

# JK LAKSHMIPAT UNIVERSITY, JAIPUR

## INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), Nov-Dec. 2017

B. Tech in Mechanical Engineering, Semester -V

Roll No.....

ME 507: Dynamics of Machines

Time: 3 hours

Max. Marks: 100

### Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark) 10

- i. The size of a cam depends upon:  
(a) base circle (b) pitch circle (c) prime circle (d) pitch curve
- ii. The power transmitted by a belt is maximum when the maximum tension in the belt (T) is equal to:  
(a) TC (b) 2TC (c) 3TC (d) 4TC
- iii. Which of the following governor is used to drive a gramophone?  
(a) Watt governor (b) Porter governor  
(c) Pickering governor (d) Hartnell governor
- iv. The swaying couple is due to the:  
(a) primary unbalanced force (b) secondary unbalanced force (c) two cylinders of locomotive (d) partial balancing
- v. The size of a gear is usually specified by  
(a) pressure angle (b) circular pitch (c) diametral pitch (d) pitch circle diameter
- vi. A differential gear in an automobile is a :  
(a) simple gear train (b) epicyclic gear train (c) compound gear train (d) none of these
- vii. The brakes commonly used in railway trains is:  
(a) shoe brake (b) band brake (c) band and block brake (d) internal expanding brake
- viii. When the relation between the controlling force (FC ) and radius of rotation (r) for a spring controlled governor is  $FC = a.r + b$ , then the governor will be:  
(a) stable (b) unstable (c) isochronous
- ix. The centrifugal tension in belts:  
(a) increases power transmitted  
(b) decreases power transmitted  
(c) have no effect on the power transmitted  
(d) increases power transmitted up to a certain speed and then decreases
- x. The train value of a gear train is:  
(a) equal to velocity ratio of a gear train (b) reciprocal of velocity ratio of a gear train (c) always greater than unity (d) always less than unity

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| Q.2  | Short answer type questions (2questions @ 5 marks)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 10 |
| 1.   | Define the following terms as applied to cam:<br>(a) Base circle, (b) Pitch circle, (c) Pressure angle, and (d) Stroke of the follower.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |    |
| 2.   | Explain clearly the terms 'static balancing' and 'dynamic balancing'.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |
| Q.3A | In a flat belt drive the initial tension is 2000 N. The coefficient of friction between the belt and the pulley is 0.3 and the angle of lap on the smaller pulley is $150^\circ$ . The smaller pulley has a radius of 200 mm and rotates at 500 r.p.m. Find the power in kW transmitted by the belt.                                                                                                                                                                                                                                                                                                                                                                     | 05 |
| Q.3B | What is centrifugal tension in a belt? How does it affect the power transmitted?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 05 |
| Q.4A | The turbine rotor of a ship has a mass of 8 tonnes and a radius of gyration 0.6 m. It rotates at 1800 r.p.m. clockwise, when looking from the stern. Determine the gyroscopic couple, if the ship travels at 100 km/hr and steer to the left in a curve of 75 m radius.                                                                                                                                                                                                                                                                                                                                                                                                  | 05 |
| Q.4B | Discuss the various types of the brakes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 05 |
| Q.5  | What is the function of a governor? How does it differ from that of a flywheel?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 5  |
| Q.6  | A cam, with a minimum radius of 25 mm, rotating clockwise at a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion described below :<br>1. To raise the valve through 50 mm during $120^\circ$ rotation of the cam ;<br>2. To keep the valve fully raised through next $30^\circ$ ;<br>3. To lower the valve during next $60^\circ$ ; and<br>4. To keep the valve closed during rest of the revolution i.e. $150^\circ$ ;<br>The diameter of the roller is 20 mm and the diameter of the cam shaft is 25 mm. Draw the profile of the cam when (a) the line of stroke of the valve rod passes through the axis of the cam shaft. | 15 |
| OR   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |
| Q.6  | Derive the following expressions, for an uncoupled two cylinder locomotive engine: (a) Variation in tractive force (b) Swaying couple (c) Hammer blow.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 15 |
| Q.7  | A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with $20^\circ$ pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio.                                                                                                                                                                                                                                                                                                                                                                                                                                  | 10 |
| OR   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |
| Q.7  | In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 rpm in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed makes 300 rpm in the clockwise direction, what will be the speed of gear B?                                                                                                                                                                                                                                                                                                            | 10 |
| Q.8  | Discuss the effect of the gyroscopic couple on a two wheeled vehicle when taking a turn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 10 |

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| Q.9  | In an engine governor of the Porter type, the upper and lower arms are 200 mm and 250 mm respectively and pivoted on the axis of rotation. The mass of the central load is 15 kg, the mass of each ball is 2 kg and friction of the sleeve together with the resistance of the operating gear is equal to a load of 25 N at the sleeve. If the limiting inclinations of the upper arms to the vertical are $30^\circ$ and $40^\circ$ , find, taking friction into account, range of speed of the governor.                                                                                                                                                   | 10 |
| Q.10 | Discuss the balancing of V-engines.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 10 |
| OR   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |    |
| Q.10 | An inside cylinder locomotive has its cylinder centre lines 0.7 m apart and has a stroke of 0.6 m. The rotating masses per cylinder are equivalent to 150 kg at the crank pin, and the reciprocating masses per cylinder to 180 kg. The wheel centre lines are 1.5 m apart. The cranks are at right angles. The whole of the rotating and $\frac{2}{3}$ of the reciprocating masses are to be balanced by masses placed at a radius of 0.6 m. Find the magnitude and direction of the balancing masses. Find the fluctuation in rail pressure under one wheel, variation of tractive effort and the magnitude of swaying couple at a crank speed of 300 rpm. | 10 |