(Please write your Exam Roll No.)

Exam Roll No. .....

END TERM EXAMINATION

FOURTH SEMESTER [B.TECH] MAY-JUNE 2018

Paper Code: ETAT-202 **Subject: Theory of Machines**

(Batch 2013 Onwards)

Time: 3 Hours **Maximum Marks: 75**

Note: Attempt any five questions including Q no.1 which is compulsory. Assume suitable missing data if any.

Q1 Short answer type questions:- (5x5=25)

(a) Explain Klein's construction with neat sketch, write their applications.
(b) Discuss different types of kinematics pairs.
(c) Discuss the effect of gyroscopic couple on ships and aircrafts.
(d) Discuss compound gear train and epicyclic gear train with neat sketch.
(e) Describe transmissibility ratio, balancing of revolving masses and balancing of reciprocating engine.

Q2 (a) State and prove the laws of gearing. Show that involute profile satisfies the condition for correct gearing. (6.5)

(b) Derive an expression for minimum numbers of teeth required on a pinion to avoid interference when it gears with a rack. (6)

Q3 A single cylinder motor cycle engine runs at 1500 r.p.m. and has a stroke of 20 mm. The piston has a mass of 0.3 kg and mass of connecting rod is 0.6 kg. The revolving masses at crank pin are 0.4 kg. If all revolving and 65% of reciprocating masses are balanced by placing a balance mass at 30 mm radius. Find the balance mass and also draw a graph of resultant unbalanced force for crank angles varying from 0 to 180 degree. Assume that two-third mass of connecting rod acts at crank pin. (12.5)

Q4 In a simple watt governor the length of upper arm is 10 mm and its inclination to the vertical is 30 degree. Estimate the percentage change in speed for a rise in the level of balls by 20 mm. (12.5)

Q5 Draw a profile of cam operating knife edge follower from the following data.

(a) Follower to move outward through 40 mm during 60 degree of cam rotation.
(b) Follower to dwell for the next 45 degree.
(c) Follower to return to its original position to next 90 degree.
(d) Follower to dwell for the rest of cam rotation.

The displacement of the follower is to take place with S.H.M during both outward and return stokes. The least radius of the cam is 50 mm. If the cam rotates at 300 rpm., determine the maximum velocity and acceleration of the follower during the outward stroke and the return stroke. (12.5)

Q6 Explain the concept of flywheel. A flywheel having a mass of 4 tones has a radius of gyration of 2 m. What amount of energy this flywheel will store in it in changing its speed from 420 to 462 r.p.m. (12.5)

Q7 (a) Explain the inversions of 3R-P, 2R-2P chains with suitable examples and diagrams. (6.5)

(b) Explain the Grublers rule for degree of freedom with suitable example and applications. (6)

Q8 A steel shaft 60 mm dia and 2.5 m long is fixed horizontally at one end. It is loaded with a load of 300 N at its free end. Calculate the frequency of its free transverse vibrations if $E = 2.5 \times 10^5$ MN/m^2. (12.5)

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