Regd. No.

FULL-TIME B.E./B.Tech. DEGREE EXAMINATIONS, Apr/May 2011
III – Semester, Regulations 2008
Common to Manufacturing, Printing and Industrial Engineering

ME 9211 – Mechanics of Machines
Note: A3 Drawing sheet is to be supplied to the students in the examination

Duration: 3-Hours **Max. Marks: 100**

Answer ALL questions
Part – A (10X2 = 20 marks)

1 State the Grubler's criterion for determining the degrees of freedom (n) of mechanism having plane motion.
2 Name the cam follower extensively used in air-craft engines.
3 Define the following with respect gears
(i) Arc of approach (ii) Arc of contact
4 Name the gear train in which the axis of the shafts, over which the gears are mounted, move relative to a fixed axis.
5 What is the condition for maximum power transmission in a belt drive?
6 Name the different types friction clutches?
7 Write the mathematical equation for inertia force acting on reciprocating masses of a single slider crank mechanism.
8 What is the velocity of the piston in a single slider crank mechanism for the crank position at the inner dead centre?
9 Differentiate between static and dynamic balancing of rotating masses.
10 A spring of stiffness 200 N/m is attached with a mass of 20 kg. What is the natural frequency of longitudinal vibration?

Part – B (5 X 16 = 80 marks)

Q 11 is compulsory, from Q 12 onwards answer either (a) or (b)

11) Describe with neat sketch the mechanisms obtained by the inversions of single slider crank chain. (16)

12 a) Two gear wheels mesh externally and are to give a velocity ratio of 3 to 1. The teeth are of involute form; module = 6 mm, addendum = one module, pressure angle = 20°. The pinion rotates at 90 rpm. Determine: i) the number of teeth on the pinion to avoid interference on it and the corresponding number of teeth on the wheel, ii) the length of path and arc of contact, iii) The number of pairs of teeth in contact, and iv) the maximum velocity of sliding. (16)

[OR]

12 b) An epicyclic gear train consists of three gears A, B and C as shown in Fig. 12b. The internal gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both gear A and gear C and is carried on an arm EF which rotates about the centre A at 18 rpm. If the gear A is fixed, determine the speed of gears B and C. (16)

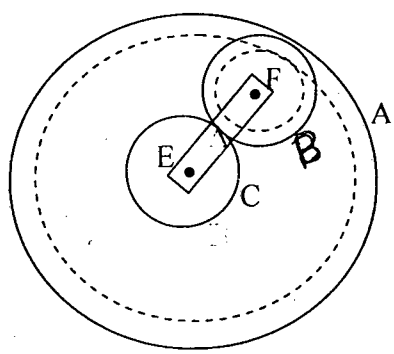

Fig.12b

13 a) A shaft rotating at 270 rpm drives another shaft at 300 rpm and transmits 8 kW through a belt. The belt is 140 mm wide and 15 mm thick. The distance between the shafts is 4.4 m. The smaller pulley is 0.65 m in diameter. Calculate the stress in the belt, if it is an open belt drive. Coefficient of friction between the belt and pulley is 0.32. (16)

[OR]

13 b) The mean diameter of the screw jack having pitch of 12 mm is 54 mm. A load of 26 kN is lifted through a distance of 180 mm. Find the work done in lifting the load and efficiency of the screw jack when

(i) the load rotates with screw, and

(ii) the load rests on the loose head which does not rotate with the screw.

The external and internal diameter of the bearing surface of the loose head are 64 mm and 12 mm respectively. The coefficient of friction for the screw as well as the bearing surface may be taken as 0.072. (16)

14 a) The crank and connecting rod of a steam engine are 0.2 m and 1 m in length. The crank rotates at 200 rpm clockwise. Determine the velocity and acceleration of the piston when the crank is at 45° from inner dead center position. Also determine the position of the crank for zero acceleration of the piston. (16)

[OR]

14 b) During a trail on steam engine, it is found that the acceleration of the piston is 36 m/s^2 when the crank has moved 30° from the inner dead center position. The net effective steam pressure on the piston os 0.6 MPa and the frictional resistance is equivalent to a force of 650 N.The diameter of the piston is 320 mm and the mass of the reciprocating parts is 200 kg. If the length of the crank is 250 mm and the ratio of the connecting rod length to the crank length is 4, find: (i) reaction on the guide bars (ii) thrust on the crank shaft bearings (iii) turning moment on the crankshaft. (16)

15 a) A rotating shaft carries four masses A, B, C and D of magnitude 250 kg, 350 kg, 400 kg and 250 kg respectively and revolving at radii 70 mm, 60 mm, 50 mm and 70 mm in planes measured from A at 350 mm, 450 mm and 750 mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 450 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 80 mm, find their magnitudes and angular positions. (16)

[OR]

15 b) A vibrating system consists of a mass of 8 kg, spring of stiffness 5.6 N/mm and a dashpot of damping coefficient of 40 N/m/s. Find (i) damping factor (ii) logarithmic decrement and (iii) ratio of the two consecutive amplitudes. (16)