

SUMMARY DYNAMICS MODULE N4

| SUBJECT | EQUATION | DISCUSSION |
|----------------------------|---|---|
| Work | ${}_1U_2 = \sum_1^2 \bar{F} \cdot d\bar{r}$ $= \int F_x dx + \int F_y dy + \int F_z dz$ | Work is defined as the dot product of force and |
| | ${}_1U_2 = - w\Delta y$ | Work due only to lifting a weight where Δ is the vertical displacement of the center of gravity. |
| | ${}_1U_2 = \frac{1}{2} k [x_2^2 - x_1^2]$ | The work due to compression or stretching a string. |
| | ${}_1U_2 = GMm \left[\frac{1}{r_2} - \frac{1}{r_1} \right]$ | Work of a gravitational force. |
| Kinetic Energy | $T = 1/2 mv^2$ | ${}_1T_2 = \int_1^2 F ds = \int_1^2 m a ds$ $= \int_1^2 m v \frac{dv}{ds} ds = \int_1^2 m v dv$ $= \frac{1}{2} m [v_2^2 - v_1^2]$ |
| Conservation of Energy | $E_1 = E_2$ | The total energy measured at any time is constant. |
| Non-conservation of Energy | $E_1 + {}_1U_2 = E_2 + {}_1L_2$ | ${}_1U_2$ - work done from 1 to 2 ${}_1L_2$ - losses incurred in going from 1 to 2 |
| Power | $P = \frac{dU}{dt} = \bar{F} \cdot \bar{V}$ | |
| Efficiency | $\eta = \frac{U_{out}}{U_{in}} = \frac{P_{out}}{P_{in}}$ | |
| Conservative | $\bar{F} = - \text{grad } v$ | In a conservative system, work is independent of path. Force is the gradient of the potential function. |

WORDS TO KNOW MAJOR MODULE 4

1. Power - defined as the time rate at which work is done. Units are watts which is equal to a joule per second. (Rate of doing work.)
2. Efficiency - concerns the performance of a machine. It is the ratio of the energy output to the energy input of a machine; or the power output to the power input.
3. Conservative Force - a force is said to be conservative if the work done by the force is independent of the path that the force takes.
4. Instantaneous - at that particular time.
5. Datum Line - a defined line or base from which dimensions are taken or calculations are made. It establishes an exact geometrical reference.
6. Horsepower - the engineer's unit of power. One h. p. is equivalent to 745.7 watts.