7657

BOARD DIPLOMA EXAMINATION, (C-20)

DECEMBER—2022

DME - FIFTH SEMESTER EXAMINATION

THEORY OF MACHINES

Time : 3 hours]   [*Total Marks* : 80

PART—A

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answers should be brief and straight to the point and shall not exceed five simple sentences.

1. Write any three differences between belt drive and chain drive. 3

2. Two pulleys, 400 mm and 800 mm diameters which are fixed to two parallel shafts 4 m apart, are connected by open belt. Find the length of belt required.   3

3. Define the terms *(a)* circular pitch and *(b)* pressure angle.   1½+1½

4. State any three advantages and disadvantages of gear drive.   1½+1½

5. State three applications of flywheel.   3

6. Define *(a)* sensitivity, *(b)* stability and *(c)* isochronism of a governor.   1+1+1

7. Write the classification of cams.   3

8. Define *(a)* cam angle, *(b)* base circle and *(c)* dwell.   1+1+1

9. Write four types of damping.   3

10. Find the natural frequency of a spring-mass system in Hz, if the mass is 10 kg and stiffness of the spring is 10 N/mm.   3

PART—B

Instructions : (1) Answer **all** questions.

(2) Each question carries **eight** marks.

(3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer.

11. *(a)* Two pulleys having 500 mm diameter and 250 mm diameter are on parallel shafts 2·2 m apart connected by an open belt drive. Find *(i)* angle of contact between the belt and each pulley, *(ii)* power transmitted when the smaller pulley rotates at 400 rev/min, if the maximum permissible tension in the belt is 2 kN. Take coefficient of friction as 0·25.   3+5

(OR)

(b) A belt 100 mm wide and 9·5 mm thick is used to transmit power. If the safe permissible stress in belt material is 1·75 N/mm^2, calculate the absolute maximum power that can be transmitted by the belt. Assume ratio of belt tensions as 2 and mass of belt per meter length as 0·95 kg.   8

12. *(a)* With the help of a neat sketch, explain the back gear arrangement of a lathe.   4+4

(OR)

(b) A three-speed sliding gear box of a motor car is required to give speed ratio of 4:1, 2·5:1 and 1·5:1 for the first, second and third gear respectively. Diametral pitch of all gears is 0·3 and the center distance between mating gears is 70 mm. Find suitable number of teeth for various gears, if the number of teeth on pinion is 14.   8

13. *(a)* Find the diameter and cross-section of a suitable rim of a flywheel having width twice its thickness, so that centrifugal stress in it does not exceed 6000 kN/m^2. Density of the rim material is 7250 kg/m^3. Assume weight of flywheel to be 1·5 kN and running speed 600 r.p.m.   4+4

(OR)

(b) Explain the working of porter governor with a neat sketch.   8

14. *(a)* Draw the profile of a cam to give the following motion to a reciprocating follower :

  (i) Out stroke during 120° of cam rotation

 (ii) Dwell for the next 30° of cam rotation

(iii) Return stroke during 120° of cam rotation

(iv) Dwell for the remaining 90° of the cam rotation

The stroke of the follower is 30 mm and the minimum radius of the cam is 25 mm. The follower moves with uniform velocity during both out stroke and return stroke. The axis of the follower passes through the axis of the cam shaft. The cam is rotating in anticlockwise direction. 8

(OR)

(b) Draw the cam profile to give the following motion to a roller follower :

  (i) Out stroke during 60° of cam rotation

 (ii) Dwell for 15° of cam rotation

(iii) Return stroke during 60° of cam rotation

(iv) Dwell for the remaining part of cam rotation

The stroke of the follower is 25 mm; the diameter of the roller is 20 mm; the minimum radius of cam is 40 mm. The line of stroke of the follower passes through the centre of the cam axis and the outward and return strokes take place with uniform acceleration and retardation. 8

15. *(a)* Explain the sources of vibrations in mechanical systems. 8

(OR)

(b) Explain methods of controlling the vibrations in mechanical systems. 8

PART—C

10×1=10

Instructions : (1) Answer the following question.

(2) The question carries **ten** marks.

16. A spur gear of straight teeth is designed to transmit 30 kW when the pinion rotates at 300 r.p.m. The velocity ratio is 1 : 3. Allowable static stresses for the pinion and gear materials are 120 N/mm^2 and 100 N/mm^2. The pinion gear has 15 teeth and its face width is 14 times the module. Calculate— 6+2+2

(a) module;

(b) face width of the gear;

(c) pitch circle diameters of the both pinion and gear from the strength point of view only.

Take $y = 0.154-(0.912/T)$.

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