sleeve, if the speed at the beginning of ascent from the lowest position is equal to the speed at the beginning of the descent from the highest position? What is then the range of speed of governor, all other things remaining the same?

———— [2546/5/I/13]



**[03 – 2212]**

II/IV B.E. DEGREE EXAMINATION.

Second Semester

Mechanical Engineering

THEORY OF MACHINES – I

(Effective from the admitted batch of 2006-2007)

Time : Three hours Maximum : 70 marks

Question No. 1 is compulsory.

Answer any FOUR questions from the remaining.

All questions carry equal marks.

1. (a) Differentiate machine and structure.

(b) Define angle of friction and angle of repose.

(c) What are the limitations of Scott Russell mechanism?

(d) Explain Grashof's law.

(e) What is a wedge and where is it used?

(f) Define fixed centrode and moving centrode.

(g) Explain dynamically equivalent system.

2. What is pantograph? Show that it generates a path similar to the path traced by a point on the mechanism.

3. (a) State and prove Arnold Kennedy's theorem of instantaneous centers.

   (b) A reciprocating engine has connecting rod of length 20 cm and crank 5 cm long. By Klein's construction determine the velocity and acceleration of piston when the crank has turned through an angle of 45 degrees from IDC clockwise and is rotating at 240 rpm.

4. (a) Define Kinematic pair. What is the difference between lower pair and higher pair? Give examples for each type.

   (b) Describe the three inversions of Double slider crank chain with neat sketches.

5. (a) Explain the construction and working of Davis steering gear with a neat sketch.

   (b) A Hooke's joint is used to connect two shafts whose axes are inclined at 20°. The driving shaft rotates uniformly at 6,000 rpm. What are the extreme angular velocities of the driven shaft? Find the maximum value of retardation or acceleration and state the angle where both will occur.



6. (a) What do you mean by friction circle? Explain.

   (b) A load of 10 kN is raised by means of a screw jack, having a screw threaded screw of 12 mm pitch and of diameter 50 mm. If a force of 100 N is applied at the end of a lever to raise the load, what should be the given length of the lever used? Take coefficient of friction = 0.15. What should be the mechanical advantage obtained? State whether the screw is self locking.

7. A single cylinder four stroke cycle engine develops 15 kW Power at 330 rpm. The maximum fluctuation of energy is 80% of the indicated energy per cycle .The engine is connected through a gearing to a machine having a speed of 726 rpm. The moment of inertia of rotating parts of the engine is 104 kg-m$^2$ and that of the machine is 9.5 kgm$^2$. Determine the weight of additional flywheel that will be required to keep the overall range of speed variation to 0.75% of mean speed. Radius of gyration of the flywheel is 0.45 m.

8. In a Porter governor, the arms and links are each 25 cms long and intersect on the main axis. Each ball weighs 4 kgf and the central load is 20 kgf. The sleeve is in its lowest position when the arms are inclined at 300 to the axis. The lift of the sleeve is 5 cm. What is the force of friction at