UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, Dec- 2017

Program Name: B-Tech (PIE) **Semester – V**

Course Name : Theory of Machines **Max. Marks : 100**
Course Code : GNEG 251 **Duration : 3 Hrs**
No. of page/s: 03

SEC - A

Attempt All

1. Define terms degrees of freedom and constrained motion of a mechanism. (05)
2. Explain briefly the differences between simple, compound and epicyclic gear trains. (05)
3. What do you understand by the term 'interference' as applied to gears. (05)
4. Explain the term 'fluctuation of energy' and 'fluctuation of speed' as applied to flywheels. (05)

SEC – B

Attempt All

5. Two mating spur gears with module 6.5 mm have 19 and 47 teeth of 20^{o} pressure angle and 6.5 mm addendum. Determine the number of pairs of teeth in contact and the angle turned through by the larger wheel for one pair of teeth in contact.

   Also determine the sliding velocity at the point of engagement, pitch point and disengagement. (15)
6. A single cylinder steam engine develops 150 kW at a mean speed of 80 rpm. The coefficient of fluctuation of energy is 0.1 and the fluctuation of speed is ± 2% of mean speed. Find the mass of the flywheel. (10)
7. (a) State and prove the law of gearing. Show that involute profile satisfies the conditions for correct gearing. (10)

   (b) What are the effects of friction and of adding a central weight to the sleeve of a governor? (5)

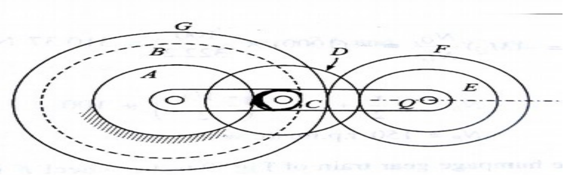
OR

The arms of a Porter governor are 200 mm long. The upper arms are pivoted on the axis of revolution, but the lower arms are attached to a sleeve at a distance of 60 mm from the axis of rotation. The weight on the sleeve is 500 N and the weight of each ball is 90 N. Determine the equilibrium speed when the radius of rotation of the balls is 100 mm. If the friction is equivalent to a load of 20 N at the sleeve, determine the range of speed for this position. (15)

SEC – C

Attempt All **(20 x 2)**

8. Figure shows an epicyclic gear train with the following particulars:
A has 40 teeth external; B has 80 teeth external (Compound wheel)
C has 20 teeth external and compound wheel D has 50 teeth external
E has 20 teeth external and F has 40 teeth external (compound wheel)
G has 90 teeth external
Gear wheel C gears with A and B. Wheel D gears with E. Gear F gears with G. Wheel A is fixed and the arm runs at 100 rpm in clockwise direction. Determine the sense and speed of Gear G and gear B. (20)



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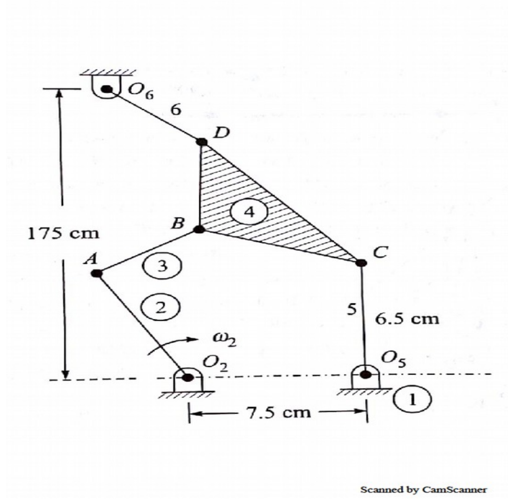
9. In the mechanism shown links O_2 A and AB are of lengths 7.5 cm and 5 cm respectively. Floating link BCD is a ternary link of sides BC = 7.5 cm, BD = 5 cm and CD = 10 cm. Link O_6 D = 5 cm and O_5 C = 6.5 cm. The instantaneous configuration has angle $AO_2O_5 = 100^o$ and angle $CO_5O_2 = 90^o$.
The input crank 2 rotates with constant angular velocity of 10 r/s in CW direction. Determine angular velocity of link 6 and also of the ternary floating link 4. (20)



OR

In the crank and slotted lever type quick return mechanism, the crank AB rotates at 1 rps. Determine (a) Velocity of ran at D, (b) magnitude of Coriolis acceleration component, and (c) acceleration of ram D. AB = 200 mm, OC = 600 mm, CD = 500 mm, and OA = 250 mm. (20)