

**B.TECH. SEM -V MECHANICAL 2014 COURSE (CBCS) : WINTER
2017**

SUBJECT: THEORY OF MACHINES

Day: **Saturday**
Date: **13/01/2018**

Time: **02.30 PM TO 05.30 PM**
Max. Marks: **60**

W-2017-2158

N.B:

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Use of non-programmable **CALCULATOR** is allowed.
- 4) Draw neat and labeled diagrams **WHEREVER** necessary.

- Q.1** Two 20° pressure angle involute gears in mesh have a module of 10 mm. The addendum is one module. The large gear has 50 teeth and the pinion 13 teeth. (10)
- i) Does interference occur?
 - ii) If it occur, to what value should the pressure angle be changed to eliminate interference?

OR

- Q.1** A pair of involute gears with 14 and 21 teeth have pressure angle 16° , find maximum addenda on pinion and gear to avoid interference if module is 6 mm. Also find the length of path of contact and contact ratio. (10)

- Q.2** Derive the expression for virtual number of teeth of helical gear. (10)

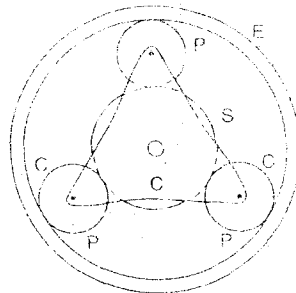
OR

- Q.2** Derive an expression for maximum efficiency in case of spiral gears in terms of spiral angle and angle of friction. (10)

- Q.3** An internal wheel B with 80 teeth is keyed to a shaft F. A fixed internal wheel C with 82 teeth is concentric with B. A compound wheel D-E gears with the two internal wheels, D has 28 teeth and gears with C while E gears with B. The compound wheels revolve freely on a pin which projects from a disc keyed to a shaft, A co-axial with F. If the wheels have the same pitch and the shaft A makes 800 rpm, what is the speed of the shaft F? Sketch the arrangement. (10)

OR

- Q.3** An epicyclic gear train consists of a sun wheel S, a stationary internal gear E and three identical planet wheels P carried on a star-shaped planet carrier C. The size of different toothed wheels are such that the planet carrier C rotates at $1/5^{\text{th}}$ of the speed of the sun wheel S. The minimum number of teeth on any wheel is 16. The driving torque on the sun wheel is 100 N-m. Determine. (10)
- i) Number of teeth on different wheels of the train
 - ii) Torque necessary to keep the internal gear stationary.



P.T.O.

Q.4 Describe with neat sketch a centrifugal clutch and deduce an equation for the total torque transmitted. **(10)**

OR

Q.4 a) Distinguish between brakes and dynamometers. **(05)**

b) Explain with neat sketch the principles of operation of an internal expanding shoe brake. **(05)**

Q.5 Construct the profile of a cam to suit the following specifications cam shaft diameter = 40 mm, Least radius of cam = 25 mm, Diameter of roller = 25 mm, Angle of lift = 120° , Angle of fall = 150° , lift of follower = 40 mm, Number of pauses are two of equal interval between motions. During the lift motion is S.H.M. and During fall motion is uniform acceleration and deceleration. The speed of the cam shaft is uniform. The line of stroke of the follower is off-set 12.5 mm from the center of the cam. **(10)**

OR

Q.5 A cam rotating clockwise of a uniform speed of 1000 rpm is required to give a roller follower the motion defined below: **(10)**

- i) Follower to move outward through 50 mm during 120° of cam rotation.
- ii) Follower to dwell for next 60° of cam rotation.
- iii) Follower to return during next 90° of cam rotation.
- iv) Follower to dwell for the rest of cam rotation. The minimum radius of cam is 50 mm and diameter of roller is 10 mm. The line of stroke of the follower is offset by 20 mm from the axis of cam shaft. If its displacement takes place with uniform and equal acceleration and retardation on both the outward and return strokes, draw profile of cam and find the maximum velocity and acceleration during out stroke and return stroke.

Q.6 The turbine rotor of a ship has mass of 30 tons, a radius of gyration of 6 mm and rotates at 2400 rpm in a clockwise direction when viewed from aft. The ship pitches through a total angle of 15° , 7.5° above and 7.5° below the horizontal, the motion being simple harmonic and having a period of 12 sec. Determine the maximum gyroscopic couple on the holding down bolts on the turbine and the direction of yaw as the bow rises. **(10)**

OR

Q.6 What is stability of ship? Why is it necessary? How it is achieved? **(10)**

* * * * *