Code No: NR310304 **NR**

**III B.Tech I Semester Supplementary Examinations, April/May 2005**
**DYNAMICS OF MACHINES**
**( Common to Mechanical Engineering, Mechatronics and Production Engineering)**

**Time: 3 hours** **Max Marks: 80**

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1. A horizontal, single cylinder, single acting, otto cycle gas engine has a bore of 300 mm and a stroke of 500 mm. The engine runs at 180 rpm. The ratio of compression is 5.5. the maximum explosion pressure is 3.2 N/mm$^2$ gauge and expansion follows the law p.V$^{1.3}$ = constant. If the mass of the piston is 150 kg and the connecting rod is 1.25 m long, calculate the turning moment on the crankshaft when the crank has turned through 60 from the inner dead centre. The atmospheric pressure is 0.1 N/mm$^2$.

2. A horizontal steam engine 20 cm diameter by 40 cm stroke, connecting rod 100 cm makes 160 r.p.m. The mass of the reciprocating parts is 50 kg. When the crank has turned through an angle of 30 degrees, the steam pressure is 4.5 bar.
   (a) Calculate the turning moment on crank shaft.
   (b) If the mean resistance torque is 30 N-m and the mass of fly7wheel is 50 kg and the radius of gyration 70 cm Calculate the acceleration of the flywheel.

3. (a) Describe with sketches one form of torsion dynamometer and explain in detail the calculations involved in finding the power transmitted.
   (b) In a vertical belt transmission dynamometer the diameter of the driving pulley rotating at 1500 r.p.m. is 80mm. The centre distance of the intermediate pulleys from the fulcrum is also 80mm each. The weighing pan on the lever is at a distance as 250mm. Find the power transmitted when a mass of 20 kg is required in the pan, including its own mass.

4. A car engine has its rated output of 10kW. Maximum torque developed is 100Nm. The clutch used is of single plate type having two active surfaces. Axial pressure is not to exceed 0.85 bar. External diameter of the friction plate is 1.25 times the internal diameter. Determine the dimensions of the friction plate and the axial force exerted by the springs. Assume uniform wear and coefficient of friction as O.3.

5. (a) What are the limitations of a simple Watt governor? Why has this type of governor become obsolete?
   (b) A Porter governor has all four arms 300mm long. The upper arms are pivoted on the axis of rotation and the lower arms are attached to the sleeve at a distance of 3.5mm from the axis. The mass of each ball is 7kg and the mass on the sleeve is 54kg. If the extreme radii of rotation of the balls are 200mm and 250mm, find the range of speed of the governor.

6. (a) Distinguish the static balance and dynamic balance with appropriate examples.

   (b) A,B,C and D are four masses carried by a rotating shaft at radii 100mm, l50mm, 150 mm and 200 mm respectively. The planes in which masses rotate are spaced at 500 mm apart and the magnitude of the masses B,C and D are 9 kg, 5 kg and 4 kg respectively. Find the required mass A and the relative angular settings of the 4 masses so that the shaft shall be in complete balance.

7. An air compressor has four vertical cylinders 1,2,3 and 4 inline and the driving cranks at 90 intervals reach their upper most positions in this order. The cranks are of 150mm radius, the connecting rods 500mm long and the cylinder centre line 400mm apart. The mass of the reciprocating parts of each cylinder is 22.5kg and the speed of rotation is 400r.p.m. Show that there are no out-of-balance primary or secondary forces and determined the corresponding couples, indicating the positions of No. 1 crank for maximum values. The central plane of the machine may be taken as reference plane.

8. Two rotors A and B are connected to the ends of a circular rod of 4 cm diameter and 180 cm long. The rotor A has a mass of 18 kg and is 25 cm in diameter. The rotor B has a mass of 70 kg and is 40 cm in diameter. The rod is held in a horizontal position by a clamp at a point C between A and B such that the frequency of transverse vibration of the past of the system on either side of C is equal. Determine:

   (a) the distance of C from A

   (b) the frequency of transverse vibration of the system

   (c) the ratio of the frequencies of the torsional vibrations.

   Take E=200 $GN/m^2$ . Neglect the inertia of the of the rod and the effect of obliquity of discs.

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