

**G. PULLAIAH COLLEGE OF ENGINEERING & TECHNOLOGY**

**MID TEST-II**

**SET - 1**

**Sub: DOM**  
**Class: III – I**

**BRANCH : ME**  
**DATE: 08-11-2017**

**WRITE ANY THREE OF THE FOLLOWING (3X10=30)**

1. Short Answer type questions

a State the laws of static friction?	Marks:2	Unit:I	CO:303.1	CL: Remember
b Difference between flywheel and Governor?	Marks:2	Unit:II	CO:303.3	CL: Remember
c Define static balancing?	Marks:2	Unit:II	CO:303.4	CL: Understand
d Why is balancing of rotating parts necessary for high speed engine ?	Marks:2	Unit:IV	CO:303.4	CL: Understand
e What is meant by coefficient of steadiness?	Marks:2	Unit:II	CO:303.3	CL: Understand

2 The turbine rotor of a ship has a mass of 3500 kg. It has a radius of gyration of 0.45 m and a speed of 3000 r.p.m. clockwise when looking from stern. Determine the gyroscopic couple and its effect upon the ship: (i) When the ship is steering to the left on a curve of 100 m radius at a speed of 36 km/h? (ii) When the ship is pitching in a simple harmonic motion, the bow falling with its maximum velocity? The period of pitching is 40 seconds and the total angular displacement between the two extreme positions of pitching is 12 degrees.

Marks:10	Unit:II	CO:303.3	CL: Understand
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(or)

3.a) What is Dynamometer ? Explain Working principle of ROPE BRAKE DYNAMOMETER?

Marks:6	Unit:I	CO:303.1	CL: Understand
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b) What is a brake? What is the difference between a brake and a clutch

Marks:4	Unit:I	CO:303.1	CL: Understand
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4) A circular disc mounted on a shaft carries three attached masses 4 kg, 3kg and 2.5 kg at radial distances 75 mm, 85 mm and 50 mm and at the angular positions of 450 ,1350 and 2400 respectively. The angular positions are measured counter-clockwise from the reference line along x-axis. Determine the amount of the counter mass at a radial distance of 75 mm required for the static balance. (8M)

Marks:10	Unit:IV	CO:303.4	CL: Understand
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Or

5) The cranks and connecting rods of a 4-cylinder in-line engine running at 1800 r.p.m. are 60 mm and 240 mm each respectively and the cylinders are spaced 150 mm apart. If the cylinders are numbered 1 to 4 in sequence from one end, the cranks appear at intervals of 90° in an end view in the order 1-4-2-3. The reciprocating mass corresponding to each cylinder is 1.5 kg. Determine : **1.** Unbalanced primary and secondary forces, if any, and **2.** Unbalanced primary and secondary couples with reference to central plane of the engine.

Marks:10	Unit:IV	CO:303.4	CL: Understand
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**Sub: DOM**

**BRANCH : ME**

**Class: III – I**

**Marks-30**

**DATE: 08-11-17**

Short Answer type questions

a Write the expression for efficiency for the body going up the plane	Marks:2	Unit:I	CO:303.1	CL: Remember
b What is hammer blow? Write its equation?	Marks:2	Unit:IV	CO:303.4	CL: Remember
c State the reason why the reciprocating masses are partially balanced?	Marks:2	Unit:IV	CO:303.4	CL: Understand
d Name the different laws of friction ?	Marks:2	Unit:I	CO:303.1	CL: Understand
e Describe gyroscopic couple?	Marks:2	Unit:III	CO:303.3	CL: Understand

2. A conical pivot supports a load of 20kN, the cone angle is 120° and the intensity of normal pressure is not to exceed 0.3 N/mm<sup>2</sup>. The external diameter is twice the internal diameter. Find the outer and inner radii of the bearing surface. If the shaft rotates at 200 r.p.m. and the coefficient of friction is 0.1. Find the power absorbed in friction. Assume uniform pressure.

Marks:10	Unit:I	CO:303.1	CL: Understand
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(or)

3. An aeroplane makes a complete half circle of 50 metres radius, towards left, when flying at 200 km per hr. The rotary engine and the propeller of the plane has a mass of 400 kg and a radius of gyration of 0.3 m. The engine rotates at 2400 r.p.m. clockwise when viewed from the rear. Find the gyroscopic couple on the aircraft and state its effect on it.

Marks:10	Unit:III	CO:303.3	CL: Understand
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(or)

4) A three cylinder single acting engine has its crank set equally at 120° and runs at 600 rpm. The torque crank angle diagram for each cylinder is triangle for the power, with maximum torque 80 N-m at 60° after the dead center of the corresponding crank. The torque on the return stroke is sensibly zero. Determine:(i) Power developed. (ii) The coefficient of fluctuation of speed if the flywheel used has a mass of 10 kg and has radius of gyration of 8 cm. (iii) Coefficient of fluctuation of energy. (iv) The maximum angular acceleration of the flywheel.

Marks:10	Unit:III	CO:303.3	CL: Understand
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(or)

5) A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions.

Marks:10	Unit:IV	CO:303.4	CL: Understand
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Sub: DOM

BRANCH : ME

Class: III – I

Marks-30

DATE: 08-11-17

1. Short Answer type questions

a Write the expression for efficiency for the body going down the plane	Marks:2	Unit:I	CO:303.1	CL: Remember
b What do you mean by force balancing linkage?	Marks:2	Unit:IV	CO:303.4	CL: Remember
c State the Limiting angle of friction?	Marks:2	Unit:I	CO:303.1	CL: Understand
d Write any one special characteristic exhibited by gyroscope when it is in motion?	Marks:2	Unit:III	CO:303.3	CL: Understand
e Describe coefficient of steadiness?	Marks:2	Unit:III	CO:303.3	CL: Understand

2. a) Explain the following with sketches

(i) Limiting friction, (ii) Angle of friction,

Marks:5	Unit:I	CO:303.1	CL: Understand
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b) write short note on Flywheel in punching presses

Marks:5	Unit:III	CO:303.3	CL: Understand
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(or)

3. A uniform disc of 150 mm diameter has a mass of 5 kg. It is mounted centrally in bearings which maintain its axle in a horizontal plane. The disc spins about its axle with a constant speed of 1000 r.p.m. while the axle precesses uniformly about the vertical at 60 r.p.m. The directions of rotation are as shown in Fig. 14.3. If the distance between the bearings is 100 mm, find the resultant reaction at each bearing due to the mass and gyroscopic effects.

Marks:10	Unit:I	CO:303.1	CL: Understand
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4. A shaft has three eccentricities of mass 1 kg each. The central plane of the eccentricities is 50 mm apart. The distances of the centers from the axis of revolution are 20, 30 and 20 mm and their angular positions are 120° apart. Find the amount of out-of-balance force and couple at 600 rpm. If the shaft is balanced by adding two masses at radius of 70 mm at a distance of 100 mm from the central plane of the middle eccentric, find the amount of masses and their angular positions.

Marks:10	Unit:IV	CO:303.4	CL: Understand
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OR

5. A four cylinder engine has cranks arranged symmetrically along the shaft. The distance between the outer cranks A and D is 5.4 metres and that between the inner cranks B and C is 2.4 metres. The mass of the reciprocating parts belonging to each of the outer cylinders is 2 tonnes, and that belonging to each of the inner cylinders is  $m$  tonnes. If the primary and secondary forces are to be balanced and also the primary couples, determine the crank angle positions and the mass of the reciprocating parts ( $m$ ) corresponding to the inner cylinders. Find also the maximum value of the unbalanced secondary couple, if the stroke is 1 metre, the connecting rod length 2 metres, and the speed of the engine is 110 r.p.m.

Marks:10	Unit:IV	CO:303.4	CL: Understand
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**Sub: DOM**

**BRANCH : ME**

**Class: III – I**

**Marks-30**

**DATE: 08-11-17**

Short Answer type questions

- a Write the magnitude of maximum secondary unbalanced force due to reciprocating parts in terms of its maximum primary unbalanced force
- b Why the uniform rate of wear theory does is used over the uniform pressure theory in case of design of friction clutches?
- c State the laws of film friction?
- d List various brakes?
- e Define gyroscopic effect?

Marks:2	Unit:IV	CO:303.4	CL: Remember
Marks:2	Unit:I	CO:303.1	CL: Remember
Marks:2	Unit:I	CO:303.1	CL: Understand
Marks:2	Unit:I	CO:303.1	CL: Remember
Marks:2	Unit:III	CO:303.3	CL: Understand

2. An effort of 1500 N is required to just move a certain body up an inclined plane of angle  $12^\circ$ , force acting parallel to the plane. If the angle of inclination is increased to  $15^\circ$ , then the effort required is 1720 N. Find the weight of the body and the coefficient of friction.

Marks:10	Unit:I	CO:303.1	CL: Understand
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(or)

3. A rear engine automobile is travelling along a track of 100 metres mean radius. Each of the four road wheels has a moment of inertia of  $2.5 \text{ kg-m}^2$  and an effective diameter of 0.6 m. The rotating parts of the engine have a moment of inertia of  $1.2 \text{ kg-m}^2$ . The engine axis is parallel to the rear axle and the crankshaft rotates in the same sense as the road wheels. The ratio of engine speed to back axle speed is 3 : 1. The automobile has a mass of 1600 kg and has its centre of gravity 0.5 m above road level. The width of the track of the vehicle is 1.5 m. Determine the limiting speed of the vehicle around the curve for all four wheels to maintain contact with the road surface. Assume that the road surface is not cambered and centre of gravity of the automobile lies centrally with respect to the four wheels.

Marks:10	Unit:III	CO:303.3	CL: Understand
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4 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 angles between successive masses are  $45^\circ, 75^\circ$  and  $135^\circ$ . Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m.

Marks:10	Unit:IV	CO:303.4	CL: Understand
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Or

5) The firing order in a 6 cylinder vertical four stroke in-line engine is 1-4-2-6-3-5. The piston stroke is 100 mm and the length of each connecting rod is 200 mm. The pitch distances between the cylinder centre lines are 100 mm, 100 mm, 150 mm, 100 mm, and 100 mm respectively. The reciprocating mass per cylinder is 1 kg and the engine runs at 3000 r.p.m. Determine the out-of-balance primary and secondary forces and couples on this engine, taking a plane midway between the cylinder 3 and 4 as the reference plane.

Marks:10	Unit:IV	CO:303.4	CL: Understand
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