farm Power
x

Torque (E) :- application of force at any point to develop turning effect is called torque. $T = \vec{r} \times \vec{F}$

Power :- $\frac{\text{work done}}{\text{Time required}} = \frac{w}{t} = \frac{F \times d}{t}$

$\boxed{P = \text{force} \times \text{Velocity}}$

wind Energy :-

Co-efficient of performance (Cp) :-

$\boxed{Cp = \frac{P}{\frac{1}{2} \rho \times A \times v^3}}$

P = wind power kw
A = area m²
ρ = density kg/m³
v = velocity, m/s.

Power of wind Mill :-

$\eta = \frac{P_{in}}{P_{out}}$

$\boxed{P_w = \frac{1}{2} \times \rho \times A \times v^3 \times Cp}$ $\Rightarrow$ tip speed ratio (λ)
Pmax

$\lambda = \frac{\text{tip speed of blade}}{\text{wind speed}}$

$\boxed{\lambda = \frac{\omega R}{v}}$
ω = rotation speed rad/s
R = rotor radius
v = wind speed m/s

Hydraulic Power :

$\boxed{P_h = \gamma Q \times H}$ γ = Sp weight of water

Q = discharge rate m³/s ρ_w = density of water
H = Height, m.

$\boxed{P_h = \rho_w g \times Q \times H}$, W

Declination :-

$\boxed{\delta = 23.45 \sin \left[\frac{360}{365} (284+n) \right]}$ degree

Hour angle (ω) :-

1 hour is equivalent to $\frac{2\pi}{24} = 0.262$ radian

$\frac{360}{24} = 15° h^{-1}$

Zenith angle (θ_z) :-

$\boxed{\theta_z = \frac{\pi}{2} - \alpha}$

Note ① Total Solar radiation Measured by pyranometer.
⑤ Beam radiation is measured by pyrheliometer

biogas digester :-

ⓐ Volume of dry matter
V_d (L/day) $= \frac{\text{dry matter available per day}}{\text{density of matter}}$

ⓑ volume of biogas diester (V_b) = V_d × retension time (L)

② Biogas produced per day
= Biogas yield × dry matter available per day.

Power available from digester = (kW)

$P = \eta \times H_m \times F_m \times V_b$

H_m = Heat of Combustion of Methane
F_m = Methane proportions.

Thermodynamic principle I.C Engine.

① Isothermal process
$\Delta T = 0$ $\boxed{q = \omega}$

② adiabatic process
$q = 0$, $\boxed{\Delta E = \omega}$

③ Isochoric processes
$\Delta V = 0$, $\boxed{q_v = \Delta E}$

④ Isobaric process
$\boxed{\Delta P = 0}$, $\boxed{q_p = \Delta H}$

① Boyle law
$V \propto \frac{1}{P}$

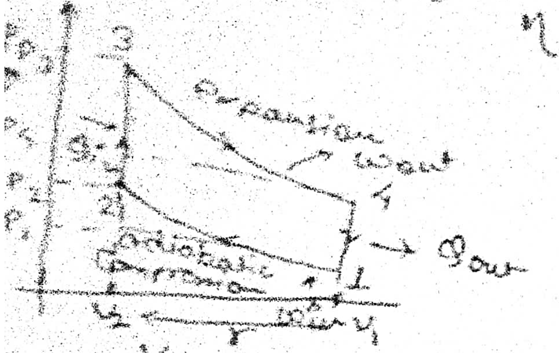
② charle's law
$V \propto T$

Some importance Results of adiabatic Expansion.

① PV^{γ} = Constant ② $T^{\gamma}p^{1-\gamma}$ = Constant

③ $V^{\gamma-1}T$ = Constant.

④ air-standard otto cycle.



$$\eta_{otto} = \frac{Q_{in} - Q_{out}}{Q_{in}} = 1 - \frac{1}{\left(\frac{V_1}{V_2}\right)^{\gamma-1}}$$

$$= 1 - \left(\frac{1}{r}\right)^{\gamma-1}$$

$$= 1 - \left(\frac{P_1}{P_2}\right)^{\gamma-1/\gamma}$$

r = compression ratio

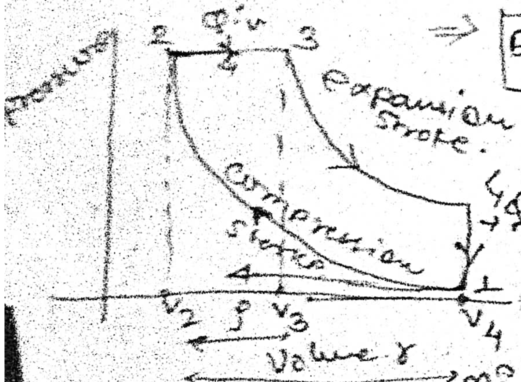
Compression ratio $r = V_1/V_2$

suet volume

$$V_s = A \times L$$

$$= \frac{\pi}{4} \times D^2 \times L$$

⑤ air-standard diesel cycle.



$$\Rightarrow \boxed{ER = \frac{V_4}{V_3}}$$

$$\boxed{CR = \frac{V_1}{V_2}}$$

$$\frac{P_3}{P_4} = \left(\frac{V_4}{V_3}\right)^{k}$$

$$\frac{P_1}{P_2} = \left(\frac{V_2}{V_1}\right)^{k}$$

$$\eta_{diesel} = W/Q_{in} = \frac{Q_{in} - Q_{out}}{Q_{in}} = 1 - \left(\frac{1}{r}\right)^{\gamma-1} \frac{(\rho^{\gamma}-1)}{\gamma(\rho-1)}$$

$$\boxed{\eta_{diesel} = 1 - \left(\frac{1}{r}\right)^{\gamma-1} \frac{(\rho^{\gamma}-1)}{\gamma(\rho-1)}}$$

✓

Imp
Note ① r is compression ratio = V_1/V_2

② ρ is fuel cut off ratio = $\frac{V_3}{V_2}$

⇒ formula:

$$\rho = V_c + \left(V_s \times \frac{\%\ cutoff}{100}\right)$$

$$\text{Expansion ratio} = \frac{\text{compression ratio}}{\text{cut off ratio}}.$$

Term Related to I.C Engine and power Measurement

① Compression Ratio (r) r_{diesel} = 14:1 to 22:1

$$r = \frac{V_t}{V_c} = \frac{V_s + V_c}{V_c}$$ r_{petrol} = 6:1 to 8:1

V_s = swept volume.

② piston displacement (Pd)

swept volume (V_s)

$$P_d = A \times L = V_s$$

L = stroke length

Note During run the swept volume $V_s = V_c + x \cdot V_s$

$$= V_t - xV_s$$

x is the displacement of piston during run.

③ displacement volume :-

$$V_d = A \times L \times p \times n$$

P = No. of power stroke rpm

n = No. of Cylinder

④ piston speed : -

$$P_s = 2 \times L \times N$$

⑤ Indicated power :- (I.P)

the power generated in the engine cylinder and received by piston. [4-stroke]

$$I.P(kW) = \frac{P \times L \times A \times n}{60 \times 10^{12}} \times \frac{x}{2}$$

P = pressure, Pa, L = length, mm

A = cross section mm², n = rpm, n = no. of cylinder

IP [2-Storke]

$$IP = \frac{P \times L \times A \times n}{60 \times 10^{12}} \times \frac{x}{1}$$

$\boxed{x = 1}$ 1 hp = 0.746 kW

⑥ **Indicated horsepower :-**

ⓐ $IHP = \frac{P \times L \times A \times n}{4500} \times x/2$ [for 4 storke]

ⓑ $IHP = \frac{P \times L \times A \times n}{4500} \times \frac{x}{1}$ [for 2-storke]

P = pressure kg/cm² L = length m.
A = Cross section cm², n = rpm
x = No. of cylinder.

⑦ **Breake power :-** It is the power delivered by the engine and is available at the end of the crankshaft (shaft power)

$$B.P = \frac{2\pi NT}{60,000} \text{ kW}$$

N = rpm T = Torque N-m,

⑧ **Break mean effective pressure :-**
this is a pressure acting in the power storke which are necessary to produce breake power

$$bmep\ (Pa) = \frac{B.P \times 30,000}{L \times A \times N \times n/2} \ (Pa)$$

(four for stroke)

⑨ **FRICTIONAL POWER (F.P) :-**

$$F.P = I.P - B.P$$

⑩ Indicated thermal efficiency (η_i)

$$\eta_i = \frac{60 \times IP}{w_f \times H.V}$$

w_f = fuel supplyed kg/min
H.V = heat value of fuel kJ/kg.
w_s = Specific fuel consumption

⑪ specific output.
Breake power per unit of piston

$$(SP)_{out} = \frac{B.P}{A \times L}$$

⑫ **Breake thermal efficiency :-** η_b

$$\eta_b = \frac{\text{Break work done in heat unit}}{\text{Energy supplied.}}$$

$$= \frac{60 \times B.P}{w_f \times H.V}$$

⑬ **Mechanical efficiency :-**

$$\eta_m = \frac{B.P}{I.P} \times 100 = \frac{B.P}{B.P + F.P}$$

⑭ **fuel consumption :-**
the total fuel consumption per hour or per kW developed.

① $ISFC = \frac{60 \times w_f}{IP} = \frac{3600}{H.V \times \eta_i}$, kg/kwh

② $BSFC = \frac{60 \times w_f}{B.P} = \frac{3600}{H.V \times \eta_B}$, kg/Bkwh.

⑮ **Volumetric efficiency (η_v)**

In generally air standard efficiency $= \left[1 - \frac{1}{\gamma^{m-1}}\right]$

$$\eta_v = \frac{\text{actual air capacity}}{\text{Ideal air capacity}}$$

$$\eta_v \approx \frac{\text{actual volume of air intaken}}{\text{Swept volume} \times \text{No. of cylinder} \times \text{No. of cycle per hour.}}$$

⑯ **Relative effeciency!.**

$$\eta_r = \frac{\text{Indicated thermal efficiency}}{\text{Air standard efficiency of the relevant cycle}}$$

⑰ **FIRING Intervals:-**

$$F.I = \frac{720^\circ}{n}, \ [4\text{-Storke}]$$

$$= \frac{360}{n}, [2\text{-storke}]$$

⑱ **Power overlapping:-**

$$P.O = 180 - F.I$$

$$= 180 - \frac{720}{n}$$

do not use four - storke engine only 6, and 8 other cylinder.

⑲ **valve timing:-**

$$\text{Location of valve} = \frac{1}{2}(1 - \cos\theta)$$

$$\text{Time}(t) = \frac{\theta}{360^\circ} \times \frac{1}{N} \text{ min}.$$

Air supply measurement :- (mass of dry air through orifice) in kg/s

$$m = d_a A \times C_0 \sqrt{2gh \frac{d_w}{d_a}} \ \text{kg/s}$$

density of water

[illegible]

① **Prony Breake Dynamometers:-**

$$P = \frac{2\pi l \times FN}{60{,}000}, \text{ KW}$$

F = force, N

N = is the speed

l = distance, m

T = torque, N-m.

② **Rope Brake Dynamometer**

$$P = \frac{(W - S)\pi(D + d)N}{60{,}000} \text{ kw}$$

Power (kw)

W = dead load (N)

S = Spring balance load (N)

D = dia. of wheel (m)

d = dia. of rope (m)

-fuel Combustion and fuel System of I.C engine.

⇒ crude petrolum consist of 86% carbon 14% hydrogen.

⇒ **Quality of FUEL PROPERTIES:-**

ⓐ Volatility of FUEL.

ⓑ Calorific value of fuel.

ⓒ Ignition quality of fuel.

⇒ ① characteristic of spark ignition engine two method evaluating the volatility of fuel. distillation test, and the Reid vapour pressure test.

② ⇒ The heat liberated by combustion of a fuel is know as calorific value.

③ ⇒ Ignition quality refers to the ease burning the oil in the combustion chamber, ⓐ Octane No. ⓑ Cetane No, Measured ignition quality of the fuel!

① **Octane No:-** It is Measured of knock characteristics of a fuel.

The perctanage of Iso-Octane (C_8H_{18}) in the reference fuel consisting of a Mixture of Iso-octane and normal heptane.

① ⇒ Octane No. excellent antiknock value → $\boxed{100}$

② ⇒ Normal heptane would knock = $\boxed{zero}$

② **cetane No:-** The percentage of cetane in a mixture of cetane ($C_{16}H_{34}$) and alphamethyl naphthalene ($C_{11}H_{16}$) produced same knocking effect.

⇒ diesel fuel have got cetane rating varying from 30 to 60.

FUEL TEST:- C.N = (% of n-cetane) + 0.15 (% heptamethyl no. nan)

① **Gravity test:-** with the help of API

$$\text{API degress} = \frac{141.5}{\text{specific gravity of oil at } 60°F} - 131.5$$

The instrument used for testing the specific gravity of oil hydrometer.

Imp → Pure water has got API gravity as 10.

② **Distillation test:-** measure of volatility of a fuel.

Imp

③ **Vapour pressure test:-** Special instrument known as Reid vapour pressure test commonly used to measure the vapour pressure of a fuel. $\boxed{(100°F)}$ ✓

④ **Sulphur test:-** (122°F) following purpose.

ⓐ find out presence of corrosive sulphur compounds in the fuel oil.

ⓑ To find out quantity of free and combined sulphur present in fuel oil.

⑤ **carbon residue:-** amount of carbon residues left on evaporating an oil under specific cond.

⑥ **colour test:-** physical condition

⑦ **Gum test:-** The presence of gum.

⑧ **Flash test:-** The oil sample is heated → (continuously heating) → (50-70°F) and the temperature at which distinct flash is obtained when flame is passed over the container is called flash point.

उत्पन्न होना

⑨ **pour point:** the lowest temp. at which fuel ceases to flow.

⑩ **cloud point:-** ([illegible]) this point will generally occur about 5°C above (temp. at which paraffin wax or other solid substance begins crystallise out or separate from solution.),

fuel consumed per cycle per hour = $\dfrac{BHP \times \text{sp. fuel consumption}}{n \times P \times 60}$

= n is the No. of cylinder

= P is the power stroke in one minute,

Viscous force:-

$$F = \eta \times A \times \frac{dv}{dx}$$

$\frac{dv}{dx}$ = viscosity gradient

A = area

η = absolute viscosity

viscosity of Newtonian fluid

$$\eta = \frac{F/A}{dv/dx} = \frac{\text{Shear Stress}}{\text{Rate of shear}}$$

Poiseuille's law :

$$\eta = \frac{\pi p r^4 t}{8 V l}$$

Relationship b/w v_r and v_{max}

$$v_r = v_{max}\left(1-\frac{r^2}{R^2}\right)$$

$$V = \frac{\pi p r^4 t}{8 \eta l}$$

p = the pressure difference
r = radius of tubo
t = time
v = the volume of liquid
l = length of tube
η = is Absolute viscosity. poise.

Traction : - Traction is the term applied to driving force developed by interaction b/w traction devices and Soil.

Tractive efficiency (T.E) :-

$$T.E = \frac{\text{Drawbar power}}{\text{Axle power}} = \frac{P.V_a}{T.W}$$

P → drawbar pull
V_a → actual velocity
T → dynamic weight
W → wheel torque

Net coefficient of traction : → $\mu = \frac{P}{W} = \frac{\text{Net pull}}{\text{Normal load}}$

$$\boxed{\mu = \frac{P.V_a}{T.W}} = \frac{\text{drawbar power}}{\text{axle power}} = T.E$$

Note $T.E = \frac{p \times \cancel{x} (1-s)}{T}$

$$T.E = \frac{P.V_a}{F V_t} = \frac{P}{F}(1-S) =$$

$$\left[\text{because } S = 1 - \frac{V_a}{V_t}\right]$$

$$= \frac{P/W}{F/W}(1-S).$$

$$= \frac{\mu}{\mu_g}(1-S) = \frac{\mu}{\mu+f}(1-S) \quad \text{Imp}$$

$$= \boxed{T.E = \frac{\mu}{\mu+f}(1-S)}$$

μ_g = gross traction coefficient
$\mu_g = \mu + f$

Motion Resistance Ratio

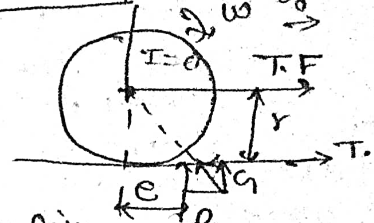
$$f = \frac{\text{Rolling resistance (T.F)}}{\text{Normal load (W)}} =$$

wheel slip (s)

$$\boxed{S = 1 - \frac{V_a}{V_t}}$$

V_a = actual travel speed
V_t = theoretical wheel speed $r\omega$.
r = Rolling radius.
ω = angular velocity.

Rolling Radius :- The distance travelled / revolution of the traction device divided by 2π when operating at specified zero condition



Force acting on the towed wheel

G = is the soil reaction

$$(T.F) r - R.e = 0$$

$$\boxed{e = \left(\frac{T.F}{R}\right).r}$$

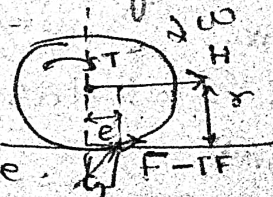
R = Normal load

$$\boxed{f = \frac{T.F}{W}}$$

$$\boxed{e = f \times r}$$

f = motion resistance ratio
r = Rolling radius

force acting on driving wheel :



Horizontal component

$$H = F - T.F$$

F = gross traction force.
T.F = Motion resistance force.

$$H/W = F/W - \frac{T.F}{W}$$

$$\mu = \mu_g - f \Rightarrow \boxed{\mu_g = f + \mu}$$

Moment acting on the wheel.

$$T - (F - TF) r - R.e = 0$$

$$(F.r) \leftarrow \boxed{T = F.r} \quad [Re = (T.F) r]$$

Transmission and drive Train :-

plat clutch :-

Torque of plate clutch is expressed

$\boxed{T = \mu \times W \times r_m \times n}$ (N-m)

W = axial load exerted by acutating spring. N.

μ = Cofficient of friction

r_m = mean radius of the clutch

n = the Number of torque transmitting surface $\boxed{(n_a + n_b - 1)}$ driving shaft, driven shaft

Mean Radius of clutch facing :

ⓐ The intensity of pressure is uniform.

$$\boxed{r_m = \frac{2}{3} \frac{r_2^3 - r_1^3}{r_2^2 - r_1^2}}$$

ⓑ The rate of wear is uniform.

$$\boxed{r_m = \frac{r_1 + r_2}{2}}$$

In single plate clutch both sides of the clutch plate are effective, thus the No. of torque transmitting surface $\boxed{\text{are } 2}$

(n+1) no. of disc or plates.

Intensity of pressure :

⇒ Intensity of pressure is maximum at inner radius of facing of the clutchplate

$p_{max} r_1 = C$, $= p_{min} r_2$

⇒ **Axial Load (W) :-** it is mathematically expressed.

$$W = 2\pi C (r_2 - r_1)$$

⇒ Average pressure (Pav)

it is expressed.

$$P_{av} = \frac{W}{\pi (r_2^2 - r_1^2)}$$

Cone clutch :-

(i) Torque :- (T) :- $\frac{\mu (r_2 + r_1) W}{2 \sin\theta}$, $\boxed{t = \frac{I_g}{gT} \times \frac{2\pi N}{60} , s}$

$= \frac{\mu W r_m}{\sin\theta} = \mu W r_m \operatorname{cosec}\theta$

$\boxed{T = 2\pi \mu p_{max} r_m^2 \, w}$ (Nm)

pressure

② The power capacity of the clutch (P) :-

$$P = \frac{2\pi N T}{60{,}000} , kW$$

Velocity Ratio (V.R) :-

$$V.R = \frac{\text{speed of driver}}{\text{speed of driven}}$$

$$\frac{N_1}{N_2} = \frac{D_2}{D_1} = \frac{T_2}{T_1}$$

Gear Ratio (G.R)

$$G.R = \frac{1}{V.R} = \frac{T_1}{T_2} = \frac{N_2}{N_1}$$

T = periphery of gear / circular pitch of the toothed wheel.

differential condition (loaded condition in differential unit)

$$\boxed{T_R N_R + T_L N_L = T_{in} N_{in} \times \eta_d}$$

R.

$$\frac{N_{in}}{G} = \frac{N_L + N_R}{2}$$

HYDRAULIC SYSTEM AND CONTROL

→ PASCAL'S LAW

$P_1 = P_2$

$\frac{\omega_1}{\omega_2} = \frac{A_1}{A_2}$

ω_1 = wt. on small hydraulic cylinder

A_1 = cross section area of small hydraulic cylinder

ω_2 = wt. on large cylinder

A_2 = cross —||— large.

Imp

→ Hydraulic power :-

$$\boxed{P_h = \varphi . \Delta P ;}\ \text{KW}$$

φ = discharge rate lpmin

ΔP = pressure differen. MPa

$$\boxed{P_h = 0.01667 \times \underset{\hookrightarrow l/s}{\varphi} \times \underset{\hookrightarrow pa}{\Delta P}} \rightarrow \text{KW}$$

MOTORS :-

① Volumertic efficiency

$$\eta_{vm} = \frac{D_m \times \Theta_m}{\varphi_L}$$

Θ_m = speed of motor rpm

D_m = displacement of motor (cm³/rev)

② Mechanical (torque efficiency) motor

$$\eta_t = \frac{T_L \times \text{[illegible]}}{D_m \times \Delta P} \times \text{[illegible]}$$

ΔP = pressure drop across motor

T_L = N-m/rev

③ overall efficiency

$$\eta_{oa} = \frac{\text{output}}{\text{input}} = \eta_t \times \eta_{vm} = \frac{T_L \times \Theta_m}{\Delta P \times \varphi_L}$$

PUMP :-

Volumetric efficiency :-

$$\eta_v = \frac{\varphi_{out}}{D_p \times \Theta_p} \qquad \eta_L = \frac{\Delta P \times D_p}{2\pi T_L}$$

② pump efficiency

$$\eta_p = \frac{\varphi_p \times \Delta P}{2\pi T_p \times \Theta_m}$$

(7) transmission from laminar to turbulence flow vice versa is determined based on Reynold No.

$$R_e = \frac{\rho \times v \times d}{\eta} = \frac{1.27 \varphi}{d\nu} = \frac{1.27 \times \varphi . \rho}{d\eta}.$$

φ = the flow rate cm³/s

d = dia. of pipe (cm)

η = absolute viscosity (dyne s/cm²)

σ = the mass density. dynes²/cm⁴

ν = kinematic viscosity cm²/s

ω = sp. wt. g/cm³.

Hydraulic diameter (D)

$$\boxed{D = \frac{4A}{S}}$$

A = passage area of flow

S = perimeter of flow passage.

ORIFICES :-

The fine orifice in the. The pressure drop through a sharp - edged orifice for turbulent flow

$$\boxed{\Delta P = \frac{\varphi^2 \rho}{2 \times C_d^2 \times A^2}}$$

ρ = massdensity

Imp

POWER STEERING PUMPS

Power of pump

$$\boxed{P = \frac{V \times \Delta P \times n}{E}}$$

n = rps

E = overall pump efficiency

V = flow rate per revolution

ΔP = pressure drop Pa

Human Factor in Tractor Design :-

ⓐ SOUND PRESSURE LEVEL (SPL)

$$\boxed{SPL = 20 \log \frac{P}{P_0} ; dB}$$

P = Measured R.M.S Sound pressure, N/m^2

P_0 = Reference sound pressure level 2×10^{-5} N/m^2

Note ① Sound pressure double with increase of 6dB.

Ⅱ If unit of SPL in dB then the value of $P_0 = 1$ N/m^2

Imp

ⓑ VIBARATION ACCELERATION LEVEL (VAL)

Vibration is usually measured with an accelerometer.

$$VAL = 20 \log \frac{V}{V_0} ; dB.$$

V_0 = Reference acceleration, 1 m/s^2

V = Measured RMS acceleration m/s^2

The Kingpin torque T required to turn the wheel under a vertical load W can be calculated by the following equation

$$T = wf\sqrt{\frac{I_0}{A} + e^2}$$

Now Modified Equation

$$Torque(T) = wf\sqrt{\frac{b^2}{8} + e^2}$$

relationship :- temp, pressure, volume.

$$\frac{T_2}{T_1} = \left(\frac{V_2}{V_1}\right)^{1-K} \qquad \frac{T_2}{T_1} = \left(\frac{P_2}{P_1}\right)^{\frac{K-1}{K}}$$

$$\frac{P_2}{P_1} = \left(\frac{V_1}{V_2}\right)^{K} , \quad \frac{P_2}{P_1} = \left(\frac{T_2}{T_1}\right)^{\frac{K}{K-1}}$$

$$\frac{V_2}{V_1} = \left(\frac{P_1}{P_2}\right)^{1/K} , \quad \frac{V_2}{V_1} = \left(\frac{T_1}{T_2}\right)^{1/K-1}$$

① $PV^{\gamma} = c$, ② $T^{\gamma} P^{1-\gamma} = c$

③ $V^{\gamma-1} T = c$

centance Number :-

centance No. = (% of n-cetralice) + 0.15×(% of heptamethylno name).

Note

$\boxed{\text{n-centance = centane No is 100}}$

non-combustiable constituents :-

① non flammable producer gas

→ $\boxed{N_2 + CO_2}$

② flammable producer gas

→ $\boxed{N_2 + CO}$

③ $$Power\ kW) = \frac{discharge\ (m^3/s) \times pressure \times 10^{?}(N/m}{1000}$$

Imp

Note Cone Index :- Soil strength in bale equation
Measured with a cone penetrometer ↑ Meas

HYDRAULIC SYSTEM AND CONTROL

Differential :- Function :-

① To Transmit Engine power to the wheel.

② To act as a gear reduction ~~to~~ in the vehicle that is slowing the rotational speed of the transmission.

③ To Transmit the power to the wheel while allowing them at rotate at different speed.

Note :- ① Day length in sunshine (hours)

Day length = $\frac{2\omega}{15}$ =

$\omega = \cos^{-1}(-\tan\phi \times \tan\delta)$.

$= \frac{2}{15}\cos^{-1}(-\tan\phi \times \tan\delta)$.

Transmissibility :- $\frac{\text{output vibration intensity}}{\text{Input vibration intensity}}$
(T)

$$(T) = \left[\frac{1+4\varepsilon^2\left(\frac{\omega_t}{\omega_s}\right)^2}{\left(\left(1-\left(\frac{\omega_t}{\omega_s}\right)^2\right)\right)^2 + 4\varepsilon^2\left(\frac{\omega_t}{\omega_s}\right)^2}\right]^{0.5}$$

ε - damping ratio

ω_t = tractor chassis frequency

ω_s = Undamped natural frequency rad/s

Damping ratio :-

$$\varepsilon = \frac{c}{c_c}$$

c = Seat suspension rate N/m-s

c_c = critical damping rate N/m-s

⇒ c_c = critical damping rate

$c_c = 2M\omega_s$

M = Mass of seat and operator

$\omega_s = \sqrt{K/M}$

K = spring rate of seating system

M = Mass of seat and operator in kg
kg.

① **Traction force.** :- motion resistance or rolling resistance of a pneumatic tyre is dependent on load size and inflation pressure as well as soil strength.

$\rho = \frac{T.F}{W} = \frac{1.2}{C_n} + 0.04$

C_n is wheel numeric.

$$\boxed{C_n = \frac{CIbd}{W}}$$

CI = cone index

$\frac{b}{d} = 0.3$

② **performance index :-**

$$P.I = \frac{d \times A \times I \times P}{D}$$

d → depth
A → effective field capacity
I → soil inversion
P → soil pulverization
D → draft kg/cm²

⇒ The concentration being measured with fluorometers, colorimeter, or atom atomic absorption spectrophotometer

Note ① In restrained link operation of three (3-) point hitches, the line of pull passes above the virtual hitch point and tending force exists on lower link.

② ASAE - SAE standards for 3- point hitches, specify all dimension related to the 3- connecting point b/w implement and the tractor

① minimum limits for lift height
② laterally leveling adjustment and side sway
③ The minimum lift force to available at the hitch pin

③ while carrying out tillage operation, negative slip is sometime exprienced ~~with~~.

Ans! - wheels of power tiller pulling a mould board plough.

④ Positioning the hitch on the implement frame of pull type offset disk harrow without gauge wheel help in

Ans. - decreasing the depth of penetration for the front gang.

⑤ The ~~es~~ essential requirement for turning in a power tiller is accomplished by having

Ans! - one wheel disconnected from the engine at the time of turning.

ⓒ A lubricating oil with high viscosity index is desirable for tractor engine due.

Ans! Less variation of viscosity with temp.

ⓓ Stability factor :-

$$\boxed{K = \frac{F_w \times W_b}{P \times h}}$$

W_b → wheel base

h → height of static line of pull ~~paral~~ perpendicular to ground.

F_w → static front weight

P → maximum drawbar pull parallel to ground

ⓔ Rimpull :-
(kg)

$$\boxed{\frac{170 \times HP \times \eta}{\text{Speed (km/hr)} \times 100}}$$

II ~~del~~

Note !. In gasification biomass is heated to high temp ≥ 700°c to produce a synthesis gas "(H_2 and co.)"

ⓕ Cylinder Speed :-

$$N = \frac{N_p \times D_p}{d}$$

D_p → dia. of prime mover pully (m).

d → dia of thresher pully cm

N → Speed of thresher pully rpm

N_p → Speed of primary pulley

threshing efficiency :- total grain input - unthreshed grain from all outlets

HYDRAULIC SYSTEM AND CONTROL

fferential :- functio

Break-even-point :-
(which profit is zero)

Break even point can be calculated using either the equation method or (contribution margin Method).

(CVP)(cost volume profit).

$PX = VX + FC$ → fixed cost

price/unit, No. of unit

① **Utility index :-** It is a direct indication of work Machine content hours.

$$K = \frac{\text{No. of actual working hours/year}}{\text{No. of expected working hours/years}}$$

② **Reliability index :-** This index measured the percentage of assurance of proper working of tractors

$$RI = \frac{A_1P_2}{A_2P_1} = \frac{160\,n\,P_2}{BA_2}$$

n → No. of years of breakdown

B → No. of Breakdown hours.

$\frac{P_2}{A_2} = 1$ (assumed)

$$R.I = \frac{160\,n}{B}$$