

# Unit 12 - Week 11

## Course outline

How does an NPTEL online course work?

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Week 2

Week 3

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Week 6

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Week 10

Week 11

Calculation of vector potential

Boundary conditions on magnetic field

Magnetic dipole

Multipole expansion of the vector potential

Magnetism, force and torque on magnetic dipole

Fringing magnetic field

Magnetization

A tutorial on the magnetic dipole moment

Quiz : Assignment 11

Week 11 Feedback : Electromagnetism

Week 12

Download Videos

Lecture materials

## Assignment 11

The due date for submitting this assignment has passed.  
As per our records you have not submitted this assignment.

**Due on 2020-04-15, 23:59 IST.**

1) Magnetic Dipole

5 points

A circular loop of wire, with radius  $R$ , lies in the  $x$ - $y$  plane, centered at the origin, and carries a current  $I$  running counterclockwise as viewed from the positive  $z$  axis. What is its magnetic dipole moment?

$$\vec{m} = 2I\pi R\hat{z}$$

$$\vec{m} = I\pi R^2\hat{z}$$

$$\vec{m} = 3\pi\mu_0 I R\hat{z}$$

$$\vec{m} = I^2\pi R^2\hat{z}$$

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
 $\vec{m} = I\pi R^2\hat{z}$

A thin uniform donut, carrying charge  $Q$  and mass  $M$ , rotates about its axis  $\hat{z}$

2) The gyromagnetic ratio is

4 points

$$g = \frac{2Q}{M}$$

$$g = \frac{Q}{M}$$

$$g = \frac{Q}{4M}$$

$$g = \frac{Q}{2M}$$

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
 $g = \frac{Q}{2M}$

3) What is the gyromagnetic ratio for a uniform spinning sphere of radius  $R$ ?

4 points

$$g = \frac{2QR}{M}$$

$$g = \frac{2Q}{RM}$$

$$g = \frac{Q}{2M}$$

$$g = \frac{QR}{2M}$$

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
 $g = \frac{Q}{2M}$

A uniform current density  $J = J_0\hat{z}$  fills a slab straddling the  $yz$  plane, from  $x = -a$  to  $x = +a$ . A magnetic dipole  $m = m_0\hat{x}$  is situated at the origin.

4) The force on the dipole is

4 points

$$\vec{F} = \mu_0 J_0 a^2 \hat{x}$$

$$\vec{F} = m_0 \mu_0 J_0 a \hat{x}$$

$$\vec{F} = 0$$

$$\vec{F} = \mu_0 J_0 a \hat{y}$$

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
 $\vec{F} = \mu_0 J_0 a^2 \hat{x}$

5) What is the force if the dipole pointing in the  $y$  direction:  $m = m_0\hat{y}$ .

4 points

$$\vec{F} = m_0 \mu_0 J_0 \hat{x}$$

$$\vec{F} = m_0 \mu_0 J_0 a \hat{z}$$

$$\vec{F} = \mu_0 J_0 a \hat{y}$$

$$\vec{F} = 0$$

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
 $\vec{F} = m_0 \mu_0 J_0 \hat{x}$