Reg. No.



MANIPAL INSTITUTE OF TECHNOLOGY

V SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)

## **END SEMESTER EXAMINATIONS, NOV/DEC 2016**

SUBJECT: THEORY OF MACHINES [AAE3152]

## REVISED CREDIT SYSTEM (29/12/2016)

Time: 3 Hours

MAX. MARKS: 50

## Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data may be suitable assumed.



An airplane is travelling at a speed of (02) 300km/hr., is turning a circle of radius 5km, with centre at C, as shown in fig. As it do so, the pilot sees a rocket 30km away travelling on a straight course at 2000km/hr. What is the velocity of the rocket as seen by the pilot of the plane?

In the mechanism shown in fig., link **(03)** 2 and link 4 are two wheels of radius 500mm and 250mm respectively, rotating about the centre O2 and O4 and rolling on the fixed link 1. If link 2 rotates at an angular velocity of 12 rad/s clockwise find the angular velocity of link 4 by I-centre method.

**1C** Derive an equation for contact ratio for spur gear

3

1

1200

2A Draw the follower displacement diagram for the following motion of the follower. (04)
(i) Rise of the follower for fist 1200 of cam rotation with SHM

O₄

- (ii) Dwell for the 600 of cam rotation.
- (iii) Return with uniform velocity for 900 of cam rotation.

Follower rises through 60mm. If the rotation of the cam is at 120rpm, find the max, velocity during rise of the follower

2

 $O_2$ 

(05)

- **2B** For Q 2A If the cam is a radial cam, draw the cam profile if the base circle radius **(03)** of the cam is 25mm. The follower is knife edge follower.
- **2C** State and prove law of gearing
- **3A** Derive an equation for gyroscopic stability of a two wheeler
- 3B Four masses A, B, C and D are completely balanced. Masses C and D make angles (06) of 90° and 195° respectively with B in the same sense. The rotating masses have following properties. mb =25 kg, mc =40 kg, md =35 kg, ra =150 mm, rb =200 mm, rc =100, rd =180 mm, Planes B and C are 250 mm apart. Determine 1. The mass A and its angular position, 2. The position of planes A and D.
- 4A The arms of a porter governor are 250mm long. The upper arms are pivoted on the axis of rotation, but the lower arms are attached to the sleeve at a distance of 50mm from the axis of rotation. The weight of the sleeve is 600N and weight of each ball is 80N. Determine the equilibrium speed when the radius of rotation of the ball is 150mm. If the friction is equivalent to a load of 25N at the sleeve, determine the range of speed for this position.
- **4B** Define the following: (i) Hunting and sensitivity of a governor (ii) Gyroscopic couple **(04)** (iii) backlash and clearance in gears (iv) structure and mechanism
- **5A** With neat diagram explain witworth quick return motion mechanism.



Fig. Shows an epicyclic gear train known as Fergusons paradox. Gear A is fixed. The arm B and gears C &D are free to rotate on shaft S. Gears A,C,D have 100,101 &99 teeth respectively, all cut to same Pitch circle diameter from gear blanks of the same diameter so that same planet wheel of 20 teeth meshes with all of them. Determine the revolutions of gear C and D for one revolution of arm B

**5C** What is a lower pair? What are the types of lower pairs

(02)

(03)

(03)

(04)