

**Question 10)** A homogeneous solid cylindrical roller of radius  $R$  and mass  $M$  is pulled on a cricket pitch by a horizontal force. Assuming rolling without slipping, angular acceleration of the cylinder is:

- (A)  $3F/2mR$
- (B)  $F/3mR$
- (C)  $F/2mR$
- (D)  $2F/3mR$

**Answer: (D)  $2F/3mR$**

**Solution:**

$$F - f_r = ma \quad \text{---(1)}$$

$$f_r R = I\alpha = (mR^2/2)\alpha \quad \text{---(2)}$$

For pure rolling

$$a = \alpha R \quad \text{---(3)}$$

From (1), (2) and (3)

$$F - (mRa/2) = maR$$

$$\Rightarrow a = 2F/3mR$$