Reg. No.



V SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, DEC 2017 (MAKE-UP)

SUBJECT: THEORY OF MACHINES [AAE3152]

REVISED CREDIT SYSTEM (21/12/2017)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- ✤ Missing data may be suitable assumed.
- 1A) A rotating shaft carries four masses A, B, C and D which are radially attached to it. The mass centers are 30 mm, 40 mm, 35 mm and 38 mm respectively from the axis of rotation. The masses A, C and D are 7.5 kg, 5 kg and 4 kg respectively. The axial distances between the planes of rotation of A and B is 400 mm and between B and C is 500 mm. The masses A and C are at right angles to each other. Find for a complete balance, (i) the angles between the masses B and D from mass A, (ii) the axial distance between the planes of rotation of C and D, and (iii) the magnitude of mass B.
- **1B)** A slider-crank mechanism with crank radius 60 mm and makes an angle of 600 with the line of stroke of the piston. The connecting rod length is 240 mm. The crank is rotating with a uniform angular speed of 10 rad/s, counter clockwise. For the given configuration, find the velocity and acceleration of the slider.
- 2A) Fig. shows a reverted planetary train. Gear 2 is connected to input shaft and is driven at 250 rpm, cw. Gears 4&5 are planet gears which are joined but are free to turn on the shaft carried by the arm 3. Gear 6 is stationary. Find the speed and direction of rotation of arm.



2B) 'Complete balancing of reciprocating masses in impossible'. Explain with neat sketch.
2C) Differentiate between flywheel and the governor based on their functions.
3A) Derive an equation to find minimum number of teeth on spur gear to avoid interference.
3B) What is interference and undercutting in gears? How it can be minimized?

- 3C)
- A gear train is made up of five spur gears as shown in the figure-2. Gear 2 is driver **(02)** and gear 6 is driven member. N2, N3, N4, N5 and N6 represent number of teeth on gears 2, 3, 4, 5, and 6 respectively. Show that Gear 5 is the idler gear.



- 4A) A translating roller follower is offset to the left of the cam center by 1.5cm. The cam has a base circle radius of 3 cm and the follower has a lift of 4cm. The cam rotates in the clockwise direction. The follower has 150° simple harmonic motion for both rise and return phases. The duration of the dwell before and after the rise is 30°. Assume the roller radius to be 0.5cm, and determine the required cam profile.
- **4B)** Find maximum velocity and acceleration during rise of the follower. **(02)**
 - Two mating gears have 50 and 13 teeth of involute form. The module of teeth is 10 (02) mm and pressure angle is 20°. The addendum of both gears is equal to one module. Does the interference occur?
- 5A)

4C)

- Derive an equation for the stability of a 4-wheeler negotiating a curved path. (05)
- 5B)

The arms of a porter governor are 17.8cmlong and hinged at a distance of 3.8cm from (05) the axis of rotation. The mass of the governor ball is 1.15kg and the mass of sleeve is 20kg. The governor sleeve begins to rise at 280rpm when the links are at an angle of 30° to the vertical. Assuming the friction force to be constant determine the higher and lower speeds when the angle of inclination of the arms to the vertical is 45°.