the power stroke is 1.3 times the average work done during the whole cycle. Take the mean diameter of the flywheel as 3 meters. The total fluctuation of speed is limited to 5 per cent of the mean speed. The material density is 7250 kg/m$^3$. The permissible shear stress for the shaft material is 40 MPa and flexural stress for the arms of the flywheel is 20 MPa.

OR

11. Design a CI piston for a single acting IC engine having 200 mm as the cylinder bore. The maximum explosion pressure may be taken as 4 N/mm$^2$. The piston is to have 5 compression rings and one oil ring. The permissible tensile stress for CI may be taken as 38.5 N/mm$^2$. The permissible stress for the piston ring is 100 N/mm$^2$ and the radial wall pressure is 0.04 N/mm$^2$.

## Module – IV

12. a) What is the fundamental difference between thin and thick walled pressure vessels ? **6**

    b) A 100 mm diameter thick cylindrical pipe is subjected to an internal pressure of 12 MPa and is free to expand axially. Determine the thickness of the pipe assuming a suitable pipe material. **7**

    c) In connection with the above problem, show the applicability of Lame, Clavarino and Birnie's equations. **7**

OR

13. An engine developing 22 kW at 1000 rpm is fitted with a cone clutch having mean diameter of 300 mm. The cone has a face angle of 12°. If the normal pressure on the clutch face is not to exceed 0.07 N/mm$^2$ and the co-efficient of friction is 0.2, determine the face width of the clutch and the axial force necessary to engage the clutch.