

**R16**

Code No: 134AU

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****B.Tech II Year II Semester Examinations, April - 2018****DYNAMICS OF MACHINERY****(Mechanical Engineering)****Time: 3 Hours****Max. Marks: 75****Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit.

Each question carries 10 marks and may have a, b, c as sub questions.

**PART- A****(25 Marks)**

- 1.a) Write the expression for gyroscopic couple. [2]
- b) What is the effect of gyroscopic couple on rolling of ship? [3]
- c) Explain the term maximum fluctuation of energy in flywheel. [2]
- d) Why flywheels are needed in forging and pressing operations? [3]
- e) What is difference between co-efficient of friction and angle of friction? [2]
- f) What are the different types of mechanical brakes? [3]
- g) What is the function of Governor? [2]
- h) What is meant by sensitiveness of a governor? [3]
- i) What are the various types of damping? [2]
- j) When do you say a vibration system is under-damped? [3]

**PART-B****(50 Marks)**

2. In a four link mechanism ABCD, the link AB revolves with an angular velocity of 10 radians/second and angular acceleration of  $20 \text{ radians/sec}^2$ . The instant when it makes an angle of  $45^\circ$  with AD the fixed link. The lengths of the links are  $AB=CD=800 \text{ mm}$ ,  $BC=1000 \text{ mm}$  and  $AD=1500 \text{ mm}$ . The mass of the links is  $4 \text{ kg/m}$  length. Determine the torque required to overcome the inertia forces, neglecting the gravitational effects. Assume the links to be of uniform cross-section. [10]

**OR**

3. A racing car weighs  $20 \text{ kN}$ . It has a wheel base of  $2 \text{ m}$ , track width of  $1 \text{ m}$  and height of C.G  $300 \text{ mm}$  above ground level and lies midway between the front and rear axles. The engine flywheel rotates at  $3000 \text{ rpm}$  clockwise when viewed from the front. The moment of inertia of the flywheel is  $4 \text{ kgm}^2$  and the moment of inertia of each wheel is  $3 \text{ kgm}^2$ . Find the reactions between the wheels and the ground when the car takes a curve of  $15 \text{ m}$  towards right at  $30 \text{ km/hr}$ , taking into consideration the gyroscopic and centrifugal effects. Each wheel radius is  $400 \text{ mm}$ . [10]

4. Draw the turning moment diagrams for the following engines neglecting the effect of inertia of the connecting rod:

- a) Four stroke I.C. Engine
- b) Multi-cylinder engine.

**[5+5]****OR**

5. The torque exerted on the crank shaft of a two stroke engine is given by  $T=15000+2000\sin 2\theta-1800\cos 2\theta$  N-m. Assuming the resistance torque to be constant, determine:

- a) The power of the engine when running at 150 r.p.m
- b) The moment of inertia of flywheel if the speed variation from the mean speed of 150 r.p.m is not to exceed  $\pm 0.5\%$ .
- c) The angular acceleration of flywheel for  $\theta = 30^\circ$ . [3+4+3]

6.a) Describe a single plate clutch with a neat diagram.

b) State the laws of static and dynamic friction. [5+5]

**OR**

7.a) Explain a torsion dynamometer with a neat sketch.

b) The following data refer to a rope brake dynamometer in a Laboratory experiment.

Diameter of the flywheel=1m

Diameter of the rope=10 mm.

Dead weight on the brake=50 kg

Speed of the engine =180 rpm

Spring balance reading=120 N.

Find the power of the engine. [5+5]

8.a) Derive an expression for the determination of equilibrium speed of a Porter governor.

b) Calculate the minimum speed of a Porter governor, which has equal arms each 200 mm long and are pivoted on the axis of rotation. The mass of each ball is 5 kg and the minimum radius of rotation for the ball is 100 mm. [5+5]

**OR**

9.a) What is primary and secondary balancing in reciprocating engines?

b) The cranks of a three cylinder locomotive are set at  $120^\circ$ . The stroke is 120 mm, the length of the connecting rod is 240 mm, the mass of the reciprocating parts per cylinder is 1 kg and the speed of the crank shaft is 2400 rpm. Determine the magnitude of primary and secondary balancing. [5+5]

10.a) Describe Dunkerley's method to find the natural frequency of a shaft carrying several loads.

b) A shaft 50 mm diameter and 3 m long is simply supported at its ends and carries three loads of 1000 N, 1500N and 750N at 1m, 2m and 2.5m from the left support. Modulus of elasticity is  $200 \text{ GN/m}^2$  Find the frequency of transverse vibrations. [5+5]

**OR**

11.a) Establish an expression for the amplitude of forced vibration.

b) A body of mass 20kg is suspended from a spring which deflects 15mm under this load. Calculate the frequency of free vibrations and verify that a viscous damping force of 1000N at a speed of 1 m/s is just sufficient to make the motion a periodic. [5+5]

---ooOoo---