Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2142001 **Date: 06/06/2017**

Subject Name: Kinematics & Dynamics of Machines

Time: 10:30 AM to 01:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 Short Questions MCQ 14

1 Velocity is the
(a) distance covered per unit time (b) displacement covered per unit time
(c) time taken per unit distance (d) time taken per unit displacement

2 When a body moves with simple harmonic motion, the product of its periodic time and frequency is equal to
(a) 0 (b) 1 (c) $\pi/2$ (d) π

3 The factor which affects the critical speed of a shaft is
(a) diameter of disc (b) span of shaft
(c) eccentricity (d) all of these

4 If the opposite links of a four bar linkage are equal, the links will always form a
(a) Triangle (b) Rectangle (c) Parallelogram (d) Pentagon

5 The motion of a shaft in a circular hole is an example of
(a) Completely constrained motion (b) Incompletely constrained motion
(c) Successfully constrained motion (d) None of these

6 Cam size depends upon
(a) Base circle (b) Pitch circle (c) Prime circle (d) Outer circle

7 Scotch yoke mechanism is the inversion of
(a) Single slider kinematic chain (b) Double slider kinematic chain
(c) Four bar chain (d) None of the above

8 Which of the following is a higher pair?
(a) Turning pair (b) Screw pair (c) Belt and Pulley (d) None of the above

9 To connect two parallel and coplanar shafts the following type of gearing is used
(a) Spur gear (b) Bevel gear
(c) Spiral gear (d) None of the above

10 Klein's construction gives a graphic construction for
(a) Slider-crank mechanism (b) Velocity polygon
(c) Acceleration polygon (d) Four bar chain mechanism

11 When there is a reduction in amplitude over every cycle of vibration, then the body is said to have
(a) Free vibration (b) Forced vibration
(c) Damped vibration (d) Under damped vibration

12 Which one of the following is an exact straight line mechanism using lower pairs?
(a) Watt's mechanism (b) Grasshopper mechanism
(c) Robert's mechanism (d) Paucellier's mechanism

13 The partial balancing means
(a) balancing partially revolving masses
(b) balancing partially reciprocating masses
(c) best balancing of engines
(d) all of these

14 The contact ratio for gears is
(a) Zero (b) Less than one (c) Greater than one (d) Infinity

Q.2 (a) What is the difference between machine, mechanism, and structure? **03**

(b) What is active and reactive gyroscopic couple? Give the practical application in which gyroscopic principal is observed. **04**

(c) In a four bar chain ABCD, AD is fixed link. Crank AB rotates in clock wise direction at an angular velocity of 10 red/sec. Link AB = 60 mm , BC = CD= 70 mm, DA = 120 mm. when angle DAB = 60° and the points B and D are on one side of the link AD, Find angular velocity of link BC and link CD. **07**

OR

(c) A four bar mechanism with AB = 20 cm, BC = 30 cm, CD = 32 cm and AD = 60 cm dimension. Crank AB rotate at uniform speed of 300 r.p.m. in anticlockwise direction. When the crank AB has turned 60°, locate all the instantaneous centers and find the angular velocity of link BC. **07**

Q.3 (a) State the advantages of helical gear over spur gear. **03**

(b) What are the different forms of gear tooth? Explain any one form in detail. **04**

(c) Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 rev/min, if the maximum permissible tension in the belt is 1 kN, and the coefficient of friction between the belt and pulley is 0.25? **07**

OR

Q.3 (a) Explain the phenomena of ‘slip’ and ‘creep’ in a belt drive. **03**

(b) Derive the condition for transmitting the maximum power in a flat belt drive. **04**

(c) Explain with a neat sketch the “Sun and Planet wheel”. Write its merits and demerits as compared to reverted and compound gear trains. **07**

Q.4 (a) Identify the kinematic chains to which the following mechanisms belong : **03**
(1) Steam engine mechanism (2) Beam engine (3) Whitworth quick return motion mechanism and (4) Elliptical trammels.

(b) Define : (1) Contact ration (2) Module (3) Circular pitch (4) Gear ratio **04**

(c) An epicyclic gear train consists of three gears A, B, and C, as shown in fig 1. The number of the teeth on annular gear A is 74 and on gear C is 34. The gear B meshes with both gear A and C and it are carried on an arm F which rotates about the center A at 25 rpm. If the gear A is fixed, find the speed of gear B and C. **07**

OR

Q.4 (a) What are the different types of motion with which a follower can move? **03**

(b) Define the following terms as applied to cam with a neat sketch :- **04**
(a) Base circle (b) Pitch circle (c) Pressure angle and (d) Stroke of the follower.

(c) What do you understand by degree of freedom? What are the various causes of vibrations? How the effects of undesirable vibrations can be reduced? **07**

Q.5 (a) What do you mean by damping? What are the various types of damping? **03**

(b) Define following terms: **04**
(1) Simple harmonic motion (2) Time period (3) Frequency (4) Amplitude

(c) Four masses A, B, C, and D are completely balanced. Masses C and D makes angles of 90° and 195° respectively with B in the same sense. The rotating masses have following properties: **07**

m_b = 25 kg, m_c = 40 kg, m_d = 35 kg and r_a = 150 mm , r_b = 200 mm , r_c = 100 mm and r_d = 180 mm. planes B and C are 250 mm apart. Determine: (1) The mass A and its angular position. (2) The position of planes A and D.

OR

Q.5 **(a)** Distinguish between longitudinal, transverse and torsional vibration. **03**

(b) The vibrating system shown in fig.2, for this system if K_1 = 2400 N/m , K_2 = 1600 N/m, K_3 = 3600 N/m and K_4= K_5 = 500 N/m; find the mass m such the system will have a natural frequency of 10 H_z **04**

(c) A spring mass damper system has a mass of 4 kg, a stiffness of spring is 300 N/m and damping coefficient of 35 N sec/m. Determine: (1) Natural frequency of damped vibration, (2) Natural frequency of the system, if instead of viscous damping dry friction damping is present. **07**

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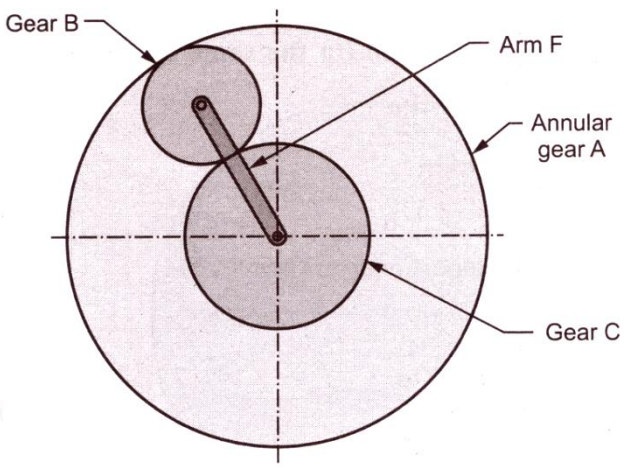

Fig. (1) Q.4 (c)

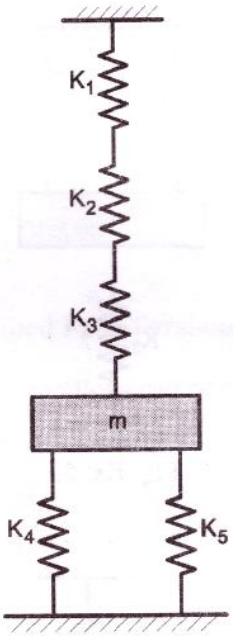

Fig. (2) Q.5 (b) (OR)