

BACHELOR OF TECHNOLOGY (C.B.C.S.) (2020 COURSE)
B.Tech.Sem - IV MECHANICAL :SUMMER- 2022
SUBJECT : THEORY OF MACHINES

Day : Friday

Date : 24-06-2022

S-24500-2022

Time : 10:00 AM-01:00 PM

Max. Marks : 60

N.B :

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Draw neat and labeled diagrams **WHEREVER** necessary.
- 4) Use of no programmable **CALCULATOR** is allowed.
- 5) Assume suitable data if necessary.

- Q.1** A pair of involute spur gear has 20° pressure angle and pitch of module 6 (10)
mm. The gear ratio is 1.8 and number of teeth on gear is 36. The rotational
speed is 280 r.p.m. find the following in order that the interference is just
avoided.
- i) The addenda on pinion and gear wheel.
 - ii) The length of path of contact.
 - iii) The maximum velocity of sliding of the teeth on either side of the pitch
point.

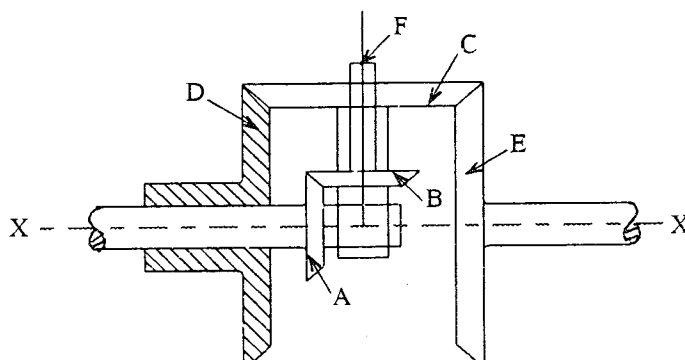
OR

- Two gears in mesh have a module of 8 mm and a pressure angle of 20° . The (10)
larger gear has 57 while the pinion has 23 number of teeth. If the addenda on
pinion and gear wheel are equal to one module, find :
- i) The number of pairs of teeth in contact.
 - ii) The angle of action of the pinion and the gear wheel.
 - iii) The ratio of the sliding to rolling velocity at a) the beginning of contact
b) the pitch point c) the end contact.

- Q.2** A gear wheel 'A' having 44 teeth is rigidly mounted on the driving shaft. It (10)
gears with compound wheel C- D. Wheel 'C' has 22 teeth and wheel D has
26 teeth. C gear with A and D gears with interval wheel 'B'. The compound
wheel revolves freely on a pin which projects from an arm rigidly mounted
on the driven shaft. The internal wheel B is fixed and module of all the gears
is same. The driving and driven shafts and the internal wheel are co-axial.
Driving shafts rotates at 300 rpm and transmits 2.5 kW power.
- i) Sketch the arrangement.
 - ii) Find the speed of driven shaft.
 - iii) Find the torque transmitted by the driven shaft.
 - iv) Fixing torque, neglect losses.

OR

- An epicyclic gear consists of bevel wheels arranged as shown in figure. The (10)
driving pinion A has 20 teeth and meshes with wheel B which has 25 teeth.
The wheels B and C are fixed together and turn freely on the shaft F. The
shaft F can rotate in the radial plane of the shafts X - X. The wheel C has 50
teeth and meshes with wheels D and E, each of which has 60 teeth.
Find the speed and direction of rotation of E when A rotates at 200 rev/min
and i) D is fixed, ii) D rotates at 100 rev/min in the direction of A.
In both the cases find the ratio of the torques transmitted by shafts of the
wheels A and E, the losses being neglected.



P.T.O.

- Q.3** A, B, C and D are four masses carried by a rotating shaft at radii 100, 125, 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the mass of B, C and D are 10 kg, 5kg and 4kg respectively. **(10)**

Find the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance.

OR

Derive an expression the primary and secondary forces of Balancing of V-engines.

- Q.4** The upper arms of a Porter governor are pivoted on the axis of rotation, their lengths being 30 cm. the lower are pivoted on the sleeve at a distance of 3 cm from the axis, their lengths being 27 cm. Mass of each ball is 6 kg and the sleeve mass is 50 kg. Determine the equilibrium speed for a radius of rotation of 17 cm and also the effort and power for 1% change of speed. **(10)**

OR

Explain the following terms relating to governors. **(10)**

- | | |
|-------------------------|--------------------------|
| i) Stability | ii) Sensitiveness |
| iii) Isochronism | iv) Hunting |

- Q.5** Draw the profile of the cam when the roller follower moves with cycloidal motion during out stroke and return stroke, as given below:

- i)** Out stroke with maximum displacement of 31.4 mm during 180° of cam rotation,
- ii)** Return stroke for the next 150° of cam rotation,
- iii)** Dwell for the remaining 30° of cam rotation.

The minimum radius of the cam is 15 mm and the roller diameter of the follower is 10 mm. the axis of the roller follower is offset by 10 mm towards right from the axis of cam shaft.

OR

A cam drive a flat reciprocating follower in the following manner: During first 120° rotation of the cam follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation. The follower moves inwards with simple harmonic motion. The follower dwells for the next 90° of the rotation. **(10)**

The minimum radius of the cam is 25 mm. Draw the profile of the cam.

- Q.6** Explain with sketch Gyroscopic effect on ship during rolling. What is stabilization of ship? Why is it necessary? How it is achieved?

OR

The turbine rotor of a ship having a mass of 200 kg rotates at 2000 r.p.m and its radius of gyration is 0.30 m. If the rotation of the rotor is clockwise looking from the aft, determine the gyroscopic couple set by the rotor when **(10)**

- i)** Ship takes a left hand turn at a radius of 300 meters at a speed of 30 km/hr,
- ii)** Ship pitches with the bow rising at an angular velocity of 1 rad/sec. and
- iii)** Ship rolls at an angular velocity of 0.1 rad/sec.

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