# ECE 105 Quiz 5

## Thursday Tutorial

**Individual (10 marks):** A disk of radius R= 1.2 m spins about a fixed axis at an angular speed of 40 radians per second and is brought to a stop under constant acceleration over 6 revolutions. a) How much time does it take the disk to reach half its initial angular speed? b) What is the magnitude of the total acceleration vector at of a point on the circumference at that time?

**Thursday Group work:**

1. An object spins about a fixed axis. A point on the object, away from the centre of rotation
   1. does not need to be accelerating;
   2. can never have zero acceleration;
   3. has non zero acceleration only when the objects angular speed is changing
   4. more than one of the above statements is true.
2. A disk spins clockwise, while accelerating clockwise with an acceleration whose magnitude decreases linearly with time. The speed of an arbitrary point on the disk must be
   1. decreasing
   2. increasing;
   3. could be either or;
   4. none of the above, we can only comment on the acceleration and not the speed.
3. An object undergoes constant angular acceleration in the direction of motion while spinning about a fixed axis.
   1. the object’s speed doubles when the number of revolutions doubles;
   2. none of the other answers are correct.
   3. the total acceleration vector length triples as time doubles;
   4. the object’s speed doubles when the time doubles;
4. A horizontal bar is pivoted with a free hinge at one end, and is allowed to swing freely from rest.

The total acceleration vector of the point at the free end, as the bar swings

* 1. is never vertical
  2. can be vertical
  3. can never be horizontal
  4. none of the above

1. For number 4 above,
   1. The angular acceleration of a point at the free end is double that of a point at the middle of the bar;
   2. The linear speed of the point at the free end is equal to that of any other point on the bar;
   3. Neither a, b nor d is correct
   4. The total linear acceleration vector of a point at the free tip is double that of a point in the middle of the bar;

## Friday Tutorial

**Individual (10 marks):**

The propeller blades of a certain turbojet spin at such a high angular speed that the tips of the 1.7 long m blades reach supersonic speeds. If the turbo jet starts from rest with a constant angular acceleration, find the total acceleration of a point at the middle of the blade after 20 revolutions, given that the maximum speed is reached after 60 revolutions. Assume that the maximum speed is the speed of sound, 350 m/s.

**Friday Group work:**

For the quiz question, where the system is initially at rest:

1. The magnitude of radial acceleration of a point at the tip of the blade
   1. doubles when the number of turns doubles ;
   2. quadruples when the number of turn doubles.
   3. halves with doubling time;
   4. doubles with when time doubles;
2. The magnitude of the total acceleration of a point at the tip
   1. is exactly double that of a point at the middle of the blade.
   2. is more than 4 times that of the point in the middle of the blade;
   3. is exactly 4 times that of the point at the middle of the blade;
   4. None of the above

For the next two parts only (3 and 4), assume the direction of acceleration reverses after 20 revolutions.

1. Which of the following statements in true?
   1. The speed of a point at the tip halves with doubling the number of turns;
   2. The angular speed of the blades can be zero while the acceleration is non zero;
   3. The speed of point at the tip will always get smaller.
   4. None of the above
2. The angular acceleration of the point at the tip is
   1. double that of the point at the middle of the blade.
   2. none of the other answers;
   3. same as that of a point at the middle of the blade.
   4. half that at the middle of the blade.
3. A bug happens to be on one of the blades at the tip when the blades start turning. As the blades reach a high speed, many turns later, the bug is about to be thrown off. At that point:
   1. its acceleration points towards the middle of the blades;
   2. its acceleration points directly away from the middle of blades;
   3. its acceleration is along its direction of motion
   4. none of the above

# Solutions to individual parts

## Thursday Quiz

A disk of radius R= 1.2 m spins about a fixed axis at an angular speed of 40 radians per second and is brought to a stop under constant acceleration over 6 revolutions. a) How much time does it take the disk to reach half its initial angular speed? b) What is the magnitude of the total acceleration vector at of a point on the circumference at that time?

a)

magnitude

b)

## Friday Quiz

The propeller blades of a certain turbojet spin at such a high angular speed that the tips of the 1.7 long m blades reach supersonic speeds (assume this is the maximum speed) . a) If the turbo jet starts from rest with a constant angular acceleration, find the total acceleration of a point at the middle of the blade after 20 revolutions, given that the maximum speed is reached after 60 revolutions. b) Can the radial acceleration ever be equal to the total acceleration? Assume that the maximum speed is the speed of sound, 350 m/s.

After 20 revolutions

b) Yes when the speed no longer changes