Code No: R1631031 **R16** SET - 1

III B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019

DYNAMICS OF MACHINERY

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A (14 Marks)

1. a) What is the principle of gyroscope? [2M]
   b) Define the Boundary Friction. [2M]
   c) What is meant by turning moment diagram? [2M]
   d) What is the function of a governor? [3M]
   e) What is meant by balancing of rotating masses? [3M]
   f) Explain about vibration isolation. [2M]

PART –B (56 Marks)

2. a) Explain the effect of precession motion on the stability of moving vehicles such as motor cycle. [7M]
   b) Write a short note on Gyroscope and derive an expression for Gyroscopic couple in standard form. [7M]

3. a) Explain with a neat sketch the functioning of a belt transmission dynamometer. [7M]
   b) Determine the axial force required to engage a cone clutch transmitting 25 kW of power at 750 rpm. Average friction diameter of the cone is 400 mm, the average pressure intensity is $60kN/m^2$, Semi cone angle is 10^0 and the coefficient of friction is 0.25. [7M]

4. a) Explain about coefficient of fluctuation of speed and coefficient of fluctuation of energy. [7M]
   b) Discuss in brief about piston effort and crank effort. [7M]

5. a) State the different methods to determine the equilibrium speed of a Porter Governor. [7M]
   b) The following particulars refer to a Wilson-Hartnell governor: [7M]
   Mass of each ball = 2 kg; minimum radius = 125 mm; maximum radius = 175 mm; minimum speed = 240 rpm; maximum speed = 250 rpm; length of the ball arm of each bell crank lever = 150 mm; length of the sleeve arm of each bell crank lever =100 mm; combined stiffness of the two ball springs = 0.2kN/m. Find the equivalent stiffness of the auxiliary spring referred to the sleeve.

6. a) Discuss how a single revolving mass is balanced by two masses revolving in different planes? [7M]
   b) Four masses M_1, M_2, M_3 and M_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angle between successive masses are 45°, 75° and 135°. Find the position and magnitude of balance mass required if its radius of rotation is 0.25 m. [7M]

7. a) Explain the vibrations of beams with concentrated and distributed loads. [7M]
   b) A coil of spring stiffness 60 N/mm supports vertically a load of 3 kN at the free end. The motion is resisted by the oil dashpot. It is found that the amplitude at the beginning of the fourth cycle is 0.6 times the amplitude of the previous vibration. Find the ratio of the frequencies of damped and undamped vibrations. [7M]

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Code No: R1631031 **R16** SET - 2

III B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019

DYNAMICS OF MACHINERY

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A (14 Marks)

1. a) Define Spin and Precession. [2M]
   b) What do you mean by Friction Circle? [2M]
   c) What are the conditions for flywheel to accelerate and retard? [2M]
   d) Write about auxiliary springs. [3M]
   e) Define swaying couple. [3M]
   f) What are sources of Vibrations? [2M]

PART –B (56 Marks)

2. a) Explain the effect of Gyroscopic couple on a Naval ship during pitching. [7M]
   b) The moment of inertia of an aeroplane air screw is 20 kg-m^2 and the speed of rotation is 1000 rpm clockwise when viewed from the front. The speed of the flight is 200 km per hour. Find the gyroscopic reaction of the air screw on the aero plane when it makes a left-handed turn on a path of 150 m radius. [7M]

3. a) Name different types of dynamometers. Explain the function of Prony break dynamometer in brief. [7M]
   b) Derive the expression for the torque transmitting capacity of a single plate clutch by considering uniform pressure. [7M]

4. a) Draw the turning moment diagrams for the following different types of engines, neglecting the effect of inertia of the connecting rod: i). Single cylinder double acting steam engine; ii). Four stroke cycle. I.C. engine. [7M]
   b) Discuss the Dynamic force analysis of slider crank mechanism. [7M]

5. a) What is meant by the term, stability of a governor? Derive the necessary conditions of stability for a centrifugal governor. [7M]
   b) A Porter governor has arms 250 mm each and four rotating fly balls of mass 0.8 kg each the sleeve movement is restricted to 20 mm from the height when the mean speed is 100 rpm. Calculate the central dead load and sensitivity of the governor neglecting friction when the fly ball exerts the centrifugal force of 9.81 N. [7M]

6. a) What are the reasons for partial balancing of reciprocating masses? Explain. [7M]
   b) A three-cylinder radial engine driven by a common crank has the cylinders spaced at 120^0. The stroke is 100 mm, length of the connecting rod 200 mm and the reciprocating mass per cylinder 1.5 kg. Calculate the primary and secondary forces at crank shaft speed of 1500 rpm. [7M]

7. a) A shaft of 100 mm diameter and 1 m long is fixed at one end, and the other end carries a flywheel of mass 1 tonne. The radius of gyration of the flywheel is 0.5 m. Find the frequency of torsional vibrations, if the modulus of rigidity of the shaft material is 80 GN/m^2. [7M]
   b) Explain about free vibration of spring mass system. [7M]

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Code No: R1631031 **R16** SET - 3

III B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019

DYNAMICS OF MACHINERY

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A (14 Marks)

1. a) Define gyroscopic couple. [2M]
   b) Name the different types of Friction Clutches. [2M]
   c) What do you mean by resisting torque? [2M]
   d) Define sensitiveness of a governor. [3M]
   e) Why Reciprocating Engines are partially balanced? [3M]
   f) State different methods of finding natural frequency of a system. [2M]

PART –B (56 Marks)

2. a) Explain the effect of Gyroscopic couple on an Aeroplane. [7M]
   b) State and explain the effect of precession by a body fixed rigidly at a certain angle to rotating shaft. [7M]

3. a) Establish a formula for the maximum torque transmitted by a single plate clutch of external and internal radii r_1 and r_2, if the limiting coefficient of friction is μ and the axial spring load is W. Assume that the pressure intensity on the contact faces is uniform. [7M]
   b) With a neat sketch explain the method of operation of rope brake dynamometer. [7M]

4. a) Find the maximum and minimum speeds of a flywheel of mass 3250 kg and radius of gyration 1.8 m, when the fluctuation of energy is 112 kN-m. The mean speed of the engine is 240 rpm. [7M]
   b) Discuss the method of finding the crank effort in a reciprocating single acting, single cylinder petrol engine. [7M]

5. a) State the different types of governors. Explain about any one of them. [7M]
   b) For a spring controlled Hartnell type governor, following data is provided: mass of the governor ball is 2 kg, length of the vertical arm of bell crank lever is 800 mm, and length of the other arm of bell crank lever is 90 mm. The speeds corresponding to radii of rotations 120 mm and 130 mm are 300 rpm and 310 rpm respectively. Determine the stiffness of spring. [7M]

6. a) Explain the terms: variation of Tractive force, swaying couple, and hammer blow. [7M]
   b) Four masses A, B, C and D revolves at equal radii and equally spaced along a shaft. The mass B is 7 kg and the radii of C and D make angle s of 90° and 240° respectively with the radius of B. Find the Magnitude of masses A, C and D and angular position of A, so that the system may be completely balanced. [7M]

7. a) Explain the phenomenon of the whirling of shafts. [7M]
   b) Prove, from first principles that with viscous damping the amplitudes of successive oscillations are in geometric progression in the case of free damped vibration. [7M]

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Code No: R1631031 **R16** SET - 4

III B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019

DYNAMICS OF MACHINERY

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A (14 Marks)

1. a) Differentiate 'Natural Precession' from 'Forced Precession'. [2M]
   b) What is the operating principle of Dynamometer? [2M]
   c) Define angular velocity and angular acceleration. [2M]
   d) Write about isochronism? [3M]
   e) Write a short note on primary balancing. [3M]
   f) Define forced damped vibrations. [2M]

PART –B (56 Marks)

2. a) What is the effect of the gyroscopic couple on the stability of a four-wheeler while negotiating a curve? In what way does this affect along with that of the centrifugal force limit the speed of the vehicle? [7M]
   b) Explain the working of a Gyroscope along with an example and give its merits and demerits. [7M]

3. a) Derive an expression for the effort to be applied on a body for moving it down the rough inclined plane when effort applied is horizontal. [7M]
   b) A clutch has disk plates with outer radius 120 mm. Axial force of 5kN is acting on them. The disc plates are new and have coefficient of friction of 0.65. Assume uniform pressure and uniform wear, find the torque transmitted when the disc plates are solid. [7M]

4. a) Explain the effect of inertial force on the reciprocating engine mechanism by drawing the free body diagram of each link. [7M]
   b) Explain the function of a flywheel from a crank effort diagram. [7M]

5. a) Derive an expression for the height of Proell governor. [7M]
   b) Explain about Watt governor with the help of a neat sketch. [7M]

6. a) Define and explain the term 'Balancing of Rotating Masses'. What will be the harm if the rotating parts of high speed engine are not properly balanced? [7M]
   b) A number of masses (say four masses) are attached to a shaft which is rotating at an angular speed of ω rad/s. If all the masses are in the same plane, then describe the analytical method of balancing these four masses by a single mass. [7M]

7. a) Explain about vibration isolation and transmissibility. [7M]
   b) A shaft of 50 mm diameter and 3 m long. It is simply supported at the ends and carries three masses 100 Kg, 120 Kg and 80 Kg at 1.0 m, 1.75 m and 2.5 m respectively from the left support. Taking E=20 GPa. Find the frequency of transverse vibrations using Rayleigh's method. [7M]

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