B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APR/MAY 2014

COMMON TO MANUFACTURING ,PRINTING TECHNOLOGY & INDUSTRIAL ENGINEERING

THIRD SEMESTER

ME550/ME9211 – MECHANICS Of MACHINES

(REGULATION 2004 / 2008)

Time : 3 hr. Max. Mark :100

Answer ALL Questions

Part A (10 x 2 = 20 Marks)

1 Define Degrees of Freedom (Mobility).

2 Define Inversion of Mechanism

3 What are the different motions of the follower?

4 Define circular pitch and diametral pitch in spur gear

5 Why self locking screws have lesser efficiency?

6 Explain briefly significance of friction in braking.

7 Why are the cranks of a locomotive, with two cylinders, placed at 90° to each other?

8 Define the term swaying couple.

9 What is meant by balancing of rotating masses?

10 Sketch the Time Vs Displacement plot for under damped and over damped systems.

PART B (5 x 16 = 80 Marks)

11 The lengths of crank and connecting rod of a horizontal reciprocating engine are 200 mm and 1000mm respectively. The crank is rotating at 400 rpm. When the crank has turned 30 degrees from inner dead centre, the difference of pressure between the cover and piston end is 0.4 N/mm^2. If the mass of the reciprocating parts is 100kg and cylinder bore is 0.4 m, then calculate :

(i) inertial force

(ii) force on piston

(iii) piston effort

(iv) thrust on the sides of cylinder walls

(v) thrust in the connecting rod (16)

(vi) crank effort

(vii) turning moment on the crank shaft.

12a The crank of a slider crank mechanism is 15 cm and the connecting rod is 60 cm long. The crank makes 300 rpm in the clock wise direction. When it has turned 45 degrees from the inner dead centre position, determine:

(i) acceleration of the mid point of the connecting rod and (9)

(ii) angular acceleration of the connecting rod. (7)

[OR]

12b Construct the profile of a cam to suit the following specifications :

Cam shaft diameter = 40 mm ; Least radius of cam = 25 mm ; Diameter of roller is 25 mm; Angle of lift = 120° ; Angle of fall = 150° ; Lift of the follower = 40 mm ; Number of pauses are two, and of equal interval between motions.

During the lift, the motion is S.H.M. During the fall the motion is uniform acceleration and deceleration. The speed of the cam shaft is uniform. The line of stroke of the follower is off-set 12.5 mm from the centre of the cam. (16)

13a Calculate:

(i) length of path of contact

(ii) arc of contact and

(iii) the contact ratio when a pinion having 23 teeth drives a gear having teeth 57. The profile of the gears is involute with pressure angle 20 degrees, module 8 mm and addendum equal to one module. (16)

[OR]

13b Two shafts A and B are co-axial. A gear C (50 teeth) is rigidly mounted on shaft A. A compound gear D-E gears with C and an internal gear G. D has 20 teeth and gears with C and E has 35 teeth and gears with an internal gear G. The gear G is fixed and is concentric with the shaft axis. The compound gear D-E is mounted on a pin which projects from an arm keyed to the shaft B. Sketch the arrangement and find the number of teeth on internal gear G assuming that all gears have the same module. If the shaft A rotates at 110 r.p.m., find the speed of shaft B. (16)

14a A conical pivot with angle of cone of 120°, supports a vertical shaft of diameter 300 mm. It is subjected to a load of 20kN. The coefficient of friction is 0.05 and the speed of shaft is 210 rpm. Calculate the power lost in friction assuming (i) uniform pressure and (ii) uniform wear. (16)

[OR]

14b In a winch, the rope supports a load W and is wound round a barrel 450 mm diameter. A differential band brake acts on a drum 800 mm diameter which is keyed to the same shaft as the barrel. The two ends of the bands are attached to pins on opposite sides of the fulcrum of the brake lever and at distances of 25 mm and 100 mm from the fulcrum. The angle of lap of the brake band is 250° and the coefficient of friction is 0.25. What is the maximum load W which can be supported by the brake when a force of 750 N is applied to the lever at a distance of 3000 mm from the fulcrum ? (16)

15a A shaft carries four rotating masses A,B,C and D in this order along its axis. The mass A may be assumed to be concentrated at radius of 18 cm, B of 24 cm, C of 12 cm and D of 15 cm. The masses of B,C and D are 30kg, 50kg and 40kg respectively. The planes containing B and C are 30 cm apart. The angular spacing of the planes containing C and D are 90° and 210° respectively relative to B measured in the same plane. If the shaft and masses are to be in complete dynamic balance find:

(i) the mass and angular position of mass A (16)

(ii) the position of planes A and D.

[OR]

15b A machine part of mass 2 kg vibrates in a viscous medium. Determine the damping coefficient when a harmonic exciting force of 25 N results in a resonant amplitude of 12.5 mm with a period of 0.2 second. If the system is excited by a harmonic force of frequency 4 Hz what will be the percentage increase in the amplitude of vibration when damper is removed as compared with that with damping. (16)