Total No. of Questions : 10]

SEAT No. : [ ]

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[5560]-513

T.E. (Mechanical/Automobile)

THEORY OF MACHINES - II

(2015 Pattern) (Semester - I) (302043)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.***
2) ***Neat diagrams must be drawn whenever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of logarithmic calculator is allowed.***
5) ***Assume suitable data whenever necessary.***

Q1) a) Determine the number of teeth and pitch for two toothed wheels to transmit a velocity ratio of 4:1 between two shafts, centre of which are at 676mm.The drive must satisfy tile following conditions: **[6]**

i) The standard module must be chosen from 24, 22,18,16,15,14,13,12 and 11.

ii) The actual distance between shaft centre must not vary by more than 1% from the given data.

iii) The number of teeth must be as small as possible.

b) Define : **[4]**

i) Helix angle

ii) Lead angle

iii) Pitch cone angle

iv) Normal pressure angle.

OR

Q2) a) The following data relate to two spiral gears in mesh: Shaft angle = 90°, centre distance= 160mm (approximately), normal circular pitch=8mm, gear ratio=3, friction angle=5°. For maximum efficiency of the drive, determine: **[6]**

i) The spiral angles of the teeth

ii) The number of teeth

iii) The exact centre distance

iv) The pitch diameters.

P.T.O.

b) Two standard full depth gears of pressure angle 14.5° have a module of 5mm. The pinion has 15 teeth while the gear has 60 teeth. If the addendum of the gear is equal to the module: **[4]**

i) Show that the gear will interfere with the pinion.

ii) To what value should the pressure angle be increased in order to eliminate the interference?

Q3) a) An epicyclic gear train of a sun and planet type has the fixed outer annular wheel A, sun wheel S rotating at a speed of 720rpm in clockwise direction and the arm E carrying three planet wheel P needed to be driven. If diametral pitch is same for all mating gears and sun wheel S and planet wheel P have 15 and 45 teeth respectively. **[8]**

Determine :

i) Number of teeth on annular A.

ii) Speed and direction of rotation of planets.

b) Write any four types of special bevel gears. **[2]**

OR

Q4) Figure. l shows an epicyclic gear train in which driving gear A has 20 teeth, the fixed annular gear C has 150 teeth and the ratio of teeth in gears D and E is 21:50. If 2 kW of power at a speed of 800 rpm is supplied to the gear A, determine the speed and the direction of rotation of gear E. Also, find the fixing torque required at the gear C. **[10]**

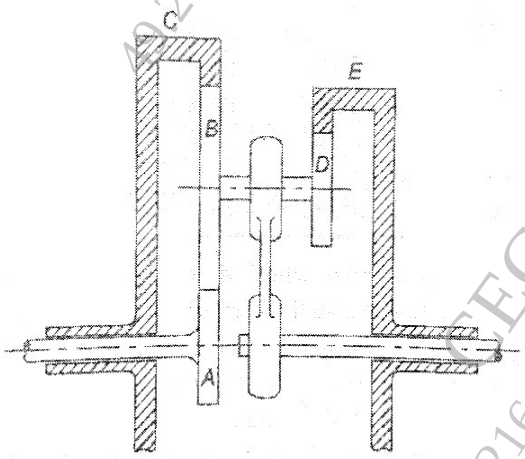

Figure.1

Q5) a) Derive an expression for displacement, velocity, acceleration and jerk for 2-3 polynomial advanced cam and also sketch the curves. **[10]**

b) Following data relates to cam and follower mechanism, find out speed of cam in rpm and maximum usable speed of cam without jump if a cam is an eccentric cam with eccentricity 3cm driving a follower of mass 1.5kg.The spring holding the cam has stiffness of 20N/mm and initial compression 3.15cm. The jump is observed at 120° of cam rotation from the lowest position of cam. **{6]**

OR

Q6) A roller follower cam with a roller diameter of 10mm is rotating clockwise. The lift of the cam is 30mm and the axis of the follower is offset to the right by a distance of 5mm.The follower completes the lift with SHM during 120° of cam rotation. The dwell at lift is 60° of cam rotation. First half of the fall takes place with constant velocity and second half with constant acceleration and retardation during 120° of cam rotation. The rest is the dwell at fall. Draw the cam profile giving details of construction and dimensions. Also, determine maximum velocity and acceleration during outward stroke. Assume base circle radius is 25mm. **[16]**

Q7) a) Determine the chebyshev spacing for function $y = x^{1.4}$ for the range $1 \leq x \leq 4$ where three precision points are required. For these precision points, determine θ_1, θ_2, θ_3 & φ_1, φ_2, φ_3 if $\Delta\theta = 40°$ & $\Delta\varphi = 90°$. **[10]**

b) Find the three precision points in the interval of 30° to 110° by using graphical method of chebyshev spacing. **[6]**

OR

Q8) a) Design a four bar mechanism with input link a, coupler link b & output link c. Angles θ & φ for 3 successive positions are given below.

Position	1	2	3
θ	20°	35°	50°
φ	35°	45°	60°

Using Frudenstein's equation, find out other links lengths b, c and d. Assume link length a = 1. **[10]**

b) Derive an equation to evaluate kinematic coefficients for synthesizing the four bar mechanism by using algebraic method. **[6]**

Q9) a) A ship is propelled by a turbine having a mass of 6500 kg and a speed of 2600 rpm. The direction of rotation of rotor is anticlockwise when viewed from the bow end. The radius of gyration of rotor is 460 mm. Determine gyroscopic effect when: **[14]**

i) Ship is steering to the left in a curve of 60m radius at a speed of 18 knots (Take 1 knot = 1856m/hr).

ii) Ship is pitching in SHM with bow descending with maximum velocity. The time period of pitching is 20 seconds and the ship pitches 7.5° above and 7.5° below the normal position.

iii) Ship is rolling and at the instant, its angular velocity is 0.035 rad/sec counterclockwise when view from stern end.

iv) Also find the maximum angular acceleration during pitching.

b) Write any four advantages of stepless drive. **[4]**

OR

Q10)a) A four wheeler motor car of mass 2 tonnes has height of CG 60cm above ground level. The engine parts and transmissions are equivalent to a flywheel of 80kg with radius of gyration of 15cm and there axis coincides with the axis of wheel. The car negotiate a curve of 60m radius (take towards right turn) at 72 km/hr with overall gear ratio 4: 1. The radius of road wheel is 30cm and its MI is 3kg-m^2. Assume wheel track as 1.5m, weight distribution as 50:50, determine reaction at each wheel. **[12]**

b) Draw and explain in detail working principle of any one type of CVT.**[6]**

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