**Round 1- Dynamics of Machine Lab**

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### Department: Mechanical Engineering

### Lab Submission Number: 143

### Discipline: Mechanical Engineering

### Name of the Lab: Dynamics of Machine Lab

### Name of experiment: Disc Type Flywheel

### Experiment Number: 8

### FOCUS AREA: Experimental Analysis Methods

**About the Experiment:**

In Rim type of flywheel, the mass of the flywheel is concentrated at the rim only i.e. not throughout the radius but only at the radius which is just opposite to disc type, thus imparting higher moment of inertia than disc type. Rim type flywheel is mounted on an axle, on the axle a small mass (bob) is tied with a thread and then the bob is released from rest. To calculate the time required for the mass to descend height **H**.

Use equation (1) and equation (2)

equating the torque and momentum of inertia

I×α=m×g×r    --------------------(1)

Hence, angular acceleration α is calculated,

Angular acceleration α is substituted in equation of motion thus, time taken for mass to descend height ‘H’ is obtained,

θ=ω0×t+0.5×α×t2   ---------------(2)

**1. Learning Objectives and Cognitive Level**

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| --- | --- | --- | --- |
| **S.No** | **Learning Objectives** | **Cognitive level** | **Action verbs** |
| 1.Student will be able to: | Define the basic structure of Disc type flywheel and how to differentiate with other type of flywheel | Recall | Define |
| 2.Student will be able to: | Describe the behavior of disc type flywheel when its rotating | Understand | Describe |
| 3. Student will be able to: | Identify the stress due to rotation | recall | identify |
| 4.Student will be able to: | Examine the time taken to reach the ground for metal bob while varying the radius and mass. Apply the angular acceleration equation and equation of motion to calculate the time in which mass will descend | Analyze | Examine |
| 5.Student will be able to: | Combine and compare the time taken to touch the ground by metal bob for both disc type and rim type flywheel | Create | Combine |

**2. Instructional Strategy**

### 2.1 Method: Expository

### 2.2 Assessment Method: Formative Assessment

2.3 Description: The animation of disc type flywheel is shown with front and top view for better visualization. The radius of flywheel and mass of metal bob can be varied to visualize the change in time taken for bob to touch the ground in the form of animation.

**3. Task & Assessment Questions**

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| --- | --- | --- | --- |
| **S.No.** | **Instructions given by the Teacher** | **Tasks to be done by the Students** | **Assessment question aligned with the task** |
| 1. | Explain the complete working of flywheel and how it is useful for physical application | Understand the complete working of the available type of flywheel | Q1, Q6, Q7, Q4 |
| 2. | Explain how disc flywheel is different from other types of flywheel | Understand the concept of disc type of flywheel and how it is different from other type of flywheel | Q9, Q5 |
| 3. | Explain how principal stresses are generated in the rotating disc. | Understand the theory behind generation of stresses | Q13, Q15 |
| 4. | Explain how to measure angular acceleration and time of descend | Understand and apply the equation angular acceleration time of descend | Q10, Q11, Q12, Q3 |
| 5. | Explain how to measure time of descend of mass at certain height by using equation of motion for disc and rim type flywheel | Apply the concept to calculate the time of descend of mass at certain height for disc and rim type flywheel and compere the results | Q5, Q14 |

**Assessment Questions:**

1. In the case of a flywheel, the maximum fluctuation energy is the
2. ratio of the maximum and minimum energy
3. ratio of the minimum and maximum energy
4. difference between the maximum and minimum energies
5. sum of maximum and minimum energies

Answer: c

1. What is the value of the radius of gyration of disc type flywheel as compared to a rim type flywheel for the same diameter?
2. ½ times
3. 2 times
4. 1/

Answer: d

1. What is the moment of inertia of disc type of flywheel?
2. I= Mr2
3. I=0.5\*Mr2
4. I=2\*Mr2
5. I=0.4\*Mr2

Answer: a

1. Which of the following statements are correct?

Statement A: To absorb energy when demand of energy id less than the supply

Statement B: To give out energy when demand of energy is more than the supply.

1. A is correct and B is wrong
2. B is correct and A is wrong
3. Both A and B are correct
4. Both A and B are wrong

Answer: c

1. what is the value of the radius of gyration of the disc type flywheel as compared to rim type flywheel for the same diameter?

a) 21/2times

b) 1/ (21/2) times

c) 2 times

d) 1/2 times

**Answer:** 1/ (21/2) times

1. The energy is stored in Flywheel in form of
2. Potential energy
3. Kinetic energy
4. Heat energy
5. Electrical energy

**Answer:** Kinetic energy

1. With usual notations for different parameters involved, the maximum fluctuations of energy for a flywheel is given by
2. 2ECS
3. ECS/2
4. 2ECS2
5. 2E2CS

**Answer:** 2ECS

1. Flywheel are generally made from

(A) Cast Iron

(B) High strength steel

(C) Ceramics

(D) All of the above

**Answer:** All of the above

1. Why is the rim type of flywheel is used over the disc type of flywheel?
2. Rim type has less weight compared to disc type of flywheel.
3. Rim type has more weight compared to disc type of flywheel.
4. Disc type of flywheel has more weight than rim type
5. None of the above

**Answer: a**

**10.** The ratio of maximum fluctuation of speed to the mean speed is called

a) Fluctuation of speed

b) Maximum fluctuation of speed

c) Coefficient of fluctuation of speed

d) None of the above

**Answer:** Coefficient of fluctuation of speed

**11.** The difference the maximum and minimum speeds during a cycle is called

a) Fluctuation of speed

b) Maximum fluctuation of speed

c) Coefficient of fluctuation of speed

d) None of the above

**Answer: (b)**

12. A circular solid of uniform thickness 20 mm, radius 200 mm and mass 20 kg, is used as a flywheel, if it rotates at 600 rpm, the kinetic energy of the flywheel, in joules is

a) 395

b) 790

c) 1580

d)3160

answer b

13. A thin flat ring is rotating at a speed v, the circumferential stress induced is given by

a) rv

b) rv2

c) 1/2v2

d) 1/2v3

answer b

14. A disc type flywheel is mounted on an axle, on the axle a small mass (bob) is tied with a thread and then the bob is released from rest. Calculate the time required for the mass to descend height 120cm. If the radius of the axel is 5 cm and radius of flywheel is 50 cm and the mass of the bob is 15 kg

a) 4.2 s

b) 5.2 s

c) 6.2 s

d) 5.5 s

answer b

15. What types of stresses are set up in the rim of the flywheel?

1. Tensile stress due to the centrifugal force
2. Shrinkage stresses due to the unequal rate of cooling of casting
3. Tensile bending stress due to restraint of the arms
4. All the above

Answer: a

**4. Simulator Interactions**

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| --- | --- | --- | --- |
| **Sr. No.** | **What students will do?** | **What Simulator will do?** | **Purpose of the task** |
| 1. | See the displayed objectives and apparatus used then click on next button | Display objective and apparatus used | Recall the experiment |
| 2 | Change the values of radius of disc and mass of the bob by scrolling the values available in variable section | Display the value of mass(bob) and radius | To provide basic environment to start the experiment |
| 3 | Click on the play button | Display the “Control” Button | To start the simulation |
| 4 | Note the value of time | Display time taken to reach the ground | To make student calculate the data |
| 5 | Calculate the time taken by mass(bob) manually | Display observation | To check for the calculated data whether it is correct or not |