Dr. Hassan Issa
Dr. Aliaa Hamadi
Lect. Mustafa Ayad



# Engineering Fundamentals for Construction Equipment

# الأسس الهندسية للمعدات الإنشائية

❖ ***Examples***

**Ex 1/ If the total weight on the driving wheels of an equipment is 18000 Kg and the maximum force of the equipment engine is 9000 Kg. This equipment is working on a road with wet sandy soil with coefficient of traction 0.3. Find the maximum force can be provided by the machine before sliding the driving tires.**

**Solution:**

**Coefficient of Traction = P / W**
**P / 18000 = 0.3**
**P = 5400 Kg**

---

**Ex 2/ A 4 cycle engine with 100 horse power at the sea level. Find its horse power at 3000 m above the sea level.**

**Solution:**

**Lost hp = [(H – 300) * hp * 0.03] / 300 (with 4 cycles of combustion engine)**
**= [(3000 – 300) * 100 * 0.03] / 300 = 27 hp**
**Real horse power = 100 – 27 = 73 hp**

---

**Ex 3/ A rim pull for a tractor at the first gear is 6000 Kg with 12.4 tons weight. This tractor moves up on a road with 2% grade and rolling resistance of 50 Kg/ton. Find**

Dr. Hassan Issa
Dr. Aliaa Hamadi
Lect. Mustafa Ayad

**the net traction power of the engine which can be used with this tractor to pull other weights.**

**Solution:**

**The force required to resist rolling = 12.4 * 50 = 620 Kg**
**The force required to counter effect of grade = 12.4 * 10 * 2 = 248 Kg**
**Total resistance forces = 620 +248 = 868 Kg**
**Net traction power = 6000 - 868 = 5132 Kg**

---

**Ex 4/ An equipment engine was tested under the circumstances provided below. Find the brake horse power for this engine under the standard circumstances:**

**- measured horse power = 86.43 hp**
**- measured Pressure = 750 mm mercury**
**- measured temperature = 5.55 $c^o$**

**Solution:**

**Hc = Ho * Ps/Po * $\sqrt{(To/Ts)}$**

**= 86.43 * 760/750 * $\sqrt{((5.55+273)/288)}$**

**= 86.13 hp**

---

**Ex 5/ A tractor on wheels weighs 10 tons. Find the net tractive effort for this tractor if the rolling resistance of the road is 70 kg/ton and the grade is 3% upward with speed of 10 km/hr and engine efficiency of 82% with 200 hp.**

**Solution:**

**Rim Pull = hp * 272.2 * efficiency/speed**

**= 200 * 272.2 * 0.82/10**

**= 4464 Kg**

**The force required to resist rolling = 10 * 70 = 700 Kg**

**The force required to counter effect of grade = 10 * 10 * 3 = 300 Kg**

**Total resistance forces = 300 +700 = 1000 Kg**

**Net tractive effort = 4464 - 1000= 3464 Kg**

**Dr. Hassan Issa**
**Dr. Aliaa Hamadi**
**Lect. Mustafa Ayad**

# Home Work

**1/ A crawler equipment weigh 15 tons with traction force of 2600 Kg on a road with rolling resistance of 50 Kg/ton. What is the real traction force for this engine on a flat road with rolling resistance of 80 Kg/ton?**

---

**2/ Find the effect of grade on the required tractive effort to move a truck weigh 20 tons on a road with grade of 5%**

---

**3/ A tractor with four cycle engine was tested under the standard circumstances and found 130 hp. What will the decrease in horse power for this engine be if it works under the following circumstances?**
**- observed pressure = 663 mm mercury**
**- observed temperature = 22.2 $c^o$**

---

**4/ A tractor with 6 tires weighs 18 tons. Find the following:**

**1- The net traction force for this tractor if the rolling resistance of the road is 85 kg/ton and the grade is 7% upward with speed of 6 km/hr and engine efficiency of 80% and 150 hp.**

**2- The weight of the trucks that could be drawn by this tractor, if the rolling resistance is 70 kg/ton.**