KUMARAGURU
college of technology
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Register Number: …….

B.E. DEGREE EXAMINATIONS: MAY 2015

(Regulation 2013)

Fourth Semester

AUTOMOBILE ENGINEERING

U13AUT405**:** Mechanics of Machines

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. In a kinematic chain, quaternary point is equivalent to
   a) One binary joint b) Two binary joint
   c) Three binary joint d) Four binary joint
2. A four bar mechanism has …… instantaneous centre's of rotation
3. The efficiency of a screw jack depends on
   a) Pitch of threads b) Load
   c) Both pitch and load d) Neither pitch nor load
4. Due to slip of belt, the velocity ratio of the belt ……
5. Train value of a gear train is equal to
   a) Speed ration of gear train b) Reciprocal of speed ratio of gear train
   c) Product of the speeds of the driver and driven values d) Half of speed ration
6. The cam follower used in automobile engines is ……..
7. Which one of the following in-line engines working on a four-stroke cycle is completely balanced inherently?
   a) 2 cylinder engine b) 3 cylinder engine
   c) 4 cylinder engine d) 6 cylinder engine
8. Partial balancing of primary forces in locomotives leads to hammer blow, variation in tractive effort and …….
9. Which one of the following causes whirling of shafts:

a) Non-homogeneity of shaft material
b) Misalignment of bearings
c) Fluctuation of speed
d) Internal damping

10. The natural frequency of free transverse vibrations is same as that of …..... vibration

PART B (10 x 2 = 20 Marks)
(Not more than 40 words)

11. Distinguish between kinematics and dynamics.
12. In what way a mechanism differ from a machine?
13. Explain the term coefficient of friction.
14. What is creep in a belt drive?
15. Compare the difference between simple gear train and compound gear train.
16. What type of motion can be transmitted with a cam and follower combination?
17. Why balancing of rotating parts is necessary for high speed engines?
18. Write a short note on primary and secondary balancing.
19. What is meant by vibration? How are they caused?
20. Define natural frequency.

PART C (5 x 14 = 70 Marks)
(Not more than 400 words)

Q.No. 21 is Compulsory

21. Enumerate the inversions of a double-slider-crank chain. Give examples.

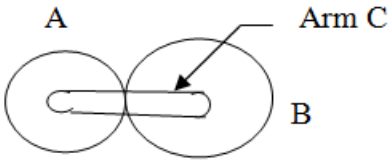
22. a) The pitch of 50mm mean diameter threaded screw of a screw jack is 12.5mm. The coefficient of friction between the screw and the nut is 0.13. Determine the torque required on the screw to raise a load of 25kN, assuming the load to rotate with the screw. Determine the ratio of the torque required to raise the load, to the torque required to lower the load and also the efficiency of the machine.

(OR)

b) An open belt drive connects two pulleys 1.2m and 0.5m diameter, on parallel shafts 4 metres apart. The mass of the belt is 0.9kg per

metre length and the maximum tension is not to exceed 2000N. The coefficient of friction is 0.3. The 1.2m pulley, which is the driver, runs at 200 r.p.m. Due to belt slip on one of the pulleys, the velocity of the driven shaft is only 450r.p.m. Calculate the torque on each of the two shafts, the power transmitted, and power lost in friction. What is the efficiency of the drive?

23. a) In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 r.p.m in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed makes 300 r.p.m. in the clockwise direction, what will be the speed of gear B?



(OR)

b) A cam rotating clockwise at a uniform speed of 200 r.p.m is required to move an offset roller follower with a uniform and equal acceleration and retardation on both the outward and return strokes. The angle of ascent, the angle of dwell (between ascent and descent) and the angle of descent is 120^o, 60^o and 90^o respectively. The follower dwells for the rest of cam rotation. The least radius of the cam is 50mm, the lift of the follower is 25mm and the diameter of the roller is 10mm. The line of stroke of the follower is offset by 20mm from the axis of the cam. Draw the cam profile and find the maximum velocity and acceleration of the follower during the outstroke.

24. a) i) Four masses m_1, m_2, m_3, m_4 are 200kg, 300kg, 240kg and 260kg respectively. The corresponding radii of rotation are 0.2m, 0.15m, 0.25m and 0.3m respectively and the angles between successive masses are 45^o, 75^o and 135^o. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2m. (7)

ii) A, B, C and D are the four masses carried by a rotating shaft at radii 100, 125, 200 and 150mm respectively. The planes in which the (7)

masses revolve are spaced 600mm apart and the mass of B, C and D are 10kg, 5kg and 4kg respectively. Find the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance.

(OR)

b) The following data refers to two cylinder locomotive with cranks at 90^o: reciprocating mass per cylinder = 300kg; crank radius = 0.3m; driving wheel diameter = 1.8m; distance between cylinder centre lines= 0.65m; Distance between the driving wheel central planes = 1.55m. Determine: 1. The fraction of the reciprocating masses to be balanced, if the hammer blow is not exceed 46kN at 96.5km.p.h; 2) The variation in tractive effort; and 3) The maximum swaying couple.

25. a) i) Explain the various types of free vibrations with the help of neat sketch (7)

ii) A shaft 50mm diameter and 3meters long is simply supported at the ends and carries three loads of 1000N, 1500N and 750N at 1m, 2m and 2.5m from the left support. The young's modulus for shaft materials is $200GN/m^2$. Find the frequency of transverse vibration. (7)

(OR)

b) A steel shaft 1.5m long is 95mm in diameter for the first 0.6mm of its length, 60mm in diameter for the next 0.5m of the length and 50mm in diameter for the remaining 0.4m of its length. The shaft carries two flywheels at two ends, the first having a mass of 900kg and 0.85m radius of gyration located at the 95mm diameter end and the second having a mass of 700kg and 0.55m, radius of gyration located at the other end. Determine the location of the node and the natural frequency of free torisional vibration of the system. The modulus of rigidity of shaft material may be taken as $80GN/m^2$.

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