



SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution



Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF AGRICULTURE ENGINEERING

19 AGT 202 –Machine Design

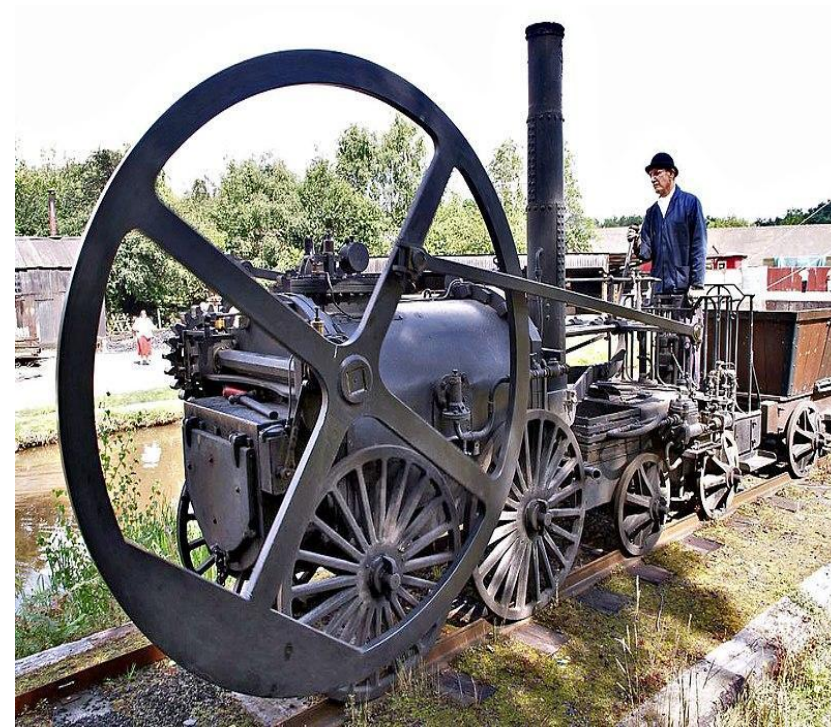
III YEAR V SEM

UNIT 4 – Fundamentals of Theory of Machines

TOPIC – Design of Flywheel



INTRODUCTION:



A flywheel acts as an energy reservoir, which stores energy during the period when the supply of energy is more than the requirement and releases energy during the period when the requirement is more than the supply.



Components of Flywheel



Rotor

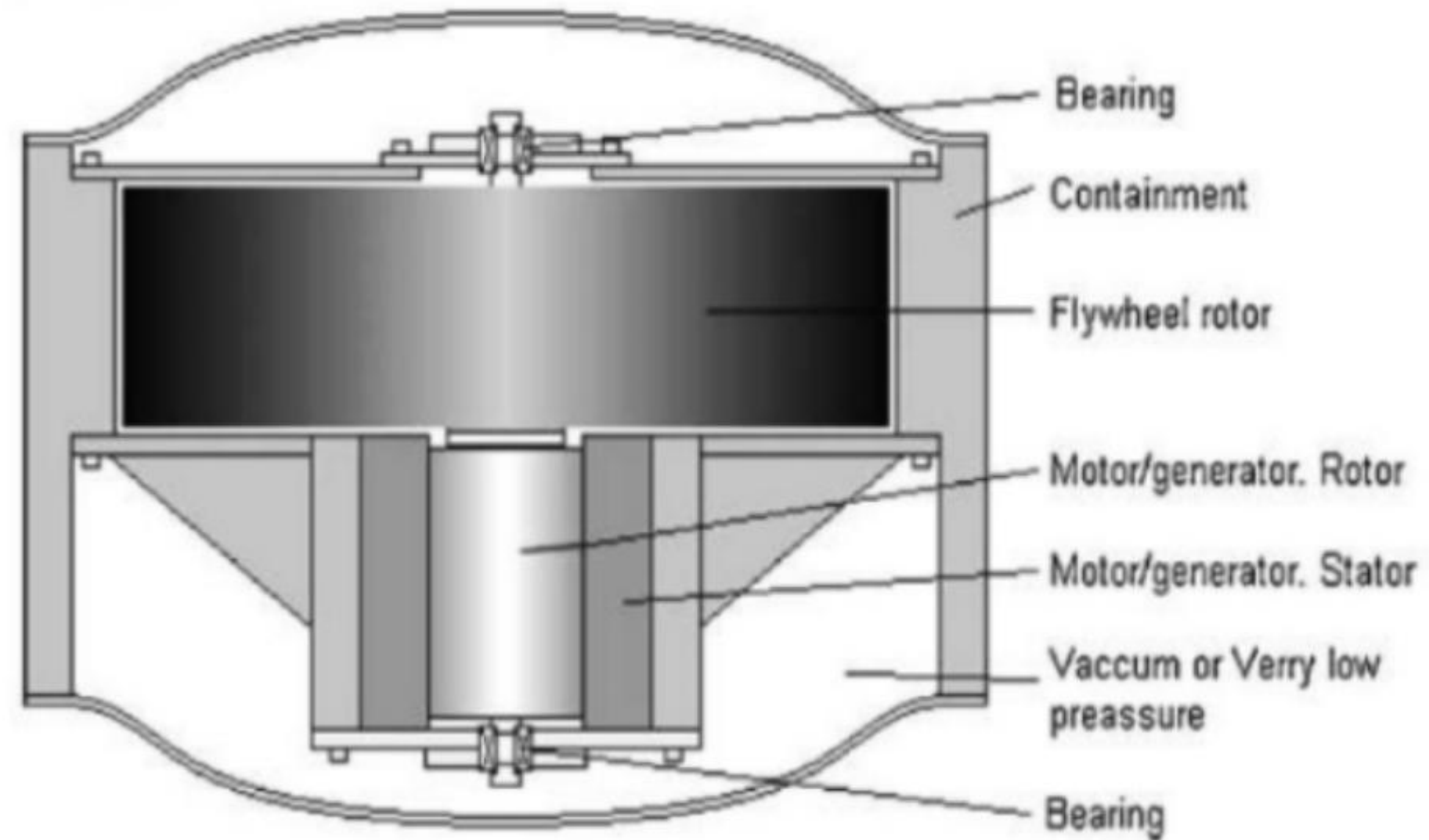
Bearing

Motor/Generator

Power Electronics

Control/Instrumentation

Housing





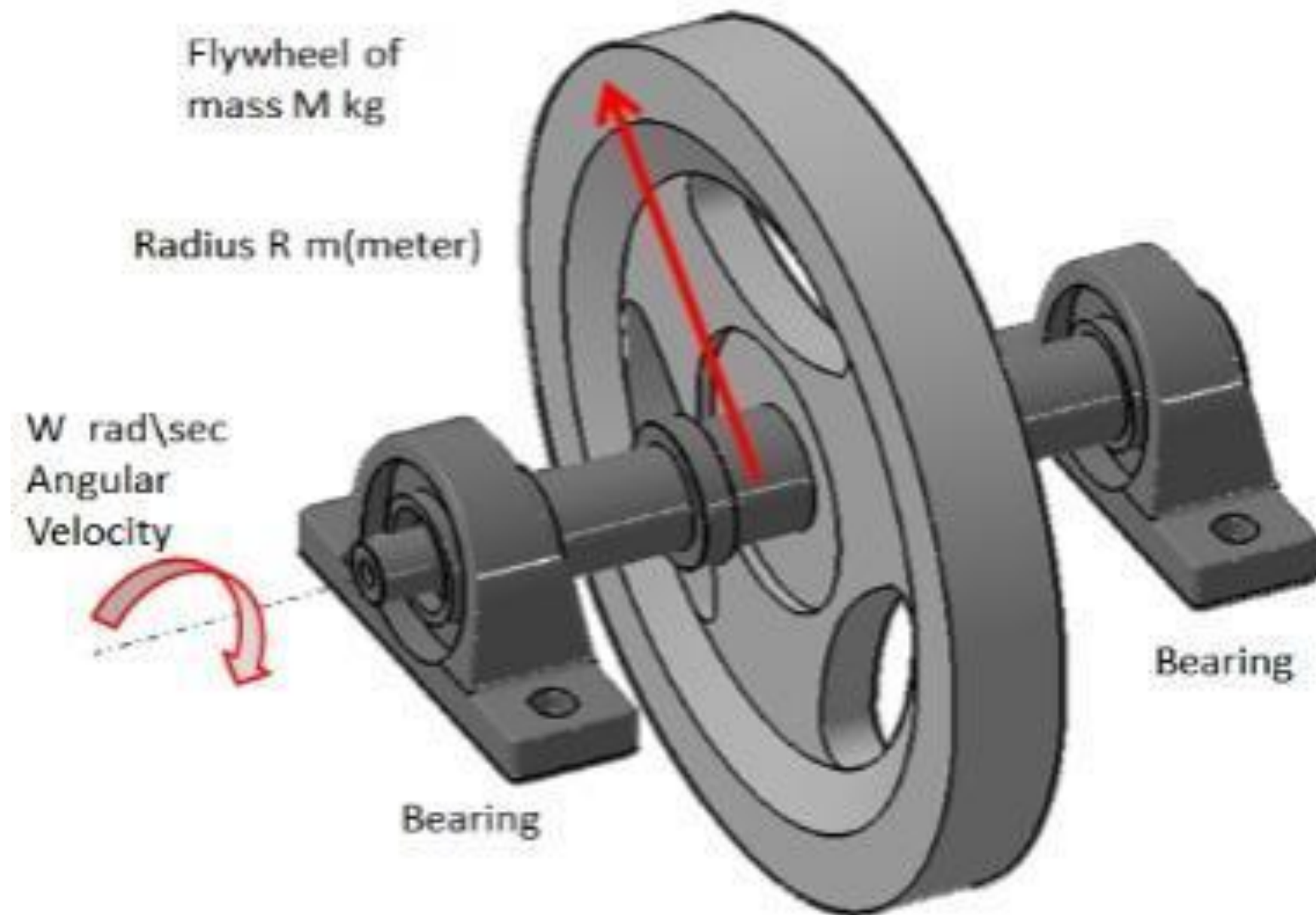
Material Selection

- Flywheels are made from many different materials; the application determines the choice of material.
- Cast iron flywheels are used in old steam engines.
- Flywheels used in car engines are made of cast or nodular iron, steel or aluminum.
- Flywheels made from high-strength steel or composites.





Design of a Flywheel



This design exercise deals with the design of a flywheel to bring the fluctuation of the engine speed to a required limit.

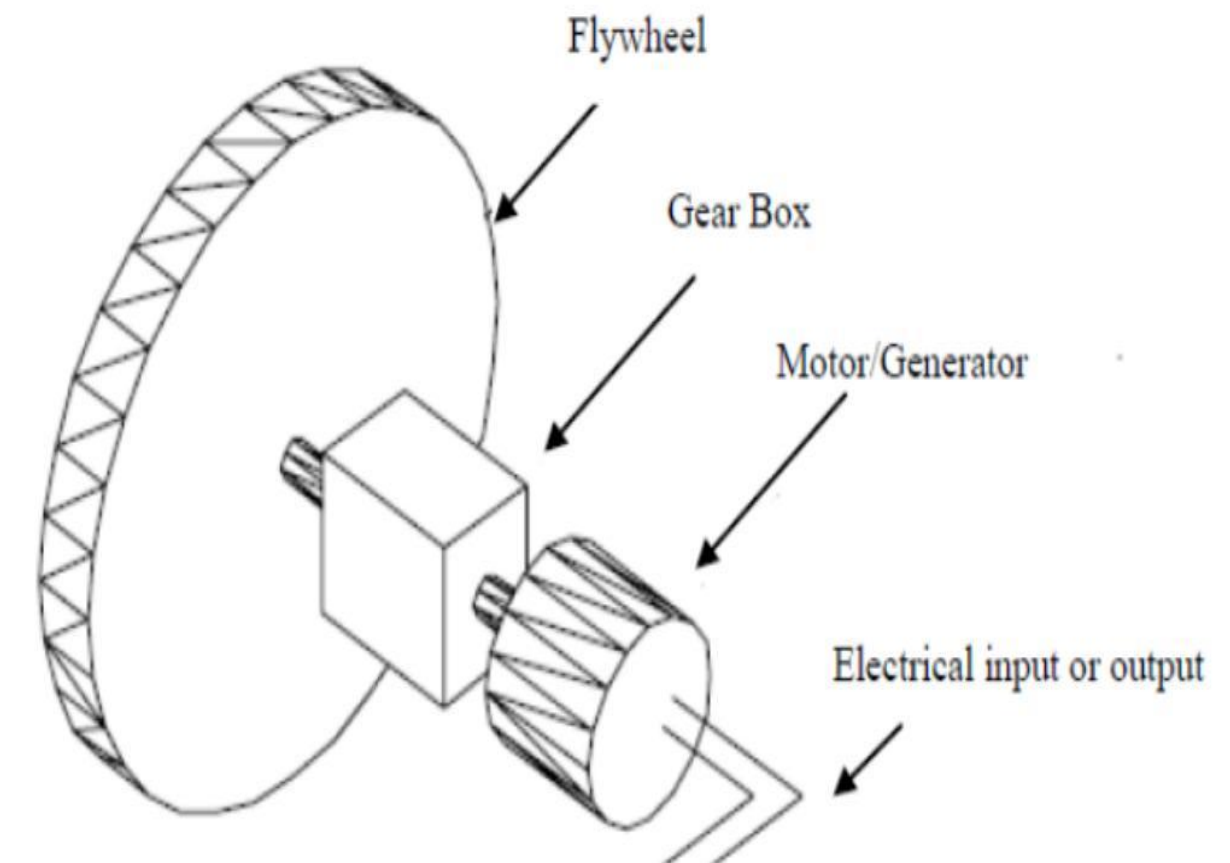


Working of Flywheel

Flywheel is essentially a mechanical battery consisting of a mass rotating around an axis.

It stores energy in the form of kinetic energy and works by accelerating a rotor to very high speeds and maintaining the energy in the system as rotational energy.

Flywheel energy storage is a promising technology for replacing conventional lead acid batteries as energy storage systems.





Design Procedure of Flywheel



- Selection of the engine.
- Data tables will be provided and select the problem based on the serial number.
- Calculation of Turning Moment.
- Calculation of torque due to inertia forces
- Obtain the turning moment and hence find the mean torque.
- Calculation of the Moment of Inertia of the flywheel to limit the speed fluctuation to given value.
- Design of the flywheel with the required Moment of Inertia.





Design of a Flywheel: Procedure

Calculation of torque due to inertia forces

$$x = (n + 1)r - r \cos\theta - r(n^2 - \sin^2 \theta)^{1/2}$$

$$x = \omega \times r \cos\theta +$$

..

$$Q = Mx$$

M is the mass of reciprocating parts

Design of a Flywheel: Mass

Find the equivalent mass system

If the mass of the

connecting rod = m $m = m_1 + m_2$

$$m_2 x l_2 = m_1 x l_1$$



Advantages of Flywheel



No degradation in power.

No daily cycling limitations.

No degradation in energy.

Highly accurate SOC measurement.

Non-inflammable.

Utility customer comfort with rotating machinery.

Easily recyclable.

High residual value at the end of life.



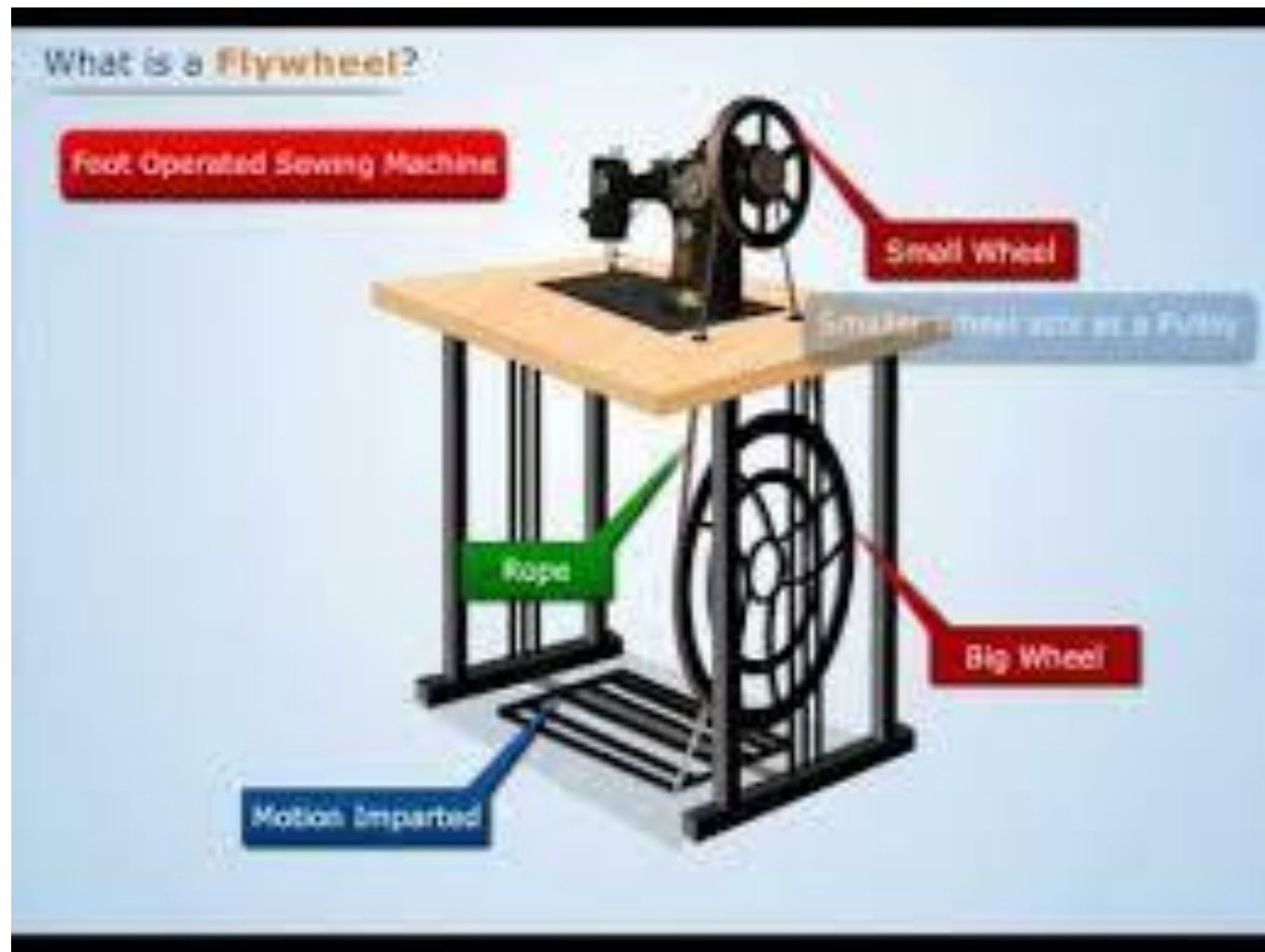
Dis advantages of fly wheel



- Unless they are couple with batteries, the run-time of a flywheel UPS is very short, typically measured in seconds.
- Flywheel design has limits, like the tensile strength of the material used for the rotor.
- They can also have a bearing failure from vibration.



APPLICATIONS OF FLYWHEEL





MULTIPLE CHOICE QUESTIONS



The flywheel is accelerated when

- (A) Driving torque $>$ Load torque
- (B) Driving torque $<$ Load torque
- (C) Driving torque = Load torque
- (D) Any of the above

Which of the following is (are) true?

- (A) Cast iron has poor tensile strength compared to steel
- (B) Failure of cast iron flywheel is sudden and total
- (C) Mach inability of cast iron flywheel is poor compared to steel flywheel
- (D) All of the above



The ratio of maximum fluctuation of speed to the mean speed is called

- (A) Fluctuation of speed
- (B) Maximum fluctuation of speed
- © Coefficient of fluctuation of speed
- (D) None of the above

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

- (A) Fluctuation of speed
- (B) Maximum fluctuation of speed
- © Coefficient of fluctuation of speed
- (D) None of the above



When the torque required by the machine is more than the torque supplied by the motor, the flywheel is

- (A) Accelerated
- (B) Retarded
- (C) Rotating with constant speed
- (D) Any of the above

If the load on the engine is constant, the mean speed will be constant from the cycle, then

- (A) The governor will not operate but flywheel will be acting
- (B) The flywheel will be acting but governor will not operate
- (C) Both flywheel and governor will be acting
- (D) Both flywheel and governor will not be acting



Thank You